Context Coercion in Sentence Processing: Evidence from Chinese

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This study investigates the on-line processing of context coercion in Mandarin Chinese. Context coercion is a kind of situation shift that is implicitly and contextually governed by the semantic reinterpretation process. We hypothesize that the coercion constructions are syntactically and semantically complicated than transparent sentences and should be more difficult to process. A self-paced reading experiment was carried out to test this hypothesis. The results of the experiment indicate that there is a strong coercion effect in reaction time and coercion constructions are more difficult to process than concord constructions (transparent constructions) in Chinese. This finding is also consistent with the commitment account of sentence processing. In addition, this study provides psycholinguistic evidence that supports a situational account for the meaning of the Chinese aspect marker *le*: the default meaning of the Chinese aspect marker *le* is perfectivity when it is used in dynamic situations and its meaning will be inchoativity when it is used in stative situations.

1. Introduction: Aspectual Coercion and On-Line Sentence Processing

Many studies have examined the on-line processing of sentences involving aspectual coercion in English, and most discussions focus on the processing cost of coercion. Piñango *et al.* (1999) argue that aspectual coercion is a combinatorial semantic operation invoked in real-time processing, and they claim that this operation is more computationally costly than parsing a syntactically transparent counterpart. For example, consider the following sentences:

(1) a. The girl slept until dawn.
    b. The girl jumped until dawn.

Sentence (1)a is a syntactically and semantically transparent composition (construction) because the meaning of the sentence is the combination, via syntactic processes, of the meanings of the lexical items. However, sentence (1)b can only be interpreted as "the girl jumped repeatedly until dawn"; otherwise, it will be ungrammatical because "jump" is a point-action activity, and is not compatible with any imposed temporal boundary. In order to achieve the compatibility between the head of the verb phrase "jump" and its aspectual modifier—the prepositional phrase "until dawn"—there

has to be an aspectual coercion that will introduce the repetition function. This kind of operation is said to consist of a set of lexicosemantic compositional operations, collectively called *enriched semantic composition* (Jackendoff, 1997, 2002; Pustejovsky, 1991, 1995). Using a cross-modal lexical decision experiment, Piñango *et al.*. (1999) found that reaction times were much longer when the primary task required enriched composition than in cases where the primary task involved processing of transparent sentences. The results support their claim that enriched semantic composition is more computationally costly than syntactically transparent semantic composition.

Along the same lines, Traxler *et al.* (2002) and Traxler *et al.* (2005) point out that verbs such as *begin*, *enjoy*, and *finish* usually take events as their arguments in order to be felicitous sentences, for example with the event *reading*, as in *begin reading*. However, such verbs also often take noun phrases whose literal interpretations denote entities such as *the book*, as in *begin the book*. According to these studies, this verb phrase may require more computations to interpret because the attempt to comprehend the sentence involves using lexical and contextual information to coerce the default interpretation from an entity (*the book*) to an event (*begin the book*), which are two different semantic categories. This coercion process involves the following operations (from Traxler *et al.*, 2005: 4):

(a)   When encountering the noun *book*, comprehenders access the word's lexical entry and attempt to integrate various stored senses of this word into the evolving semantic representation of the sentence.

(b)   The mismatch between the verb's selectional restrictions and the stored senses of the noun triggers a coercion process.

(c)   Comprehenders use salient properties associated with the complement noun and other relevant discourse elements (including but not necessarily limited to the agent phrase) to infer a plausible action that could be performed on the noun.

(d)   Comprehenders incorporate the event sense into their semantic representation of the VP by reconfiguring the semantic representation of the complement, converting [begin [the book]] into [begin [reading the book]].

The coercion cost is due to the operation in (d) because it requires time to build an eventive representation of the complement. *Begin the book* should be more difficult to process than *read the book* and *begin reading the book* because the mismatch between the verb and NP in *begin the book* triggers a coercion operation that type-shifts the NP *the book* (entity) into a compatible type *reading the book* (event), and this process will require time in order to generate the additional structures that are semantically equivalent to the explicit expression *begin reading the book*. For these reasons, the enriched form of interpretive processing is more time costly.

Using eye-tracking and self-paced reading experiments, Traxler *et al.* (2002, 2005) found that entity noun phrases take a longer time to process when they follow verbs that require event arguments, as opposed to when they follow verbs that do not require them. Difficulty does not appear when verbs such as *began* has arguments that refer to events, because this processing does not involve semantic coercion and type-shifting. The following examples are the tested sentences in one of their experiments:

(2) a. The secretary began the memo about the new office policy.
    b. The secretary typed the memo about the new office policy.
    c. The secretary read the memo about the new office policy.

In Sentence (2)b and (2)c, the verb specifying the activity and the default interpretation of the object *memo* is compatible with the verb's selectional restrictions. The eye-tracking experiment results suggest that readers had difficulties with the coerced condition in Sentence (2)a soon after they encountered the noun phrase, when they would re-fixate the verb. Overall, their experiment results indicate that entity-denoting NPs were more difficult to process when they followed verbs that require event complements; the observed difficulty of processing was attributed to the costly operation of coercion.

Other similar experiments provide additional support for the hypothesis that semantic coercion engenders a processing cost in reading because it slows the interpretation process (Pickering, *et al*, 2005; McElree, *et al.*, 2006a and McElree, *et al.* 2 006b). These studies also demonstrate that semantic coercion can cause more interpretation errors (McElree *et al.*, 2006b). However, studies on the coercion phenomenon are relatively rare, and no study has been done on the coercion effect in Chinese sentence processing.

2. Context Coercion Hypothesis

Drawing on de Swart's (1998, 2000) coercion theory and Traxler *et al.*'s (2002, 2005) experimental paradigm, the present experiment attempts to see whether there is a coercion effect in Chinese *le* sentences in which situation shifts take place due to context, which is indicated by inter-sentential elements. Note that this experiment is different from the experiments discussed above. The coercion phenomenon that occurs in English with phrases such as *begin the book*, etc. does not apply in Chinese, since in Chinese, expressions such as 开始书 *kaishi shu* 'to begin a book' are ungrammatical. However, context coercion in Chinese is also a case of enriched composition in the sense of Jackendoff (1997), who claims that in coerced sentences, the linguistic content not expressed lexically in the coerced sentence has to be composed to achieve the well-formedness of a composition and to satisfy the pragmatics of the discourse or extralinguistic content.

The coercion operation in Chinese that is hypothesized to be more difficult for subjects to process is more like the situation seen in Sentence (3):

(3) 我 修 这 辆　车 了, 以前 一直 不 愿意 修理.
　　Wo　xiu　zhe liang che le, yiqian yizhi bu yuanyi xiu li
　　I repair this CL　car LE, before always not want　repair
　　I want to fix the car, (but) I did not want to before.

Sentence (3) involves a coercion operation that is triggered by context. In this coercion construction, there is a mismatch between *le's* default meaning-perfectivity[1] and the conjoined clause (an intersentential element) because the conjoined clause indicates that *le*'s meaning should be inchoativity, per the requirements of the override principle: if a lexical item is semantically incompatible with its morphosyntactic context, the meaning of the lexical item conforms to the meaning of the structure in which it is embedded (Michaelis, 2004: 25).

To eliminate the mismatch, *le*'s meaning has to be shifted from perfectivity to inchoativity and the dynamic situation has to be coerced into a stative situation in order to accommodate the inchoative-encoding *le* because situation type has to be compatible with *le* (Wang, 2007). Following Traxler *et al.* (2005), such a coercion process is posited to consist of the following operations:

(a)　　When comprehenders encounter the aspect marker *le,* they access the word's lexical entry and try to integrate various stored senses of the word into the sentence presentation.

(b)　　 When comprehenders encounter the conjoined clause 以前一直不愿意修理 *yiqian yizhi bu yuanyi xiu li* 'I did not want to fix it before', they find a mismatch between the conjoined clause and *le* because perfectivity is the default and the preferred interpretation for *le* in accomplishment situations, whereas the conjoined clause leads comprehenders to interpret *le* as inchoative marker.

(c)　　To solve the mismatch, the situation of the first clause has to be shifted from dynamic to stative so that *le* can encode inchoativity.

(d)　　Comprehenders reconfigure the semantic representation of the first clause 我修这辆车了 *wo xiu zhe liang che le*, 'I have fixed the car' in order to incorporate the inchoative meaning into the clause by changing 我修这辆车 *wo xiu zhe liang che* 'I fix the car' into 我想修这辆车 *wo xiang xiu zhe liang che* 'I want to fix the car' implicitly. Namely, they change the accomplishment situation into a stative situation.

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[1] Wang (2007) argues that *le*'s meaning is determined by situation type and *le*'s default meaning is perfectivity in dynamic situations and its default meaning is inchoativity in stative situations

Note that shift operators such as 想 *xiang* 'to want' are not expressed linguistically, but are implicit, and have to be presented in lexical conceptual structures so that the sentence can be well-formed. If this account is correct, then this kind of sentence may constitute another form of enriched composition and should therefore be difficult to process on-line.

I would hypothesize that operation (d) will in fact be costly relative to concord constructions (as in Sentence (4) below) because it requires comprehenders to reconfigure the semantic representations of the sentence. Specifically, I hypothesize that comprehenders will take a longer time at the end of the second clause, namely at the last word of the second clause, because that is where they become aware of the mismatch and where they must then reinterpret the meaning of *le* and coerce the situation type.

(4) 我 修 这 辆　 车 了, 但是　 没有　 把 车　 修　 好。
    wo xiu　zhe liang che le,　danshi meiyou ba che　 xiu　　hao
    I repair this CL　car LE,　but　　 not　BA car repair well
    I tried to fix the car, but did not succeed.

                                      ---concord construction

Sentence (4) is a concord construction in that there is no shift of situation and no change in *le*'s meaning because the conjoined clause conforms to *le*'s default meaning (perfectivity), and thus does not trigger any coercion. The concord constructions are syntactically and semantically transparent sentences. Therefore, it is hypothesized that there will be less processing cost and shorter time for the concord construction than for the coercion construction.

This reasoning is also in line with arguments by Duffy *et al.* (1988) and Rayner and Duffy (1986), who claim that lexical ambiguity is costly only for balanced words with two meanings of roughly comparable frequency, or for biased words where context supports the non-preferred meaning. Sentence (3) is clearly the latter case, in which *le* is a biased word because it has a default or preferred meaning of perfectivity, while the conjoined clause that serves as a context supports the non-preferred meaning of inchoativity; as a result, it is lexically ambiguous and thus costly.

In short, I hypothesize that it will take longer time for comprehenders to process the sentences involving coercion or reinterpretation of *le*'s meaning. Specifically, more time will be required to process sentences with *le* encoding inchoativity in dynamic situations (achievement, accomplishment, and activity) than processing sentences with *le* encoding perfectivity in dynamic situations.

3. Methodology
3.1. Participants
35 Mandarin Chinese native speakers from China participated in the experiment. Their average length of U.S residence was 4.1 years, while their average age was 31.1.

Among the 35 subjects, 18 were female and 17 were male. All participants had normal or corrected-to-normal vision.

3.2. Stimuli

There are a total of five groups of situational constructions that involve coercion: achievement verb with a definite NP object, achievement verb with a generic NP object, accomplishment verb with a definite NP object, accomplishment verb with a generic NP object, and activity. For each stimulus sentence, there are three clauses. The first clause contains the aspect marker *le*, occurring either at the end of the sentence (*le*2), or immediately after the verb (*le*1), or in two different positions (double *le*). The second clause is called a conjoined clause, and it serves as a context for the interpretation of *le* in the first clause. The second clause is consistent, inconsistent, or neutral with the first clause in terms of *le*'s meaning. The neutral clause does not attempt either to shift or to conform to the first clause. These sentences serve as controls to compare with other constructions for the experiment. The following examples are the stimulus sentences in an achievement situation for this experiment:

Control

(5) a. 小李　打败 那 个 对手　了,　他 的 心情 非常　激动,　我 也 很　激动。
　　　X*xiao Li da-bai na ge duishou　le,　ta de xinqing feichang jidong,　wo ye hen　jidong*
　　　little Li defeat that CL opponent LE,　his DE feeling very　excited,　I also very excited
　　　Little Li defeated the opponent, he is very excited, and I am excited too.

Concord 1 (*le* at the end of the sentence)
　b. 小李　打败 那 个 对手　了, 观众　　为 他 热烈　鼓掌,　他 非常　自豪。
　　　X*iao Li da-bai　na ge duishou　le, guanzong wei ta relie　guzhang, ta feichang zihao*
　　　little Li defeat that CL opponent LE, audience　for him warmly applaud,　he very　proud
　　　Little Li defeated the opponent, the audience applauds loudly for him, he is very proud of himself.

Concord 2 (*le* immediately after the verb)
　c. 小李　打败 了 那 个 对手,　获得　了 世界 冠军,　　　他　特别　　兴奋。
　　　X*iao Li da-bai le　na ge duishou, huode　l e shijie guanjun,　　ta tebie　　xingfen*
　　　little Li defeat　LE that CL opponent, won　LE world championship, he especially　happy
　　　Little Li defeated the opponent, and won the world championship, he is especially happy.

Coercion
　d. 小李　打败 那 个 对手　了, 过去 总是　被 他 击败, 小李　高兴　极　　了。
　　　X*iao Li da-bai na ge duishou　le, guoqu zongshi bei ta jibai, Xiao Li gaoxing ji　　le*
　　　little Li defeat that CL opponent LE, before always BEI him defeat,　Xiao Li happy extreme LE.
　　　Little Li defeated the opponent, he had always been defeated by him, Xiao Li is extremely happy.

The effect regions, namely the last words of the second clauses, are underlined in the sentences here. They are all two-character words (or phrases) in length.

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As seen in the above sentences, the stimuli are designed under four conditions: concord 1 (with *le*2-sentence final *le*), concord 2 (with *le*1-verb final *le*), coercion construction, and control. Note that the difference between concord 1 and concord 2 is that the sentences in the concord 1 condition contain *le*2, while the sentences in the concord 2 condition have *le*1. There are 32 stimulus sentences and 34 fillers in total. Of the 32 stimulus sentences, there are 11 sentences each for achievement and accomplishment situations, 4 sentences for activity situations, and 6 sentences for stative situations.

One of the difficulties with the design is that comprehenders can anticipate the next item in the coercion condition because of the regularity of sentence patterns in the second clause. In the coercion condition the second clause has a fixed sentence pattern, 以前…不…(it was not … before), which can enable respondents to anticipate the next item. This anticipation may thus speed up processing or attenuate the coercion cost. To reduce the repetition effect, I tried to vary the second clause in the coercion condition by using different words; however, the structural repetition problem is not possible to solve completely, thus there are still a few repeated words and patterns in the stimuli. Another difficulty concerns having an equal number of key presses for the second clause in order to avoid a possible length effect of the last word on the interpretation. It proved very difficult to construct the second clause with the same number of key presses while making each press a single word. There are four key presses for every second clause, but sometimes one key press may be not a word, but a phrase. As a result, for the last word of the second clause, there are two phrases in concord construction and two phrases in coercion in total. This will even out or balance the design, out of the concern that a phrase may be more time consuming to process than a word. The two phrases are both commonly used, so their frequency of occurrence is comparable with the two words.

In order to avoid sentence wrap-up effects, we added a third clause to each sentence. The third clause is either neutral or concordant, and does not attempt to contradict the first clause. Since it follows the target effect region (the last word of the second clause), and will not affect the reaction time for our target word. That is to say, how it is processed is not related to the current study, the reaction time data for third clauses were discarded**.**

3.3. Procedure

The participants were instructed to read at a normal pace such that they would be able to answer comprehension questions correctly after each sentence. Sentences were presented through a self-paced moving window method using the DMDX experiment generator (Forster & Forster, 2003). A "ready" prompt appeared before the first word of the sentence appeared, and then the subject could begin to press the spacebar to elicit subsequent words until the entire sentence had appeared. When a new word appeared, the preceding word would disappear immediately. Each word appeared on the screen from left to right, in terms of its sentential position. A statement sentence as a probe would immediately follow each stimulus sentence; for these probes, participants were asked to

make true/false judgments based on the information they had received from the previous stimulus sentence. Subjects received feedback (correct or incorrect) on their true/false responses. The computer recorded the time from when a word was first displayed until the next press of the space bar. Half of the answers for the probe sentences were true, while the other half were false. It took subjects between 25 and 40 minutes to complete the test.

4. Results and Discussion
4.1. Results
The mean accuracy in sentence comprehension for all subjects is 98.5% (2331 out of 2376) for all sentences (including the fillers) and 98.2% (1132 out of 1152) for stimulus sentences.

Firstly, only the reaction times for the middle 4 items of each second clause were kept, and only the reaction times for the last word in the second clause were used for analysis since this is the only effect region that was considered. The rest of the data were discarded. Recall that in my hypothesis, the last word in the second clause is the point at which the readers realized the mismatch; thus, this is where the coercion operation is thought to take place: it is at this point in the sentence that readers have to reinterpret *le*'s meaning and coerce the dynamic situation into a stative situation.

Secondly, if the reaction time for a given word was extremely fast (less than 100 milliseconds) or slow (more than 2 standard deviations above the group mean for the word type) or if the subject made a wrong answer to the probe sentence, then for that trial the group mean reaction time will be used instead of the individual reaction time. This procedure allows us to eliminate outliers but keep the rest of the reaction time data for the sentences and the subjects. As a result, 1.38% of the entire data was replaced.

A paired sample correlation test indicates that the correlation between word frequency of the last word and reaction time is not significant ($r = -0.125$, $p<0.495$).

4.2. Coercion Effect
Recall from the stimulus design, there are four conditions: control, concord 1, concord 2, and coercion for each group. Comparing the coercion with the other three conditions in reaction time will determine whether there is a coercion effect. Table 2 depicts mean reaction times of the last words in the second clauses by condition.

Table 2. Mean reaction times (in ms.) of the target words by condition

Condition	Mean	Standard Deviation	N
Control	372	93	35
Concord 1	362	101	35
Concord 2	375	126	35
Coercion	425	135	35

Table 2 demonstrates that the coercion condition has a numerically higher mean reaction time than the other three conditions, while the other three conditions look numerically closer to each other in reaction time. In the coercion condition, the reaction time is 50 milliseconds longer than in the concord 2 condition, 63 milliseconds longer than in the concord 1 condition, and 53 milliseconds longer than in the control condition. Thus, coercion stands out among the four conditions. The contrast is clearer in Figure 1.

Figure 1. Mean reaction times (in ms.) of the target words by condition
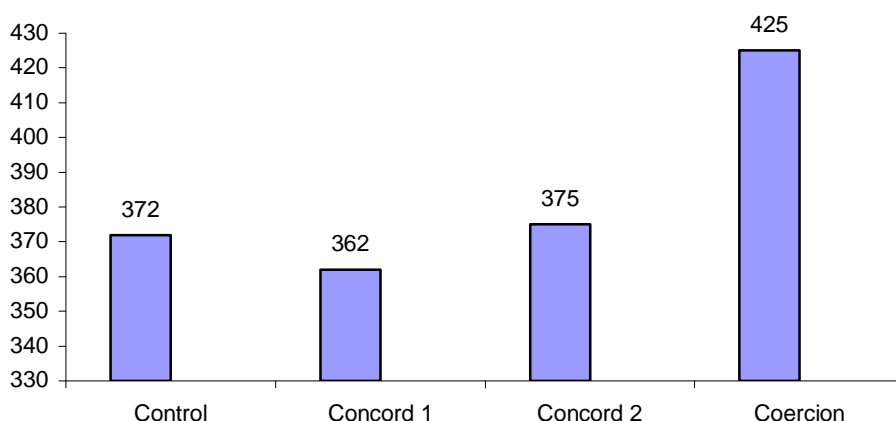
The results of a repeated measures ANOVA with condition as factor show that there is a main effect of condition (F (1,34)=7.753, $p<0.000$). The results of the Tests of Within-Subjects Contrasts suggest that there is a significant difference between control and coercion (F (1,34)=12.619, $p<0.001$), between concord 1 and coercion (F (1,34)=18.315, $p<0.000$) and between concord 2 and coercion (F (1,34)=14.125, $p<0.001$).

If we examine each group, we can make a more detailed comparison by condition and situation. Table 3 illustrates the comparison between situations and conditions for the five situations.

Table 3. Mean reaction times (in ms.) by situation and condition

Situation type	Control	Concord 1	Concord 2	Coercion
Achievement (DN)	380	367	370	412
Achievement (GN)	355	339	347	448
Accomplishment (DN)	393	359	416	455
Accomplishment (GN)	337	375	375	405
Activity	393	368	368	404

As seen in Table 3, the coercion column is all above 400 ms.; all other conditions are below 400 ms. (except one: achievement DN in the concord 2 condition). Figure 2 further illustrates the contrast.

Figure 2. Mean reaction times (in ms.) by situation and condition
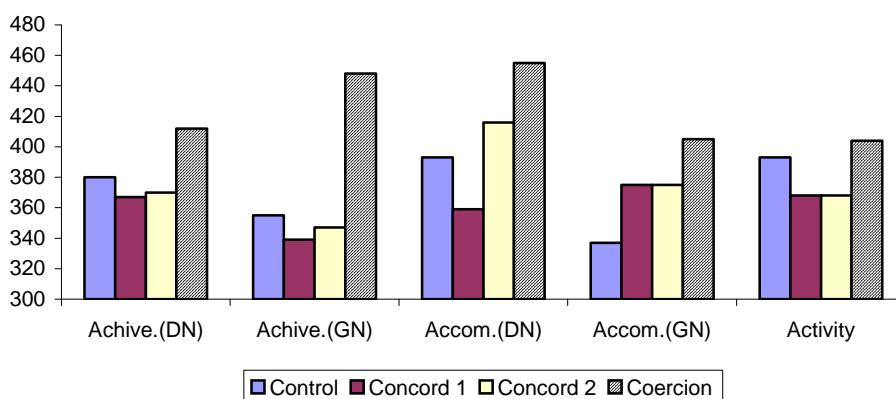
A 4x5 repeated measures ANOVA (with 4 levels by condition and 5 levels by situation) indicates that there is a main effect of condition (F (1, 34) =8.988, $p<0.000$). The result of the Tests of Within-Subject Contrasts show that there is a significant difference between coercion and concord 1 (($F1$ (1, 34) =19.656, $p<0.000$), coercion and concord 2 ($F2$ (1, 34) =17.805, $p<0.000$), and coercion and control ($F3$ (1, 34) =12.681, $p<0.001$). This shows that coercion constructions are processed significantly more slowly than control and concord constructions. This result is consistent with the findings on coercion cost by Traxler *et al.* (2005) and many others and is consistent with the enriched composition hypothesis (Jackendoff, 1997; Pustejovsky, 1991, 1995).

However, there is no main effect of situation ($F(1,34)=1.743$, $p>0.140$) and no interaction between condition and situation ($F(1,34)=1.224$, $p>0.260$). Even if we look into the specific comparisons, there are no further significant effects or interactions. Figure 3 gives us a better view of the contrasts and the general pattern of results.

Figure 3. Mean reaction time comparison between conditions and situations.
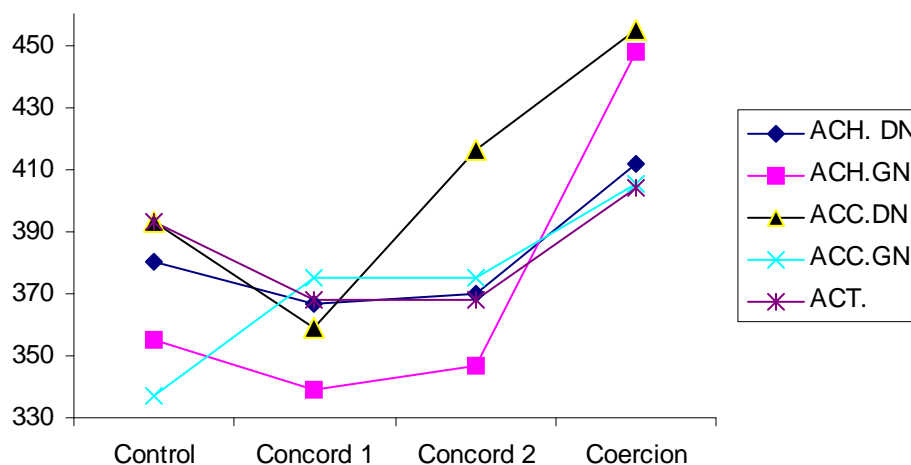
      The roughly spoon shape of the lines shows that coercion has the longest mean reaction time and control has the second longest mean reaction time, while the concord construction has the shortest mean reaction time. For all sentences in the four conditions, constructions in the coercion condition appear to be more difficult to process than the constructions in the other three conditions, although sentences in the coercion condition are rated as being as plausible as the other sentences in control and concord. The naturalness rating scores for the four conditions are comparable: control is 1.22, concord 1 is 1.28, concord 2 is 1.36, and coercion is 1.21. Thus, difference in the naturalness of the constructions is not likely the reason that the coercion construction is more difficult to process. This leads us to consider the reinterpretation process as the reason for the difficulty in the coercion condition. As we discussed in the previous section, coercion is a multi-step interpretation process in which comprehenders need to change their initial interpretation, retrieve previous semantic and syntactic information to recover an appropriate expression, and add an additional structure (a shift operator such as 想 *xiang*, 'want to') to form a coherent interpretation or to make sense of the mismatched sentence and/or expression that is not explicitly expressed in the text. This all entails a more complicated, multi-step form of processing which is both difficult and time costly. Such additional operations do not appear to be necessary for concord constructions.

      However, a few questions remain. For instance, is coercion the only reason for the longer reaction time? Could this increased reaction time not also be due to the interpretation commitment[2] that readers are required to make at the end of second clause?

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[2] Interpretation commitment means to make interpretation decisions about the meanings or references of certain lexical and syntactic items.

Alternatively, could the longer reaction times also be due to the ambiguity of *le* and the competition between alternative interpretations?

Todorova *et al.* (2000) examined the coercion effect between a verbal predicate (send a check; completive reading) and a verbal modifier (for years; durative reading) and found a significant reading cost in the coercion condition of sentences where an iterative reading arises due to coercion.

(6) a. Howard sent a large check to his daughter for years. --durative modifier, singular object
                                                          ---<u>coercion</u>
    b. Howard sent large checks to his daughter for years.   --durative modifier, plural object
    c. Howard sent a large check to his daughter last year. --non-durative modifier, singular object
    d. Howard sent large checks to his daughter last year.   --non-durative modifier, plural object

In the coercion condition of (6)a, readers have to coerce the punctual event (sent a large check) into iterative or repetitive interpretation (has been sending a check for years), and this coercion slow down the semantic parsing. Todorova *et al.* (2000) argued that there are two possible reasons for the delay in this coercion condition. One of these is that readers go through a re-analysis of the coerced sentences due to an early decision about the telicity of the sentence under construction. The other possibility is that readers are not able to make a coherent interpretation due to a lack of mediation of an iterative operator, which is not morpho-syntactically expressed. I would argue that if there is an overt iterative operator (such as "every year" in the example in (7) below), then the coercion effect will disappear and the sentence will be transparent syntactically and semantically (thus there will be no coercion cost). That is, if an overt operator is required, it is not a coercion construction any more, and it is just a normal situation shift triggered by the iterative operator *every year*.

(7) Howard sent a large check to his daughter every year.

Todorova *et al.* (2000)'s experiment offers us another possible explanation for the time delay of the coercion condition, which is early commitment to the telicity of the sentences, although they did not find a clear answer themselves.

According to the minimal commitment account (Frazier and Rayner, 1990; Pickering and Frisson, 2001), comprehenders will not make an interpretation decision until it is required. Pickering *et al.* (2006) state that "during normal reading, comprehenders do not immediately commit to the telicity of events and full commitment only occurs when processing demands induce immediate decisions" (p.131). In other words, comprehenders only fully commit to the interpretation of expressions when they have to, such as when the task at hand requires them to make a lexical decision early. There is also evidence supporting the idea that comprehenders did not commit immediately when interpreting a polysemous noun or verb (Frazier and Rayner, 1990; Pickering and Frisson, 2001). Proctor *et al.* (2004) found that readers did not rapidly use either verb or verb +

object information to draw boundedness inferences; rather, they waited until they reached the final segment of the sentence. In other words, readers are holding off on making costly inferences of telicity until they are forced to make them. This result is consistent with the minimal commitment hypothesis.

In the case of coercion in this experiment, if the minimal commitment hypothesis is correct, then comprehenders of Chinese will not specify or interpret *le*'s aspectual meaning in the first clause until they get to the last word of the second clause or even to the very end of the sentence. Because they have not committed to any specific interpretation of *le*, the coercion and reinterpretation operations will not take place. Since the interpretation has not gone in any specific direction before they reach the end of the second clause, this interpretation process will be normal, and will not cost any extra time. Thus, this coercion process should not be different from the processes for the concord and control structures.

However, the task demands of this experiment and the results of the statistical analyses favor the commitment account (for detailed discussions, see Marslen-Wilson and Tyler, 1980; Just and Carpenter, 1980; Grain and Steedman, 1985; Frazier and Rayner, 1990). The experiment design may require comprehenders to make decisions earlier because the probe questions and comprehension questions are statements regarding the sentences they just read. Some of the statements are directly related to the telicity of the event described in the target sentences, and the comprehenders may have to be fully committed to the interpretation of the aspectual meaning of *le* before it is too late (they will not be able to go back to read the sentence again, and participants are reminded of this in the beginning of the test).

Moreover, if Chinese comprehenders were not committed to *le* in the first clause, they would not be committed to the last word in the second clause either (it is not the end of the sentence) because they would not realize the clash between *le* and its context; thus, there would be no increased cost in processing for the second clause—they could just wrap it up at the very end of the sentence-the end of the third clause. Therefore, it is very likely that the Chinese comprehenders were committed to *le*'s interpretation and that they later realized the mismatch between the second clause and first clause, forcing them to reinterpret the sentence and reconstruct the first clause by coercing the situation.

Finally, the test results also suggest that *le* encodes perfectivity in dynamic situations and inchoativity in stative situations by default. For dynamic situations, if *le*'s default meaning were inchoativity and if the comprehenders were completely committed to that interpretation of *le*, then they should not have spent a longer time processing the last word of second clause in coercion sentences since the construction would be a concord construction and everything would be straightforward. The only reason that can explain why the comprehenders processed the last word of the second clause in the coercion condition with great difficulty is that *le*'s default meaning is not inchoativity but perfectivity, and thus it involves a coercion process.

Similarly, if native speakers of Chinese had interpreted *le* as perfective in stative situations and were fully committed to *le*'s interpretation early on, they would have to go through a reinterpretation process when they read a *le* sentence in a stative situation, and they should have taken a longer time to read such sentences in stative situations. However, the results do not support this hypothesis. Rather, the reaction times for the sentences in stative situations are the same as in dynamic situations in concord conditions (namely, in sentences where the conjoined clause indicates that *le* is an inchoative; stative situations cannot be coerced into dynamic by contexts, and therefore this kind of coercion construction is not felicitous and not in the test). For example,

12. 天气　冷　了，你们　多　穿　点儿 衣服. –stative situation
   tianqi   leng   le, nimen   duo chuan dianr yifu
   weather cold LE, you   more wear little clothes
   The weather is becoming cold now, you guys should wear more clothes.

The first clause in Sentence 12 is a stative situation. When the comprehenders read 天气冷了 *tianqi leng le* 'the weather is becoming cold now', they would not interpret *le* as a perfective marker; if they were to do so, their interpretation would clash with the second clause 你们多穿点儿衣服 *nimen duo chuan dianr yifu* 'you guys should wear more clothes', which is signifying inchoativity or change of state. Clearly, the situation type makes the comprehenders interpret *le* as an inchoative marker in stative situations, and since the following clause matches well with it and is a concord construction, the readers would not spend extra time attempting to encode the last word of the second clause.

5. Conclusion

The self-paced reading experiment provides psycholinguistic evidence from Chinese that supports the enriched composition hypothesis. The test results indicate that sentences in coercion conditions are more difficult to process than sentences in control and concord conditions; this is because the processing of context-coerced sentences involves a multi-step reinterpretation process, thus make them more time consuming. These results also suggest that comprehenders are committed to *le*'s interpretation as soon as they encounter *le*, and support the commitment account of sentence processing. In addition, the experiment provides us with another way to examine the relationship between situation type and *le*'s meaning, as well as the relationship between context coercion and *le*'s meaning ambiguity. The experimental results support the situational proposal that situation type affects *le*'s meaning and *le* encodes perfectivity in all dynamic situations and encodes inchoativity in all stative situations. When *le* is used in dynamic situations, it can encode inchoativity through context coercion. The ambiguity of *le*'s meaning in dynamic situations can be explained through context coercion.

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