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Influence of Concessive and Causal Conjunctions on Pragmatic Processing: Online Measures from Eye Movements and Self-Paced Reading

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\textbf{ABSTRACT}

This study investigates the influence of causal and concessive relations on discourse coherence in Chinese by means of eye movement and self-paced reading techniques. We use the sentential structure like "NP\textsubscript{HUMAN} moved from place A to place B, \{because \textit{(因为 yinwei) /although \textit{(尽管 jinguan)} /no conjunction\} + pronoun (he/she) + verb (e.g., like) + there (nali)\ldots + NP\}. The eye-movement data (Experiment 1) recorded from regions of interest consistently showed that the processing of concessive meaning is much slower than the processing of causal meaning, irrespective of whether the causal relation is explicitly coded through a causal marker (i.e., \textit{yinwei (because)}) or not. In particular, although sentences containing pragmatic anomalies were processed more slowly than sentences containing no pragmatic anomalies in causal structures, there was no such distinction in concessive structures, indicating that the processing of a concessive relation can override that of a pragmatic incongruence. Moreover, although the initial place was reread more in cases of concessive structures as compared with causal structures in region 1 (e.g., place A), there was no difference between them in region 2 (e.g., place B). The results from self-paced reading (Experiment 2) showed that the difficulties observed from processing concessive compared with causal relations were not caused by the difference in pronoun resolution. These findings suggest that processing concessive meaning is cognitively more demanding than processing causal meaning, a conclusion that is also supported by a fine-grained linguistic (i.e., conceptual and pragmatic) analysis of causal and concessive relations.

\textbf{Introduction}

Conjunctions play an important role in the interpretation of discourse by signaling coherence relations between discourse units (Hussein, \textit{2008}; Zwaan & Rapp, \textit{2006}), because they can evoke readers’ expectations of how to explain the preceding statement and how to integrate the upcoming statement into a coherent mental representation (Murray, \textit{1995}). Many types of coherent conjunctions link different clauses/sentences, including consequence-cause (e.g., “I am not going out because it is raining”) and consequence-concession (e.g., “I am going out although it is raining”). These relations are conceptually encoded and can be realized in terms of explicit discourse conjunctions like \textit{because} and \textit{although} (Sanders & Noordman, \textit{2000}), although some of them can also be realized even if there was no explicit discourse conjunction.
A considerable number of experimental studies have been conducted to investigate how causal conjunctions (e.g., *because*) affect discourse comprehension. Few studies, however, have addressed the question of whether other conjunctive relations, such as concessives, vary in their impact on the process of sentence/discourse comprehension. The aim of the present study is to shed light on the impact of the Chinese conjunctions *yinwei* (because) and *jinguan* (although) on the process of establishing a coherent discourse representation.

**Linguistic and psycholinguistic studies of causal and concessive relations**

During discourse processing the presence of a coherent conjunction influences the interpretation of the words immediately after the conjunction, and different conjunctions may influence this process in a different fashion. It has been shown that the presence of a causal conjunction leads to an immediate effect of processing facilitation, that is, a faster reading of the words or the clause after the causal conjunction, in comparison with the absence of such conjunction (Caron, Micko, & Thuring, 1988; Cozijn, Noordman, & Vonk, 2011; van Silfhout et al., 2015). However, any empirical test procedure that attempts to elucidate how language users make sense of causal and concessive sentences requires a reasonably clear conception of causal and concessive expressions (conjunctions, adverbials, etc.) and the sentences in which they occur. In the following section we attempt to analyze the semantic/pragmatic and the taxonomic differences of causal and concessive relations.

Discussion of the first question often suggests that some notion of nonlogical implication (e.g., implicature and sometimes also [semantic or pragmatic] presupposition) has to be invoked to distinguish between causal and concessive relations. It has been claimed that concessivity presupposes or implicates causality. More precisely, a concessive relation is believed to implicate or presuppose a causal connection between a propositional content \(p\) and the negation of another propositional content \(q\). This causal connection is explicitly canceled in a concessive utterance. Thus, in a sentence of the form *although p, q*, the respective situations symbolized by \(p\) and \(q\), contrary to expectation, co-occur. This kind of analysis has, for example, been proposed by König (1985). König analyzes *although* as truth-conditionally equivalent to *and*, i.e., the truth of *although p, q* entails the truth of both \(p\) and \(q\). Obviously, it is insufficient to state that *although* (and, for that matter, *because*) has the same truth conditions as *and*. König then proposes that the nontruth-conditional sense of the concessive relation can be formulated as a pragmatic implication to the effect that in the default case (given language users’ world knowledge) the proposition \(p\) would (nonlogically) imply not-\(q\). The rationale of this analysis can be illustrated with the following example:

(1) Although it is raining, I’m going to play tennis.

Sentence (1) is true if and only if the propositions “It is raining” and “I’m going to play tennis” are jointly true. These truth conditions can also be formulated as entailments. Furthermore, there is a (nonlogical) implication that under normal circumstances, the speaker would not be playing tennis if it is raining. In other words, the meteorological event of rain would cause the speaker not to go out and play tennis. Schematically, König (1985, p. 4) describes the semantic-pragmatic structure of concessives as follows (see also Iten, 2000, p. 2):

(2) a. Typical form: although \(p, q\)
   b. Entailments: \(p, q\)
   c. Nonlogical implication: normally (if \(p\), then not-\(q\))

Different from the above analysis, Iten (2005, p. 180) argues for a relevance-theoretic analysis of the meaning and use of concessive sentences of the form *although p, q and q, although p*. She proposes that *although*, in contrast to truth-conditional *because*, encodes a
procedural meaning (see also Iten, 1998). The concessive conjunction instructs the hearer to suspend an inference, as illustrated in utterance (3):

(3) Peter went out although it was raining. (Iten, 2005, p. 180)

According to Iten, after having processed the proposition “Peter went out,” the hearer is prompted by although to suspend the pragmatic inference “People do not go out when it is raining,” because this inference is not compatible with the fact that Peter went out (despite the rain).

Moreover, according to the taxonomic analyses of coherence relations posited by Sanders, Spooren, and Noordman (1992, 1993), causal and concessive (or adversative) conjunctions are both considered to belong to the same category of causal relations but differ in several important primitives such as polarity (positive relation vs. negative relation) and continuity (continuous relation vs. discontinuous relation; Morera et al., 2010; Sanders et al, 1992, 1993). Although the causal conjunction because typically conveys a positive relation (i.e., causal relation) and a continuity, the concessive conjunction although conveys a negative relation (i.e., the negation of a causal relation) and a discontinuity. These distinctions in the taxonomic properties could lead to differences in processing. Indeed, empirical studies (e.g., Morera et al., 2016) have found that positive relations (e.g., causal relations) are generally processed faster than negative relations (e.g., concessive relations).

In addition to the linguistic analyses reviewed above, the difference of concessivity from causality can also be reflected at the real-time cognitive processes. However, relative to the considerable theoretical discussions about the differences and similarities between causal relation and concessive relation, few experimental studies have been carried out to investigate the cognitive mechanisms underlying the processing of concessive versus causal relations. Millis and Just (1994) investigated how the presence of causal (and concessive) conjunction influences discourse processing. By using a probe recognition paradigm (i.e., make a judgment of whether a probe word had appeared in prior statements), the authors found that relative to the absence of coherent conjunction, the presence of an explicit conjunction, either a causal conjunction because or a concessive conjunction although, could lead to a faster and more accurate response to the probe question querying the sentence meaning, and in particular the presence of a concessive conjunction would lead to a faster reading of the subordinate clause (which described a proposition contradictory to the one in the main clause). These findings suggest that the presence of either a causal or a concessive conjunction can facilitate sentence processing. Other studies, however, showed that causal and concessive/adversative relations may exert different influences on sentence comprehension (Köhne & Demberg, 2012; Townsend, 1983). For example, Caron, Micko, and Thuring (1988) found that sentences containing the adversative conjunction but were remembered less accurately than sentences containing the causal conjunction because. Köhne and Demberg (2012) found that although both German causal and concessive conjunctions (deswegen/therefore vs. dennoch/howeve) could be integrated rapidly during online comprehension, the accuracy of answering comprehension questions was significantly lower in the concessive sentences than causal sentences. These two aspects of the evidence seem to suggest that processing adversative/concessive relations was more demanding than causal relations.

Finally, apart from the findings during normal reading, the inappropriate use of a conjunction during comprehension can also bring difficulties to language processing. For instance, if two causally related statements are connected by a concessive rather than a causal conjunction, like (4),

(4) Peter passed the exam although he exerted himself.

this would be pragmatically unacceptable and thereby might cause comprehension difficulty. Likewise, if two concessively related statements are causally connected, like (5),

(5) Peter did not pass the exam because he exerted himself.

comprehension problems would be also observed. However, although both cases would disrupt the normal process of establishing a coherent discourse representation, pragmatic incoherence should not be treated in the same way. We address more about this issue in General discussion, below.
To conclude this brief review of the relevant linguistic and psycholinguistic literature on causal and concessive sentences, we have identified some crucial semantic/pragmatic and taxonomic properties of causals and concessives. What the schematic representations for causal sentences (e.g., *because* sentence) and concessive sentences (e.g., *although* sentence) suggest is that concessives are conceptually and pragmatically more complex than causals. However, it remains unclear whether these linguistic differences are manifested at the processing level. In particular, much of the relevant linguistic literature on this topic has been theoretically oriented and focused on Indo-European language conjunctions such as English *because* and *although* (König, 1985; König & Siemund, 2000; Izutsu, 2008; Sweetser, 1990; Iten, 1998, 2000, 2005), Spanish *como* (because) and *aunque* ([although], Morera et al., 2016; Morera, de Vega, & Camacho, 2010), and German *deswegen* (therefore) and *dennoch* ([however], Köhne & Demberg, 2012). It is not clear whether the dissociable patterns could be also manifested in Chinese, a language that is substantially different from the other languages typically investigated (e.g., English, Spanish, and German).

To the extent that our analysis of the English conjunctions *because* and *although* carries over to the corresponding Chinese conjunctions *yinwei* and *jinguan*, respectively, we tentatively predict that the processing of concessive adverbial sentences would require more cognitive effort (e.g., more processing time) than that of causal sentences in Chinese language. The cognitive effort involved in the interpretation of causal and concessive relations is, however, also a matter of how compatible the respective relation of causality or concessivity is with language users’ encyclopedic knowledge.

At this juncture, it would be useful to analyze the conceptual-pragmatic structure of the Chinese test sentences listed in Table 1 in more detail. For the reader’s convenience, we consider English equivalents with the causal conjunction *because* and the concessive conjunction *although*. In (6) and (8) plausible coreference relations between place names Shenyang and Hainan and the locative pronoun there are indicated by means of subscripts. The symbol “#” in front of (7) and (9) marks these sentences as pragmatically odd or incompatible with world knowledge about the winter temperatures in Shenyang and Hainan, respectively:

(6) Grandma moved from Shenyang to Hainan, because the winters are warm there.
(7) #Grandma moved from Hainan to Shenyang because the winters are warm there.
(8) Grandma moved from Hainan, to Shenyang, although the winters are warm there.
(9) #Grandma moved from Shenyang to Hainan although the winters are warm there.

<table>
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<th>Conditions</th>
<th>Examples</th>
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<td><strong>because-congruent</strong></td>
<td>10a. 外婆从/沈阳/迁到了/海南，因为/她/喜欢/那里/冬天暖和。</td>
</tr>
<tr>
<td></td>
<td>Grandma from/Shenyang/go-to- PPV/Hainan /because/she/like/there/winter warm.</td>
</tr>
</tbody>
</table>

| **because-incongruent**                        | 10b. 外婆从/沈阳/迁到了/海南，因为/她/喜欢/那里/冬天暖和。                   |
|                                                  | Waipo cong/Hainan/qiandaole/Shenyang, yinwei/ta/female/xihuan/nali/dongtian nuanhuo. |
|                                                  | Grandma from/Hainan/go-to- PPV /Shenyang /because/she/like/there/winter warm. |

| **although-congruent**                         | 11a. 外婆从/海南/迁到了/沈阳，尽管/她/喜欢/那里/冬天暖和。                   |
|                                                  | Waipo cong/Hainan/qiandaole /Shenyang, jinguan/ta/female/xihuan/nali/dongtian nuanhuo. |
|                                                  | Grandma from/Hainan/go-to- PPV /Shenyang /although/she/like/there/winter warm. |

| **although-incongruent**                        | 11b. 外婆从/沈阳/迁到了/海南，尽管/她/喜欢/那里/冬天暖和。                   |
|                                                  | Waipo cong/Shenyang/qiandaole/Hainan, jinguan/ta/female/xihuan/nali/dongtian nuanhuo. |
|                                                  | Grandma from /Shenyang/go-to- PPV /Hainan/although/she/like/there/winter warm. |

| **no-congruent**                               | 12a. 外婆从/沈阳/迁到了/海南，她/喜欢/那里/冬天暖和。                   |
|                                                  | Waipo cong/Shenyang/qiandaole/Hainan, /ta/female/xihuan/nali/dongtian nuanhuo. |
|                                                  | Grandma from/Shenyang/go-to- PPV /Hainan /she/like/there/winter warm. |

| **no-incongruent**                             | 12b. 外婆从/海南/迁到了/沈阳，她/喜欢/那里/冬天暖和。                   |
|                                                  | Waipo cong /Hainan/qiandaole /Shenyang, ta/female/xihuan/nali/dongtian nuanhuo. |
|                                                  | Grandma from/Hainan/go-to- PPV/Shenyang/she/like/there/winter warm. |
|                                                  | Grandma has moved from Hainan to Shenyang, she liked the winter there being warm. |
In both English and Chinese the interpretation of causal and concessive sentences is based on a variety of factors. Apart from the meanings of causality and concessivity given in (6) and (8), respectively, and the selection of an appropriate antecedent for *there*, the acceptability of sentences like (6) through (9) depends on world knowledge about meteorological conditions in *Shenyang* and *Hainan*. Chinese speakers know that winter temperatures are low in the northern city of *Shenyang* and warm in the southern province of *Hainan*. Furthermore, the interpretations of sentences (6) to (9) are also based on assumptions about what kind of climate Grandma would like to live in. In the default case one would expect an elderly person like Grandma to prefer a warm climate in the winter (i.e., favor the mild temperatures in *Hainan* over the harsh winters in *Shenyang*). It is this kind of encyclopedic knowledge that influences the interpretation of the locative pronoun *there* (Chinese *nali*) as either coreferring with the antecedent *Shenyang* or *Hainan*.

Let us briefly discuss (6) through (9) in turn. In (6), given the assumption that *Hainan*’s pleasant climate is a good reason to move there, the use of *because* is fully motivated and the antecedent of *there* is *Hainan*, which is also the closest possible antecedent of the locative pronoun.

In (7), there is a clash between world knowledge and the default interpretation of the sentence. Under normal circumstances *Shenyang* would be selected as the antecedent of *there*, but this choice is incompatible with the world knowledge that many people, including grandma, prefer to live in warmer climates. There is, however, the possibility that the antecedent of *there* is *Hainan*. The selection of *Hainan* as the antecedent would pragmatically implicate that for Grandma the colder climate of *Shenyang* is preferable to the warmer one in *Hainan* (she didn’t like warm climate in winter), which is why she moved to *Shenyang*. Under this interpretation the causal connective *because* makes sense, but it seems a plausible hypothesis that the cognitive effort required to arrive at a coherent interpretation of (7) is greater than that of (6).

Consider now sentence (8), which has a straightforward concessive interpretation if it is assumed that the antecedent is not the closest place name preceding *there* (i.e., *Shenyang*, but *Hainan*). The fact that a more distant antecedent has to be selected to obtain a pragmatically coherent reading can be seen as evidence that the interpretation of concessive relations requires a greater cognitive effort than that of causal relations. Grandma’s move to *Shenyang* is unexpected; the warm climate of *Hainan* would have been a good reason not to move to a colder location such as *Shenyang*.

Sentence (9) is even harder to interpret. The main clause, that is, the proposition that Grandma moved from *Shenyang* to *Hainan*, implicitly invites the inference that Grandma moved to *Hainan* because of its warm climate; however, the concessive clause contradicts this expectation, yielding the reading that despite the warm climate Grandma moved to *Hainan*. The selection of *Shenyang* as the antecedent clashes with the encyclopedic knowledge that *Shenyang* does not have warm winters. The only coherent interpretation would then be that Grandma prefers the colder winters of *Shenyang* to the warmer temperatures of *Hainan* but, surprisingly and for unknown reasons, moved to *Hainan*. The cognitive effort required to arrive at this latter interpretation is, at least, from the perspective of conceptual and pragmatic analysis considerable.

This conceptual-pragmatic analysis of sentences like (6) to (9) suggests that different degrees of interpretive effort can be discerned both within causal and concessive relations (witness the contrast between (6) and (7), and (8) and (9), respectively) but also across causality and concession in the sense that the processing of pragmatic incongruent meaning requires more cognitive effort than that of pragmatic congruent meaning and the processing of concessive relations requires more cognitive effort than that of causal relations.

To conclude, from a semantic and pragmatic point of view, the existing theoretical analyses seem to suggest that concessivity is a more complex conceptual and pragmatic phenomenon than
causality. Additionally, if the cognitive processes underlying processing concessive and causal relations were indeed discussible in Chinese, would this dissociation be still apparent even when the causal relation was conveyed implicitly (i.e., the sentence contains no causal marker)?

The present study

In this study we examine how the establishment of a coherent discourse representation is modulated by different conjunction relations. To this end, we make use of the Chinese conjunctions yinwei and jinguan, which, under one interpretation, are equivalent to because and although in English, respectively. Yinwei denotes a consequence-cause relation, whereas jinguan denotes a concession relation (Chu & Tao, 2008; Feng, 2008; Zhang, 2012). Both yinwei and jinguan are frequently used in Chinese. Although yinwei and jinguan may belong to more than one word class (e.g., yinwei as a preposition or a verb and jinguan as an adverb), they act predominantly as a conjunction. According to the Contemporary Chinese Corpus, the frequency of occurrence of yinwei and jinguan as a conjunction is 193 and 66 (per million), respectively, suggesting that both yinwei-linked causal structure and jinguan-linked concessive structure are frequently used in Chinese. In particular, when either of them is followed by a positive mental attitude verb like xihuan (like), they would give rise to a preferable interpretation of the subsequent locative pronoun nali (there).

In light of the above linguistic and empirical considerations (Blakemore, 2005; Iten, 1998, 2005; König & Siemund, 2000; Taboada & Gómez-González, 2012; Xu et al., 2015), we predict that if the processing of concessive meaning is cognitively more demanding than the processing of causal meaning, increased reading time (e.g., more total reading time) should be observed in processing congruent concessive sentences than processing congruent causal sentences, regardless of whether the causal relation was conveyed through an explicit linguistic device or not. Moreover, additional evidence for the dissociation could be provided by the incongruence effect (i.e., incongruent sentence vs. congruent sentence), because the pragmatic incongruence should not be treated identically in concessive and causal relations. Considering that processing concessive relation is already highly demanding for the processing system, it is possible that the incongruence effect could be reduced or even disappear in the concessive relation relative to the causal relation. Finally, if the presence of an explicit causal marker can facilitate sentence integration processing, as suggested by a number of previous studies (e.g., Millis & Just, 1994), then the sentences connected by the explicit causal devices should be processed faster than those without such devices, regardless of whether there were pragmatic anomalies in the sentences.

Experiment 1

Methods

Participants

Thirty native Chinese speakers (9 men, age ranging from 18 to 27 years, with a mean age of 23.2 years) were recruited from Nanjing Normal University. All participants had normal or corrected to normal vision and were paid for their participation.

Materials and design

The experiment had a 2 × 3 factorial design, with the conjunction type (because vs. although vs. no-conjunction) and the pragmatic congruency (congruent vs. incongruent) between the critical words in the subordinate clause and the whole discourse being manipulated. Schiffrin (1987) holds that the causal conjunction because encodes three different types of causal relations, namely, fact-based,

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1This corpus is based on the 2 million word corpus of contemporary Chinese, which is provided by the Center for Studies of Chinese as a Second Language, Beijing Language and Culture University (Web address: http://www.dwhyyjzx.com/cgi-bin/yuliao/).
knowledge-based, and action-based relations. The causal relation structure (yinwei structure) here was constructed in such a way that it coded only action-based causal relations\(^2\) (the reasons of the movement of a person from one place to another). The conjunction jinguan (although), however, introduces a subordinate clause that expresses a consequence-concession relation rather than consequence-cause relation. In the present study we adopt a two-clause sentential structure of the following form (13), in which the consequence always precedes the causal or concessive event (see Table 1 for the examples):

\[(13) \text{NP}_{\text{human moved from place A (or place B) to place B (or place A) [subordinate clause because/although/no-}}\]

\[\text{conjunction + he/she + verb likes} + there + \text{NP (containing a critical word)]}\]

This structure is similar to the structure of sentences (6) to (9) we analyzed previously. Each contains an initial main clause and a subsequent subordinate clause, which is either connected by an explicit causal conjunction yinwei or concessive conjunction jinguan. However, as can be seen in Table 1, one main difference between the experimental sentences (10) to (12) and the sentences (6) to (9) is the additional appearance of an attitude-biased verb (e.g., xihuan [like]\(^3\)) in the subordinate clause in the former but not the later cases. The presence of attitude-biased verbs like xihuan (like) would lead to different expectations for the subsequent interpretation of the locative pronoun in causal versus concessive structures. First, the encyclopedic knowledge of Hainan (with a warm climate in the winter) rather than Shenyang (with a cold climate in the winter) is compatible with the attitude conveyed through the verb xihuan\(^4\) (one would prefer to move from a less comfortable to a more comfortable place). Second, when the positive attitude verb is embedded in causal structure, the default consequence-cause relation would lead to a stronger preferential interpretation of the locative pronoun toward the nearer antecedent. By contrast, when this positive attitude verb is embedded in concessive structure, the consequence-concession relation, which denotes the negation of a potential causal assumption, would lead to a stronger preferential interpretation of the locative pronoun toward the distant antecedent. Indeed, this dissociable preferential interpretation between the locative pronoun and the candidate antecedents in causal versus concessive structures was confirmed by evidence from the forced choice test (see the percentage of referents in Table 2 and statistics in the following sections).

As can be seen from the example sentences in Table 1, the main clause generally states the fact of a protagonist’s movement from place A to place B (or from place B to place A on the other half), and the subordinate clause either provides the cause of the movement in yinwei structure (sentences 10a/b) or a concessive statement concerning the preceding action in jinguan structure (sentences 11a/b). The two places mentioned in the main clause have certain characteristics that distinguish them from each other (e.g., warm vs. cold, expensive vs. cheap) or

\begin{table}[h]
\centering
\begin{tabular}{lll}
\hline
Condition & Place A (%) & Place B (%) \\
\hline
because-congruent & 0.7 (3.8) & 98.9 (4.2) \\
because-incongruent & 66.7 (31.5) & 30.7 (30.2) \\
although-congruent & 93.0 (18.6) & 6.3 (15.7) \\
although-incongruent & 23.3 (33.2) & 73.7 (33.9) \\
no-congruent & 3.3 (8.8) & 96.7 (8.8) \\
no-incongruent & 70.0 (34.5) & 27.8 (33.0) \\
\hline
\end{tabular}
\caption{Mean percentages (M) and standard deviations (SD) of preferential referents for the locative pronoun nali.}
\end{table}

\(^2\)In preparing the experimental materials, the authors referred to the Chinese sentence structure (causal sentence) provided by He and colleagues (2006, p. 502).

\(^3\)Xihuan (like/prefer) made up 72\% of the critical sentences, whereas other attitude-biased verbs (e.g., xiangzhong [fancy], kanzhong [prefer] etc.) made up 28\%.

\(^4\)On the contrary, if the attitude-biased verb has an opposite meaning, like taoyan (dislike/hate), the locative pronoun would then be preferably interpreted as referring to the distant antecedent.
refer to features well known throughout the country (e.g., the Great Wall is in Beijing). There are always two critical regions in each experimental condition. The first is nali (there), a locative pronoun, which corefers with one of the two potential locations mentioned in the main clause. The second is the NP (which contains a critical word like warm), which occurs after the locative pronoun. Although the use of the critical word (e.g., warm) is grammatically and semantically congruent with the sentential constituents in the local context (within the subordinate clause) irrespective of the pragmatic congruency, incongruence occurs when this word is checked against reader’s world knowledge regarding the global discourse context (including both the main clause and the subordinate clause). For instance, in the yinwei structure like (10a), the presence of the critical word warm is congruent with native Chinese readers’ world knowledge about the southern Chinese city Hainan. However, “warm” would be incongruent with Chinese readers’ world knowledge if the sentence is changed to (10b) by swapping the positions of the two places. The reason for this incongruity is that Hainan is a southern city in China with hot weather all year round, whereas Shenyang is a northern Chinese city well known for its cold winters. Moreover, when jinguang is substituted for yinwei in (10a), the resultant sentence (11b) becomes incoherent. However, when the same happens on sentence (10b), the result sentence (11a) should be perfectly acceptable because it is compatible with the reader’s world knowledge. Furthermore, there is a third case where the absence of the explicit causal conjunction yinwei in (10a) and (10b) would result in two no-conjunction sentences, namely (12a) and (12b). To be noted, although no explicit device signals the relation between the two clauses, sentence (12a) is equally acceptable as sentence (10a), as demonstrated by the acceptability rating test (Table 3), probably due to the existence of an implicit causal association over the two propositions.

The selected set of sentences underwent two separate pretests, including one forced choice test and one sentence acceptability rating. As a syntactically unmarked locative pronoun, nali in Chinese can be interpreted either as referring to the closer place (e.g., place B) or the distant place (e.g., place A), depending on the contextual preference; here its interpretation is mainly constrained by the semantic and discourse factors. The forced choice test aimed to examine how the interpretation of the locative pronoun was constrained by the conjunction type, the attitude-biased verbs (e.g., prefer, like), and the discourse context. In this test, 432 (72 × 6) test sentences were divided into six versions with a Latin-square procedure, and 27 participants were asked to identify which one of the two locations (e.g., Hainan vs. Shenyang) did the locative pronoun nali refer to or to opt for a location even unmentioned in the sentence. Repeated-measures of ANOVA with conjunction type (because vs. although vs. no-conjunction), congruency (congruent vs. incongruent), and place (place A vs. place B) as within-subject variables showed neither main effects of conjunction type $F < 1$, nor congruency $F (1, 26) = 2.08, p > .1$, but two-way interactions between place and conjunction type $F (2, 52) = 14.28, p < .001$ and between place and congruency $F (1, 26) = 72.29, p < .001$. The three-way interaction between conjunction type, congruency, and place was also significant, $F (2, 52) = 113.26, p < .001$. Further analysis to resolve the interaction showed that the locative pronoun has a predominant preference to refer to place B over place A in because-congruent sentence and no-
congruent sentence\(^5\) \((ps < .001)\) but place A over place B in because-incongruent and no-incongruent sentences \((ps < .01)\). For concessive sentences, however, the preferential coreference between the locative pronoun and the two potential referents was reversed, with a predominant preference to place A over place B in the congruent sentences \((p < .001)\) but place B over place A in the incongruent sentences \((p < .001)\). As can be seen in Table 2, the percentages of referential preference were much lower in the pragmatically incongruent than the congruent sentences, probably because participants were puzzled when the preferential interpretation of a locative pronoun was incompatible with one’s knowledge about the referent (e.g., the Great Wall is in Shanghai). Moreover, the percentage of preferential referents was not significantly different across the three structures when there were no pragmatic anomalies \((ps > .1)\). The absence of an effect of conjunction type suggests that the referential bias is equally strong for these three structures (Table 2).

The sentence acceptability rating examined the acceptability of the discourse coherence/incoherence led by the conjunction and the causally/concessively related statements. Similar to the forced choice test, the critical sentences, together with filler items, were divided into six versions with a Latin-square procedure. Twenty-seven students who did not participate in the eye-tracking experiment or the forced-choice pretest were randomly assigned to one of the six versions. They were asked to judge the overall acceptability of each sentence on a 7-point Likert scale (1 indicating the least acceptable and 7 indicating the most acceptable). As can be seen from Table 3, the incongruent sentences were rated as less acceptable than the congruent ones in because structure, although structure, and no-conjunction structure, as demonstrated by a significant main effect of congruency, \(F(1, 26) = 431.7, p < .001\). Moreover, there was a significant two-way interaction between conjunction type and congruency, \(F(2, 52) = 47.94, p < .001\). Further analysis to resolve this interaction showed that the although-congruent sentences were less acceptable than either the because-congruent sentences or the no-congruent sentences \((ps < .01)\), but there was no difference in acceptability between the because-congruent and the no-congruent sentences \((p > .7)\). Interestingly, although there was no difference between because-incongruent and no-incongruent sentences \((p > .2)\), the although-incongruent sentences were more acceptable than either the because-incongruent sentences or the no-incongruent sentences \((ps < .01)\), suggesting that the strength of conflict induced by pragmatic incongruence (e.g., Shenyang is warm in winter) becomes weaker in the concessive structure compared with the causal structure.

Seventy-two sets of two-clause sentences were constructed as critical sentences. In addition to the critical sentences, 72 filler sentences were constructed. Among them, 40 sentences had similar structures as the critical ones but with a negative attitude-biased verb like taoyan (hate, 20 sentences) or with no attitude-biased verbs at all (20 sentences). The remaining 32 filler sentences have different structures from the critical ones (without the “NP\(_{human}\) moved from...to...” structure), although each was connected by a conjunction. Each critical sentence in one of the six versions was assigned to a different test list with a Latin square procedure, such that in each list there were 12 sentences per experimental condition \((12 \times 6)\). The filler sentences were then added to each list \((144 \text{ sentences per condition in total})\), and the sentences in each list were then pseudo-randomized, with the restriction that no more than three consecutive sentences were of the same condition and no more than three consecutive sentences were congruent or incongruent. Participants were each randomly assigned to one of the six lists.

**Apparatus and procedure**

Participants’ eye movements were monitored with a SensoMotoric Instruments (SMI, Teltow/Berlin, Germany) iView Hi-Speed eye-tracker with sampling at 1,250 Hz (tracking resolution < 0.01 degrees) from the right eye (viewing was binocular). A forehead rest and a chin rest were used to stabilize participants’ head position and to minimize signal interference caused by head movements. Each sentence was presented in one line at the vertical position one half from the top of a 17-inch Cathode Ray Tube (CRT) screen \((1,024 \times 768 \text{ resolution, frame rate 100 Hz})\). Participants were seated 65 cm from the computer screen. At this distance, each Chinese character subtended a visual angle of 1.05 degrees.
Upon arrival at the lab, participants were provided with instructions. A 13-point calibration routine was performed, and its accuracy was checked after every fourth trial (the actual 13 points calibration accuracy is in the range of 0.25–0.5 degrees). Participants were instructed to read sentences silently at their normal rate. After reading the sentence, a yes or no comprehension question that provoked knowledge related to the sentence appeared (see Table 4 for results). The question remained on the screen until a yes or no response was made. Only half of the sentences (including both critical and filler sentences) were probed. To ensure that the answer is clear and unambiguous, the literal meaning of the contents that were inconsistent with encyclopedic knowledge (especially the critical region) would not be probed. For the critical sentences the question either probed the contents of single clause (“Has Grandma moved to Hainan/Shenyang?”) or probed the relation between the two clauses (e.g., “Grandma likes a warm/cold winter?”) but not the referential relation between the pronoun and its potential referents (e.g., “Is it very cold in winter in Shenyang?”). For filler sentences, however, all the above mentioned cases were included. This arrangement minimalized the artificial strategies possibly induced by comprehension tasks. The assignment of left or right hand to yes or no response was counterbalanced across participants. Participants completed 10 practice trials before the main experiment. The entire experiment including resting time lasted approximately 30 minutes.

**Data analysis**

Each test sentence was divided into five regions of interest (ROIs), as demonstrated in Table 5, in which region 1 was place A (or place B in the other half), region 2 was place B (or place A in the other half), region 3 was the conjunction (yinweijijinguan, which only has four conditions), region 4 was the locative pronoun nali (there), and region 5 was the NP (containing a critical word), which was composed of four characters.

To test the moment-by-moment sentence processing, the following eye-movement measures were reported for each ROI: *First fixation duration, first-pass reading time, total reading time, total number of fixations, regression into, and regression out* (Rayner, 1998). As an early measure, first fixation duration is the duration of the first fixation on a word, which reflects very early stage of information processing. First-pass reading time is the sum of all fixations made on a region of the sentence before the eye moved out of the region to either the left or right, reflecting early stages of processing such as perceptual processing and lexical access (Reichle, Rayner, & Pollatsek, 2003). Total reading time is simply the summation of all fixations in one ROI for the duration of the entire trial. Similarly, total number of fixations is the number of total fixations in one region for the duration of the entire trial. Both are late measures, reflecting later stages of sentence processing such as integrating sentential constituents and contextual information into discourse representation. Additionally, to measure participants’ reprocessing of a region and especially the reanalysis of the referential relation between the locative pronoun (nali) and its potential referent (i.e., to what degree participants looking back [or rereading] at the two places upon encountering the locative pronoun), regression into was analyzed in each region, which is assumed to reflect the processing difficulty (e.g., reprocessing/reanalysis) encountered by readers when they are reading the region (Pickering & Frisson, 2001). Similarly, regression out was also analyzed as well, because it can provide indication about how additional processing effort (going back to reread previous regions) is needed in a region.

Fixation durations shorter than 80 ms or longer than 800 ms were excluded from data analyses (<2% of trials). Trials in which there was track loss during first pass reading on the target word or during an immediately adjacent fixation were removed (<1% of the original number of trials). All eye-movement measures that were above or below three standard deviations from the mean were also eliminated. We analyzed the eye-movement data using Linear mixed models6 in R (lme4 R package, version 1.1-7; Barr, Levy, Scheepers, & Tily, 2013). Separate linear mixed models with

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6In this study no cross-region comparisons were made. Instead, all planned comparisons were made across conditions within the same region (or ROI).
participants and items as the random factors and conjunction type (because vs. although vs. no-conjunction) and congruency (congruent vs. incongruent) as the mixed factors were run on each ROI for first fixation, first pass, regression into, regression out, total reading time, and total number of fixation. We report $F$ values and $t$ values for linear mixed-effects models and corresponding $p$ values approximated using the Satterthwaite estimate for mixed model degrees of freedom (Kuznetsova, Christensen, & Brockhoff, 2014). For post-hoc comparisons following significant two-way interactions, the multcomp package (Hothorn, Bretz, & Westfall, 2008) was used with Tukey correction.

Results

Comprehension accuracy

The averaged accuracy rate (by percentage) for answering the comprehension questions for each condition were reported in Table 4. A $2 \times 2$ repeated-measures ANOVA revealed significant main effects of conjunction type $F(2, 58) = 3.10, p < .05$ and congruency $F(1, 29) = 3.81, p < .05$, but not the interaction between them $F < 1$. Follow-up $t$ tests showed that participants were significantly less accurate on answering questions following although-sentence than either following because-sentence or no-conjunction sentence $p < .05$.

Online eye-movement measures

The mean reading time (with standard deviations) from different eye-movement measures are presented in Table 5. Table 6 shows the results (i.e., the $F$ values of the main effects and potential interactions) from the linear mixed models for each measure in each region. As can be seen from Table 6, the main effect of congruency was significant across all ROIs (except regression into in region 5 and regression out in region 3), demonstrating a complete disadvantage of processing incongruent compared with congruent sentences. Because this is not the focus of the present study, we do not address it further. Instead, planned comparisons were made when the main effect of conjunction type reached significance, and further analyses were carried out when the interactions were significant. We discuss the results from each region separately in the following section.

Early eye-movement measures

The early measures failed to show clear differences across experimental conditions either for the first fixation duration or the first-pass reading time from regions 1 to 4. The results from region 5, however, demonstrated that no-conjunction sentences were read more slowly than the because and although sentences. The first fixation measure showed that the critical words were fixated longer in no-conjunction sentence than although-sentence ($\beta = 15.266, SE = 5.957, t (32.96) = 2.563, p < .05$). On the other hand, the first-pass measure showed that the critical words were fixated longer in no-conjunction sentence than because-sentence ($\beta = 58.377, SE = 19.013, t (45.07) = 3.07, p < .01$). No other comparisons reached significance.

Late eye-movement measures

Region 1. For total reading time, following the main effect of conjunction type (Table 6), pairwise comparisons showed that although-sentences were processed more slowly than either
Table 5. Mean scores (M) and standard deviations (SD) of the first fixation, first-pass, regression into, regression out, total reading time, and the total number of fixations in each ROI.

<table>
<thead>
<tr>
<th>Region 1</th>
<th>Region 2</th>
<th>Region 3</th>
<th>Region 4</th>
<th>Region 5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Place A</td>
<td>Place B</td>
<td>Conjunction</td>
<td>Locative pronoun</td>
</tr>
<tr>
<td></td>
<td>M (SD)</td>
<td>M (SD)</td>
<td>M (SD)</td>
<td>M (SD)</td>
</tr>
<tr>
<td>First-fixation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>because-congruent</td>
<td>247 (31)</td>
<td>219 (58)</td>
<td>156 (66)</td>
<td>186 (57)</td>
</tr>
<tr>
<td>because-incongruent</td>
<td>254 (42)</td>
<td>214 (56)</td>
<td>167 (64)</td>
<td>198 (47)</td>
</tr>
<tr>
<td>although-congruent</td>
<td>242 (47)</td>
<td>200 (44)</td>
<td>180 (59)</td>
<td>205 (41)</td>
</tr>
<tr>
<td>although-incongruent</td>
<td>246 (58)</td>
<td>204 (41)</td>
<td>187 (60)</td>
<td>208 (50)</td>
</tr>
<tr>
<td>no-congruent</td>
<td>257 (50)</td>
<td>204 (45)</td>
<td>–</td>
<td>203 (42)</td>
</tr>
<tr>
<td>no-incongruent</td>
<td>246 (48)</td>
<td>211 (51)</td>
<td>–</td>
<td>208 (45)</td>
</tr>
<tr>
<td>First-pass</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>because-congruent</td>
<td>344 (67)</td>
<td>269 (74)</td>
<td>232 (68)</td>
<td>250 (42)</td>
</tr>
<tr>
<td>because-incongruent</td>
<td>361 (88)</td>
<td>260 (86)</td>
<td>237 (56)</td>
<td>254 (52)</td>
</tr>
<tr>
<td>although-congruent</td>
<td>366 (107)</td>
<td>247 (68)</td>
<td>248 (61)</td>
<td>263 (49)</td>
</tr>
<tr>
<td>although-incongruent</td>
<td>358 (101)</td>
<td>244 (49)</td>
<td>246 (62)</td>
<td>257 (51)</td>
</tr>
<tr>
<td>no-congruent</td>
<td>352 (102)</td>
<td>264 (61)</td>
<td>–</td>
<td>264 (45)</td>
</tr>
<tr>
<td>no-incongruent</td>
<td>331 (78)</td>
<td>255 (69)</td>
<td>–</td>
<td>259 (46)</td>
</tr>
<tr>
<td>Regression into</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>because-congruent</td>
<td>0.56 (0.35)</td>
<td>0.49 (0.23)</td>
<td>0.30 (0.21)</td>
<td>0.10 (0.11)</td>
</tr>
<tr>
<td>because-incongruent</td>
<td>0.86 (0.38)</td>
<td>0.65 (0.35)</td>
<td>0.35 (0.28)</td>
<td>0.19 (0.19)</td>
</tr>
<tr>
<td>although-congruent</td>
<td>1.01 (0.46)</td>
<td>0.48 (0.28)</td>
<td>0.48 (0.30)</td>
<td>0.17 (0.17)</td>
</tr>
<tr>
<td>although-incongruent</td>
<td>1.04 (0.45)</td>
<td>0.54 (0.32)</td>
<td>0.56 (0.36)</td>
<td>0.19 (0.19)</td>
</tr>
<tr>
<td>no-congruent</td>
<td>0.65 (0.33)</td>
<td>0.48 (0.29)</td>
<td>–</td>
<td>0.21 (0.22)</td>
</tr>
<tr>
<td>no-incongruent</td>
<td>0.83 (0.35)</td>
<td>0.62 (0.36)</td>
<td>–</td>
<td>0.26 (0.21)</td>
</tr>
<tr>
<td>Regression out</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>because-congruent</td>
<td>0.27 (0.30)</td>
<td>0.43 (0.29)</td>
<td>0.18 (0.13)</td>
<td>0.21 (0.24)</td>
</tr>
<tr>
<td>because-incongruent</td>
<td>0.33 (0.29)</td>
<td>0.61 (0.31)</td>
<td>0.21 (0.16)</td>
<td>0.26 (0.18)</td>
</tr>
<tr>
<td>although-congruent</td>
<td>0.30 (0.34)</td>
<td>0.55 (0.38)</td>
<td>0.31 (0.19)</td>
<td>0.31 (0.21)</td>
</tr>
<tr>
<td>although-incongruent</td>
<td>0.33 (0.31)</td>
<td>0.64 (0.30)</td>
<td>0.29 (0.19)</td>
<td>0.44 (0.30)</td>
</tr>
<tr>
<td>no-congruent</td>
<td>0.23 (0.32)</td>
<td>0.48 (0.27)</td>
<td>–</td>
<td>0.24 (0.23)</td>
</tr>
<tr>
<td>no-incongruent</td>
<td>0.31 (0.37)</td>
<td>0.55 (0.29)</td>
<td>–</td>
<td>0.28 (0.23)</td>
</tr>
<tr>
<td>Total reading time</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>because-congruent</td>
<td>654 (197)</td>
<td>564 (166)</td>
<td>337 (128)</td>
<td>350 (90)</td>
</tr>
<tr>
<td>because-incongruent</td>
<td>827 (218)</td>
<td>658 (245)</td>
<td>413 (164)</td>
<td>439 (132)</td>
</tr>
<tr>
<td>although-congruent</td>
<td>933 (275)</td>
<td>615 (205)</td>
<td>480 (183)</td>
<td>468 (136)</td>
</tr>
<tr>
<td>although-incongruent</td>
<td>984 (290)</td>
<td>635 (224)</td>
<td>517 (229)</td>
<td>524 (227)</td>
</tr>
<tr>
<td>no-congruent</td>
<td>866 (164)</td>
<td>529 (143)</td>
<td>–</td>
<td>387 (110)</td>
</tr>
<tr>
<td>no-incongruent</td>
<td>781 (177)</td>
<td>692 (217)</td>
<td>–</td>
<td>494 (147)</td>
</tr>
<tr>
<td>Total fixation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>because-congruent</td>
<td>2.43 (0.66)</td>
<td>2.23 (0.54)</td>
<td>1.51 (0.37)</td>
<td>1.48 (0.41)</td>
</tr>
<tr>
<td>because-incongruent</td>
<td>3.05 (0.70)</td>
<td>2.71 (0.86)</td>
<td>1.73 (0.58)</td>
<td>1.78 (0.41)</td>
</tr>
<tr>
<td>although-congruent</td>
<td>3.28 (0.85)</td>
<td>2.48 (0.63)</td>
<td>1.95 (0.51)</td>
<td>1.85 (0.42)</td>
</tr>
<tr>
<td>although-incongruent</td>
<td>3.45 (0.95)</td>
<td>2.56 (0.66)</td>
<td>2.10 (0.58)</td>
<td>2.05 (0.72)</td>
</tr>
<tr>
<td>no-congruent</td>
<td>2.56 (0.55)</td>
<td>2.23 (0.51)</td>
<td>–</td>
<td>1.59 (0.45)</td>
</tr>
<tr>
<td>no-incongruent</td>
<td>2.90 (0.74)</td>
<td>2.76 (0.72)</td>
<td>–</td>
<td>1.94 (0.49)</td>
</tr>
</tbody>
</table>

because-sentences ($\beta = 183.199$, $SE = 34.8$, $t (31.45) = 5.264$, $p < .001$) or no-conjunction sentences ($\beta = 183.801$, $SE = 30.944$, $t (41.51) = 5.94$, $p < .001$), but there was no difference between because-sentences and no-conjunction sentences ($\beta = 0.602$, $SE = 25.99$, $t (33.30) = 0.023$, $p > .9$).

As for total fixation, pairwise comparison to resolve the two-way interaction showed that incongruent sentences were fixated more than congruent sentences in because-sentences ($\beta = 0.568$, $SE = 0.12$, $t (190.07) = 4.729$, $p < .001$) and no-conjunction sentences ($\beta = 0.353$, $SE = 0.12$, $t (189.21) = 2.946$, $p < .05$) but not the although-sentences ($\beta = 0.169$, $SE = 0.121$, $t (193.95) = 1.401$, $p > .7$). Moreover, when there was no pragmatic incongruence, although-sentences were fixated more than either because-sentences ($\beta = 0.787$, $SE = 0.156$, $t (66) = 5.038$, $p < .001$) or no-conjunction sentences ($\beta = 0.666$, $SE = 0.139$, $t (85.55) = 4.779$, $p < .001$), although there was no difference between the because-sentences and the no-conjunction sentences ($\beta = -0.120$, $SE = 0.118$, $t (110.10) = -1.023$, $p > .9$). On the other hand, when pragmatic incongruence occurred, although-sentences
were fixated more than no-conjunction sentences ($\beta = 0.482$, $SE = 0.14$, $t (86.69) = 3.442$, $p < .05$), no other comparisons were significant.

Follow-up comparisons to resolve the two-way interaction showed that incongruent words were reread more than congruent words in both because-sentences ($\beta = 0.297$, $SE = 0.061$, $t (2026.55) = 4.883$, $p < .001$) or no-conjunction sentences ($\beta = 0.177$, $SE = 0.061$, $t (2024.74) = 2.912$, $p < .05$) but not in although-sentences, ($\beta = 0.041$, $SE = 0.061$, $t (2016.40) = 0.674$, $p > .9$). Moreover, for the pragmatically congruent conditions, although-sentences were reread more than both because-sentences ($\beta = 0.446$, $SE = 0.075$, $t (76.41) = 5.914$, $p < .001$) and no-conjunction sentences ($\beta = 0.350$, $SE = 0.072$, $t (89.55) = 4.85$, $p < .001$). For the incongruent conditions, although-sentences were reread more than no-conjunction sentences ($\beta = 0.214$, $SE = 0.072$, $t (90.85) = 2.954$, $p < .05$). No other comparisons were significant.

Region 2. The resolution of the two-way interaction showed that participants spent more time processing incongruent than congruent words in both because-sentences (total reading: $\beta = 95.179$, $SE = 31.395$, $t (220.45) = 3.032$, $p < .05$; total fixation: $\beta = 0.556$, $SE = 0.107$, $t (227.52) = 5.212$, $p < .001$) and no-conjunction sentences (total reading: $\beta = 165.288$, $SE = 31.712$, $t (225.98) = 5.212$, $p < .001$; total fixation: $\beta = 0.595$, $SE = 0.107$, $t (226.40) = 5.582$, $p < .001$) but not although-sentences ($ps > .9$). Moreover, for the pragmatically congruent conditions, although-sentences were reread more than both because-sentences ($\beta = 0.446$, $SE = 0.075$, $t (76.41) = 5.914$, $p < .001$) and no-conjunction sentences ($\beta = 0.350$, $SE = 0.072$, $t (89.55) = 4.85$, $p < .001$). For the incongruent conditions, although-sentences were reread more than no-conjunction sentences ($\beta = 0.214$, $SE = 0.072$, $t (90.85) = 2.954$, $p < .05$). No other comparisons were significant.

Region 3. As can be seen from Tables 5 and 6, the conjunctions were fixated longer in the incongruent sentences than the congruent ones (total reading: 465 ms vs. 408.5 ms; total fixation: 1.915 vs. 1.73), and the conjunctions in although-sentences were processed longer than those in because-sentences (total reading: 498.5 ms vs. 375 ms; total fixation: 2.025 vs. 1.62). No interaction between conjunction type and congruency was found. Similarly, the results from the regression into
and regression out showed that although-sentences gave rise to more regression-into and regression-out performance than because-sentences (See Table 5).

**Region 4.** Following the main effect of conjunction type (Table 6), pairwise comparisons showed that although-sentences were read longer than both because-sentences (total reading: $\beta = 99.835$, SE = 26.153, $t$ (43.14) = 3.817, $p < .005$; total fixation: $\beta = 0.325$, SE = 0.084, $t$ (32.74) = 3.864, $p < .005$) and no-conjunction sentences (marginally significant, total reading: $\beta = 51.497$, SE = 22.561, $t$ (44.36) = 2.283, $.05 < p < .1$; total fixation: $\beta = 0.172$, SE = 0.075, $t$ (33.40) = 2.285, $.05 < p < .1$), and no-conjunction sentences were fixated longer than because-sentences (total reading: $\beta = 48.338$, SE = 17.285, $t$ (31.01) = 2.797, $p < .05$; total fixation: $\beta = 0.153$, SE = 0.058, $t$ (30.09) = 2.650, $p < .05$). No other comparisons were significant.

Pairwise comparisons carried out on regression into showed that no-conjunction sentence was reread more than because-sentence ($\beta = 0.093$, SE = 0.035, $t$ (31.74) = 2.701, $p < .05$). As for regression out, although-sentences were more likely regressed out than either because-sentences ($\beta = 0.135$, SE = 0.04, $t$ (33.56) = 3.399, $p < .005$) or no-conjunction sentences ($\beta = 0.11$, SE = 0.044, $t$ (30.80) = 2.499, $p < .05$).

**Region 5.** Follow-up analyses to resolve the two-way interaction showed that participants fixated the incongruent words longer than the congruent ones in both because-sentences (total reading: $\beta = 167.188$, SE = 34.759, $t$ (211.8) = 4.81, $p < .001$; total fixation: $\beta = 0.651$, SE = 0.127, $t$ (246.77) = 5.138, $p < .001$) and no-conjunction sentences (total reading: $\beta = 184.614$, SE = 34.575, $t$ (207.88) = 5.34, $p < .001$; total fixation: $\beta = 0.665$, SE = .127, $t$ (246.1) = 5.131, $p < .001$) but not although-sentences $p > .4$. For pragmatically congruent sentences, critical words were fixated longer in although-sentences than because-sentences (total reading: $\beta = 191.955$, SE = 42.927, $t$ (73.4) = 4.472, $p < .001$; total fixation: $\beta = 0.681$, SE = 0.151, $t$ (64) = 4.498, $p < .001$), and no-conjunction sentences were fixated longer than because-sentences (total fixation: $\beta = 0.344$, SE = 0.12, $t$ (109.14) = 2.864, $p < .05$). For pragmatically incongruent sentences, the critical words were fixated longer in no-conjunction sentences than in because-sentences (total reading: $\beta = 108.726$, SE = 35.253, $t$ (114.94) = 3.084, $p < .05$; total fixation: $\beta = 0.342$, SE = 0.12, $t$ (110.54) = 2.838, $.05 < p < .1$). No other comparisons were significant.

Pairwise comparisons following the main effect of conjunction type on regression out showed that the critical region in although-sentences was more likely regressed out of than the critical region in because-sentences ($\beta = 0.182$, SE = 0.073, $t$ (32.02) = 2.503, $p < .05$) and no-conjunction sentences ($\beta = 0.138$, SE = 0.065, $t$ (34.71) = 2.2, $.05 < p < .1$). The further analysis of the regression into only revealed a marginally more regressions in the although-congruent sentences than the because-congruent sentences ($\beta = 0.043$, SE = 0.015, $t$ (112.79) = 2.754, $.05 < p < .1$).

**Discussion**

The results from the total reading time and the total number of fixations from all ROIs consistently showed that processing concessive meaning requires longer time than causal meaning. However, although the results of the late measures seem to suggest that processing concessive relation is dissociable from processing causal relation, the present experiment does not allow us to fully draw the conclusion that processing concessive relation itself is cognitively more demanding than processing causal relation, because the interval between the locative pronoun and its actual antecedent is not equal between the two conditions. To examine whether the processing difficulty in concessive relation was caused by the distance difference between the locative pronoun and the antecedent, Experiment 2 was conducted.

**Experiment 2**

The longer processing time for the concessive sentence than the causal sentence may be due to the longer pronoun-antecedent distance in the concessive condition than the causal condition, because the pronoun has been found to have a general preference to refer to the near antecedent (due to
memory constraints). The purpose of Experiment 2 was to test whether the processing difficulties in concessive sentences are caused by the differences in resolving the pronoun. Experiment 2 includes two experimental conditions, a causal condition and a concessive condition, both of which are pragmatically congruent sentences. To exclude the potential interference of distance, the locative pronoun in both cases were co-referential with the closer (the second) antecedent.

**Methods**

**Participants**

Thirty-one undergraduate and postgraduate students (8 men, age ranging from 18 to 28 years, with mean age of 22.9 years) from Nanjing Normal University were recruited. All were right-handed and had normal or corrected-to-normal vision. Two participants were removed for the poor performance on answering the comprehension questions.

**Materials**

Two testing lists were created by using a Latin-square procedure, with each list containing 20 critical sentences (10 sentences per condition; Table 7) and 10 filler sentences. For causal condition, the similar sentences (see sentence 14a) as Exp. 1 were adopted. For concessive condition, however, to ensure that the locative pronoun was coreferential with the closer (second) rather than the distant (first) antecedent, positive attitude verbs (e.g., like) were replaced by negative attitude verbs (e.g., dislike). Moreover, the sentence-final word was also replaced by another one, ensuring that it is congruent with the local as well as the global context, like sentence (14b).

The filler sentences had a variety of structures, each containing a conjunction (e.g., but, and) that did not appear in the critical sentences. To measure the referential preference of the locative pronoun, 20 participants were asked to identify which one of the two locations (e.g., Shenyang vs. Hainan) did the locative pronoun nali refer to or to opt for a location even unmentioned in the sentence. The results showed that the percentage of the recent reference (the pronoun refers to the second place NP2) was more than 96% in both causal and concessive conditions, suggesting that the pronoun has an overwhelming preference to refer to the closer place in both cases. Finally, we examined some potential differences in the sentence-final position, because different words were adopted across conditions. Paired t tests conducted on the sentence-final region failed to show any significant difference between because condition and although condition either in frequency (per million: 53.8 vs. 50.9) t < 1, or the number of strokes t (19) = 1.03, p > .3 (18.1 vs. 19).

**Procedure**

Each sentence was presented using a standard noncumulative moving-window self-paced reading paradigm, using Courier 13p font. A series of dashes (10) appeared on the screen before the onset of each sentence. After the participant pressed the space bar, the dashes disappeared and the first segment of a sentence appeared. Each time the participant pressed the space bar, the computer revealed the next segment of the sentence and simultaneously concealed the segment that had

<table>
<thead>
<tr>
<th>Table 7. Experimental conditions and exemplar sentences with literal translations and glosses in Experiment 2.</th>
</tr>
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<tr>
<td><strong>Conditions</strong></td>
</tr>
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</table>
| because-congruent | 14a. 外婆/从沈阳/迁到了/海南，/因为/她/喜欢/那里/冬天/暖和。  
Waipo cong/Shenyang/qiandaole/Hainan, /yinwei/ta/nanwha/nali/dongtian nuanhuo.  
Grandma /from Shenyang/go-to-PPV/Hainan /because/she/like/there/winter warm.  
Grandma has moved from Shenyang to Hainan, because she liked the winter there being warm |
| although-congruent | 14b. 外婆/从沈阳/迁到了/海南，/尽管/她/讨厌/那里/冬天/潮湿。  
Waipo /cong Shenyang/qiandaole/Hainan, /jinguan/ta/douyuan/taoyan/nali/dongtian/chaoshi.  
Grandma /from Shenyang/go-to-PPV/Hainan /although/she/dislike/there/winter/wet.  
Grandma has moved from Shenyang to Hainan, although she disliked the winter there being wet |

Note: Each sentence is made up of 10 segments.
previously been exposed. This method ensured that participants did not backtrack to previously read segments. There were 10 segments in total for each sentence, with the first 4 segments constituting the main clause (first clause) and next 6 segments constituting the subordinate clause (second clause). To note, the last two segments of Experiment 2 correspond to the critical region (region 5) in Experiment 1. The final segment of each sentence was followed by a yes or no comprehension question probing knowledge related to the individual clause or the relationship between two clauses. The assignment of hand to response type was counterbalanced across participants. Before the formal test, each participant performed a practice block of five sentences, which had similar structures as the test stimuli.

Results

Comprehension accuracy
The average comprehension accuracy was 92.9% \( (M = 9.29, SD = 0.86) \) for the causal condition and 87.7% \( (M = 8.77, SD = 1.23) \) for the concessive condition. The pairwise \( t \) test showed that the difference was significant, \( t(28) = 2.38, p < .03 \), suggesting that participants can more accurately answer the questions following the causal sentence compared to the concessive sentence.

Self-paced reading time
Linear mixed models with participants and items as the random factors and conjunction type \( (because \) vs. \( although) \) as the fixed factor were run for each segment separately. The mean reading times for concessive and causal conditions from each segment are displayed in Figure 1. For the first four regions in the main clause, there were no significant differences between conditions \( ps > .18 \). For the subordinate clause, however, although there were no significant difference between conditions in the first two regions (i.e., the conjunction and the pronoun), \( ps > .37 \), the segments in concessive condition were read more slowly than those in causal condition in the verb region \( (\beta = 0.02, SE = 0.01, t(27.21) = 1.98, p = .058) \), the locative pronoun region \( (\beta = 0.022, SE = 0.01, t(280.6) = 2.17, p = .031) \), the second last word region \( (\beta = 0.046, SE = 0.02, t(27.25) = 3.12, p = .004) \), and the sentence-final region \( (\beta = 0.071, SE = 0.019, t(27.65) = 3.84, p = .007) \).

![Figure 1. Mean scores and standard deviations of the self-paced reading time for each segment/region (1–10).](image-url)
Discussion

The longer processing time recorded at the second clause in the concessive sentence relative to the causal sentence suggests that concessive relation is more difficult to process than causal relation. This difficulty occurred quickly after the appearance of an overt coherence conjunction. The finding speaks against the possibility that the processing difficulty observed in the eye-movement study was due to the distance difference between the locative pronoun and its referent. Instead, it suggests that the dissociation between processing concessive relation and causal relation occurs because different underpinning cognitive processes were involved during processing these two types of relations. Nonetheless, it should be noted that the processing strategies are not exactly the same in self-paced reading and in natural reading (eye-tracking), because regressions (i.e., rereading) are possible in eye-tracking but not in self-paced reading. However, although the absence of regression may increase the difficulties of processing the segmentations in the later part (i.e., second clause), given that all segmentations after the conjunction were identical across conditions, each condition should be equally affected by this effect. (See Mitchell [2004, pp. 18–26] for a detailed discussion of the similarities and differences between self-paced reading and eye tracking.)

General discussion

In Experiment 1, using an eye-movement technique, we investigated how pragmatic processing was modulated by discourse conjunctions. The online eye-movement measures failed to show clear differences across experimental conditions in the initial eye-movement measures such as the first-fixation duration and the first-pass reading time (except in region 5, where no-conjunction sentences were read more slowly than the because/although sentences), suggesting that the presence of an explicit conjunction can only lead to limited early facilitation. However, differences were indeed apparent on the late measures (e.g., total reading time, total number of fixations, regression out, etc.). For instance, the total reading time and the total number of fixations from all ROIs consistently showed that processing concessive meaning requires longer time than processing causal meaning, even if causality was not explicitly conveyed (e.g., regions 1, 2, and 4). In particular, in the critical region (region 5), although the incongruent words were processed more slowly than the congruent ones in the causal structures (including both because-sentences and no-conjunction sentences) from the late measures (e.g., total reading time and total fixation), there was no effect of congruence in the concessive structure, presumably because processing concessive relation is demanding enough to override the processing of the pragmatically incongruent information. Similarly, the off-line measures showed that comprehension questions were resolved less accurately in concessive compared with causal relations. Finally, the results from the self-paced reading test (Experiment 2) showed that processing difficulties with concessive sentences cannot be simply attributable to the differences of pronoun resolution.

Overall, these findings suggest that processing concessive meaning is dissociable from processing causal meaning. In what follows, we mainly concentrate on two issues: the dissociation of processing causal relation versus concessive relation and the effect of the absence versus presence of a different conjunction on achieving discourse coherence.

Dissociation of processing causal versus concessive relations

By signaling coherent relations, different conjunctions exert different influences on establishing a coherent discourse representation and hence may result in different eye-movement patterns. The analysis of the regression into data in regions 1 and 2 provides insight into how the referential relation between the locative pronoun nali (there) and its potential referent was reprocessed and how it was influenced by coherent relation and world knowledge. It showed different patterns over region 1 and region 2. The referent in region 1 (e.g., place A) was looked back more in concessive than
causal relations; however, the regression into measure from region 2 (e.g., place B) failed to show a
difference across conditions. This was probably because the referential relation was more difficult to
establish in concessive than causal relations, and thus the former requires more reprocessing than
the later. This measure is partially in agreement with what has been observed from the off-line
measures (i.e., the forced choice test, Table 2), because it showed that the locative pronoun has a
strong preference to refer to the distant place (place A) in concessive relation but the closer one
(place B) in the causal relation. Moreover, the analysis of the regression out data from the critical
region (region 5) showed more regression-out performance for concessive than causal sentences,
probably because readers encountered more difficulties in concessive than causal relations to
integrate the critical word into discourse; consequently, they had to go back more and spend
more time rereading previous information in concessive than causal relations.

The successful establishment of a coreferential relation between the two propositions is crucial for
constructing an integrated discourse representation, and during this process discourse conjunction
play a significant role. The causal conjunction yinwei denotes an explicit consequence-cause relation
and signals that the subordinate clause has to be interpreted as the expression of the cause of the
event in the main clause. In this case, the causal marker yinwei in combination with the attitude-
based verb (e.g., like) and the discourse context would lead to the interpretation of the locative
pronoun toward the closer referent (the second place). To illustrated this tendency with sentence
(10a) in Table 1, the two propositions can be successfully integrated into a coherent discourse
representation by activating the general world knowledge that Shenyang is cold whereas Hainan is
warm, and this activation may be facilitated by the presence of the causal relation marker yinwei (see
also sentence (6)). However, when the two propositions are connected by a concessive conjunction
jinguan, there would be a quite different interpretation of the coreferential relation across the two
clauses. In this situation, as revealed by the regression performance, the concessive conjunction in
combination with the attitude-biased verb leads to a preference for the locative pronoun nali to refer
to the first (the distant) rather than the second (the closer) place. Presumably, the longer distance
between the pronoun and its antecedent puts a higher load on readers’ working memory system and
consequently requires more processing effort for concessive than causal relations. This seems to be
consistent with previous studies showing that long-distance referential dependency demands the
engagement of more cognitive and neural processes (Hammer et al., 2008; Qiu et al., 2012).

However, although long distance could increase the time of establishing a coreferential relation in
cessive relation, the differences in the resolution of the locative pronoun (there) are not the
decisive contribution to the difficulty of processing concessivity. Indirect evidence against the
distance-based explanation comes from the direct comparison of the two inconsistent conditions.
The longer reading time in the concessive-inconsistent sentences compared with the causal-incon-
sistent sentences suggests that processing concessive relation is cognitively more demanding than
processing causal relation even when the referential relation between the locative pronoun and its
antecedents cannot be successfully established. More importantly, direct evidence to argue against
the distance-based explanation comes from the self-paced reading experiment (Experiment 2) in
which the distance between the locative pronoun and its actual antecedent remains the same (both
take reference to the close antecedent). This design, therefore, minimizes the potential interference
induced by distance differences. Even in this case the second clause (subordinate clause) was still
more difficult to process in the concessive relation than in the causal relation. This provides
compelling evidence to support the argument that the processing difficulties with the concessive
relation are not driven by differences in terms of pronoun resolution.

Instead, the dissociation of concessive relation from causal relation in eye-movement perfor-
performance could be attributable to the different degrees of semantic-pragmatic complexity of causal
versus concessive sentences. As noted in the Introduction, in contrast to causal relations (indicating
if p, then q), concessive relations invite an inference of causality, which is then, surprisingly,
contradicted by the facts (indicating if p, then not-q). For instance, sentence (11a) implicates (or
possibly, presupposes) a causal relation [CAUSE (p, q)] such as Chinese people (especially the elderly)
generally prefer to stay in the southern part of China in winter, because the winter is warm. The interpretation of concessive relation, however, is based on the negation of an expected causal relation [CAUSE (p, not-q)]. Therefore, the presence of the concessive conjunction although in (11a) reverses the causal connection and denotes an unexpected situation: Grandma has moved to a cold place in winter. In this respect the more resources for processing concessive relation than causal relation is probably because processing concessive relation involves an additional process, namely computing negation. According to Iten (2000, 2005), the presence of a concessive conjunction although indicates the suspension of an inference from what follows (i.e., concessive clause), which would result in an unresolvable contradiction. For the present study the involvement of an additional negation operation in concessive structure would make the integration of the two propositional meaning into one coherent discourse representation difficult not only for the although-incongruent sentence but also for the although-congruent sentence (Kaup, Lüdtke, & Zwaan, 2006), resulting in similar eye-movement patterns under these two situations. Moreover, the more cognitive effort engaged during processing concessive relation than causal relation may also be induced by the simultaneous activation of two conflicting causal assumptions [both CAUSE (p, q) and CAUSE (p, not-q)] in the concessive structure but not the causal one. For either interpretation the linguistic argument that concessive relations are conceptually more complex than causal relations gets well supported. Additional supportive evidence for this argument comes from the observation that although pragmatic incongruence resulted in longer reading time (and more regression performance) either in because-sentence or no-conjunction sentence, there was no influence of pragmatic congruence in concessive sentence, as revealed by results in terms of total reading time and the total fixations from regions 1, 2, and especially 5 as well as the regression into results from region 1 (Table 5). We assume that processing concessive relations is already cognitively highly demanding; as a consequence, fewer resources were left to deal with the pragmatic anomalies. However, this null effect does not mean that readers did not even notice the pragmatic incongruences, because readers processed the precritical region, namely region 4 (e.g., nali), more in although-incongruent sentence than although-congruent sentence (both total reading time and total fixation showed a main effect of congruency but no interaction with conjunction type), probably due to the more rereading induced by the pragmatic anomalies in concessive relation.

Theoretically, the above-mentioned dissociation between processing concessive versus causal meanings is in line with the fine-grained semantic-pragmatic analysis of discourse makers such as the relevance-theoretic account in Blakemore (2005) and Iten (1998, 2005), in which causal and concessive conjunctions encode different pragmatic implications. Although causal conjunctions encode conceptual meaning—it can form part of the communicated message—a concessive conjunction does not encode conceptual meaning. Instead, it typically encodes procedural information, namely it only signals how the message relates to the prior discourse (Iten, 1998): It triggers certain types of inference indicating that the conceptual meaning of the second clause is incompatible with the first (Hall, 2007; Izutsu, 2008). For instance, in (11a) the main clause expresses a truth proposition (e.g., moving to a cold place Shenyang), but the subordinate presents a potentially conflicting proposition (enjoying a warm place in winter). Thus, the concessive conjunction is believed not to contribute to the truth conditional content of the utterance containing it (Iten, 1998, 2005), whereas the causal relation like (10a) does.

Experimentally, these results fit with the existing evidence that processing concessive relation is dissociable from processing causal relation. However, compared with the previous investigations (Caron, Micko, & Thuring, 1988; Köhne & Demberg, 2012; Millis & Just, 1994; Morera et al., 2016), the current study has several novel implications. First, it not only revealed the real-time dissociation of processing concessive relative to causal relations but also examined how world knowledge incongruence was processed and reprocessed in these two types of relations. We found that encyclopedic knowledge anomalies exerted a larger influence on causal relations than concessive relations. Second, relative to other languages (e.g., Spanish, German, English) in which these relations have been investigated, Chinese relies more on pragmatic and context information (e.g., given information vs. new information, world
knowledge, word order) rather than the superficial cues such morphologic/syntactic rules and overt coherence markers to achieve coherence (Lu & Shen, 2003; Wang, 1984). It is thus argued that the overt conjunctions could play a less important role in Chinese than the other languages (e.g., English, Spanish, German; Wang, 1984, pp. 468–472). In spite of this, we found that the inappropriate use of a conjunction during Chinese sentence comprehension will certainly bring difficulties to the real-time processing of causal relation, although its impacts on processing concessive relation was attenuated (especially in the critical region). It remains to be seen whether a similar asymmetry underlying processing concessive/causal relations holds for other languages. Finally, another difference between this study and the previous ones is the sentence structure: Although most previous studies (e.g., Morera et al., 2016; Townsend, 1983) focused on forward coherence relation (i.e., cause/concession-consequence), the current study investigated how backward coherence relation (consequence-cause/concession) was processed. The similar findings from different sentence structures and diverse languages confirm the previous linguistic analysis that concessive relation is functionally dissociable from causal relation.

The behavioral dissociation underlying processing concessive relations and causal relations is in line with the diachronic fact that concessives have historically grown out of causals, but that the opposite development from concessive to causal is not attested (König & Siemund, 2000; Mauri & Auwera, 2012). Both linguists and psychologists (e.g., Gestalt psychologists) argued that causal is a basic category and causality (cause-consequence) is a fundamental relation, not just for natural language comprehension but for other cognitive processing in general (e.g., the Causality-by-default hypothesis proposed by Sanders [2005]; also see Kaiser, 2012; Mak & Sanders, 2013; Mulder & Sanders, 2012; Oudega, 2011), whereas a concessive relation is not a canonical way for either perception or cognition but rather it generally indicates a conflict or clash between two parts of expressions (Taboada et al., 2012).

Based on the taxonomic interpretation of coherence relations (by Sanders et al., 1992, 1993) as mentioned previously, Evers-Vermeul, and Sanders (2009) further explained the distinctions between coherence relations by cumulative conceptual complexity. The cumulative complexity is interpreted in terms of a number of primitive features. The two most relevant features are causal and negative. Under this analysis, concessive relation is specified for both features causal and negative whereas causal relation is specified only for the feature causal but not the feature negative. Therefore, the combination of these features would lead to concessive relation cognitively more complex than causal relation. The cognitive realities underlying this dissociation have been proved by the developmental evidence (Evers-Vermeul, & Sanders, 2009; Spooren & Sanders, 2008) showing that concessive relation (e.g., but, although) is acquired later than causal relation, probably because, as a nonbasic order relation, concessive relation is cognitively more complex than the basic-order causal relation.

**Presence versus absence of conjunction on discourse processing**

Results of the late measures (e.g., the total reading time and the total fixations) from region 4 (also regression into) and region 5 showed that sentences with no conjunctions were processed much more slowly than sentences containing the causal conjunction yinwei, regardless of whether there were pragmatic anomalies, suggesting that the presence of an explicit causal device can facilitate the integration of two reasonably related casual propositions. The findings from the online eye-movement measure are consistent with previous observation from the off-line probe-recognition paradigm showing that the presence of a causal conjunction can make the causally related sentences easier to understand (Millis & Just, 1994). However, it should be noted that although no-congruent sentences were processed more slowly than because-congruent sentences, they were processed faster than the sentences connected by concessive conjunction although (region 4), suggesting that understanding causal relation is much easier than concessive relation, even if the causality is implicitly conveyed. This seems to be inconsistent with Millis and Just’s (1994) observation, which showed that relative to the no-conjunction condition, the presence of a concessive conjunction although would lead to a faster reading of the subordinate clause. One possible explanation is that although there were no explicit
devices signaling the relation between clauses in both cases, a clear causal association was implicitly conveyed in the present study but not Millis and Just (1994)’s study. This unmarked causality can facilitate sentence processing as well; as a consequence, readers can interpret this causal relation faster, based on the encyclopedic knowledge or the prior context.

In addition to the dissociations underlying processing the pragmatically congruent relations, the processing effort to resolve the pragmatically incongruent relations were not identical either. The *because*-incongruent sentences were processed faster than either the *although*-incongruent sentences or the no-incongruent sentences, suggesting that the presence of overt causal device facilitates not only the processing of pragmatically congruent sentences but also the reinterpretation of the pragmatically incongruent sentences. Moreover, the absence of explicit causal device (in the incongruent sentences with no conjunctions) would delay the evaluation of two inconsistent propositions, causing the reinterpretation of the incongruent propositions into a discourse representation as demanding as that in the *although*-incongruent sentences.

Taken together, these findings suggest that discourse conjunctions play a significant role in establishing coherence discourse representation. However, although the presence of a conjunction can generally facilitate the establishment of a coherent discourse relation relative to the absence of a conjunction, different conjunctions should not function equally during this process. The statements connected by some conjunctions (e.g., *although*) may be more difficult to understand than those connected by others (e.g., *because*), due to the different semantic as well as pragmatic complexities of these conjunctions.

**Conclusions**

This eye-tracking study compared how the pragmatic information (pragmatically congruent vs. pragmatically incongruent) was processed in concessive and causal relations. It was found that sentences connected by concessive conjunctions were fixated longer than sentences connected by causal conjunctions. It was also found that although pragmatic-incongruent sentences were fixated longer than pragmatic-congruent sentences in both explicit (with a causal marker) and implicit (without a causal marker) causal structures, there was no congruency effect in concessive structure. These findings suggest that processing concessive relation is more cognitively demanding than causal relation, regardless of whether or not the causality was conveyed explicitly. Our experiment is in agreement with a fine-grained linguistic (i.e., conceptual and pragmatic) analysis of discourse conjunctions that concessive relation is functionally dissociable from causal relation (e.g., concessivity is treated as a negative counterpart of causality) and therefore relative to processing causal relation, and processing concessive relation involves an additional cognitive process, namely the *negation* of a potential causal relation. It is also in line with the linguistic argument that although causal conjunction encodes conceptual meaning, a concessive conjunction only encodes procedural information. This study demonstrates that the dissociation between processing causal and concessive meanings holds for Chinese, in addition to other European languages such as English, Spanish, and German.

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