How Jingran ‘竟然’ and Guoran ‘果然’ Influence Temporal Relations in Mandarin Chinese: A Case of Semantics-pragmatics Interface

Jiun-Shiung Wu
Institute of Linguistics, National Chung Cheng University
No. 168, University Road, Minhsiung, Chiayi County, Taiwan, 621
Lngwujs@ccu.edu.tw

Abstract
In this paper, I examine how jingran and guoran influence temporal relations in Mandarin Chinese. I argue that, parallel to aspect markers and situation types in Mandarin Chinese (Wu 2003, 2007a, 2007b, 2009b, 2010), jingran and guoran specify a default rhetorical relation, which in turns decides a temporal relation, and that they impose a temporal constraint. Because guoran denotes that the proposition it presents matches an expectation, I argue that by default guoran indicates Explanation. On the other hand, because jingran expresses that the proposition it presents contradicts an expectation, I propose that by default jingran indicates Contrast. They both impose a temporal constraint: the proposition they present cannot temporally precede the expectation based on which they are used. Guoran involves a directionality issue: whether it is the proposition guoran presents explains another event or the other way around. This is an important issue because it makes a great deal of difference whether $\alpha$ explains $\beta$ or $\beta$ explains $\alpha$. I argue that the directionality of guoran follows from its inference pattern. Directionality is not an issue for jingran because it makes no difference whether $\alpha$ contrasts with $\beta$ or the other way around. I also model the phenomena discussed with the Segmented Discourse Representation Theory (Asher and Lascarides 2003).

Keywords
Temporal relations, jingran, guoran, evaluative modals, semantics-pragmatics interface.

1 Introduction
The situations described by sentences (or clauses) in a discourse can be temporally related. One situation can temporally precede, overlap or follow another. Tense can, but not always, help to determine temporal relations, as shown in (1) and (2).

(1) a. He is absent today.
   b. He was hit by a car on his way to school.
(2) a. John fell down.
   b. Mary helped him up.
   b’. Mary pushed him.

In (1), (1a) is present tense and (1b) past tense. Tense information in this example indicates that (1b) temporally precedes (1a). In (2), (2a) and (2b) form a (short) discourse
and (2a) and (2b’) form another. All of the sentences in (2) are past tense and therefore there must be something other than tense that helps to determine temporal relations.

Asher and Lascarides (2003) propose Segmented Discourse Representation Theory (hereafter, SDRT), which argues that all of the sentences in a coherent discourse are connected to each other by appropriate rhetorical relations, and that inter-sentential phenomena, including temporal relations, are determined by rhetorical relations. Take (2) as an example. To help someone up is a natural response when he/she falls down. Asher and Lascarides suggest that this ‘natural response’ relationship indicates that (2a) and (2b) are connected by Narration, which indicates that the temporal order matches the contextual order, i.e. (2a) temporally precedes (2b). On the other hand, to push someone is one of the reasons why he/she falls down. They propose that this ‘cause-effect’ relationship indicates Explanation, that is, (2b’) explains (2a). Explanation indicates that the cause must temporally precede the effect if the cause is an event (Asher and Lascarides 2003: 160), i.e. in the example here, (2b’) temporally precedes (2a).

Mandarin Chinese is not morphologically marked for tense (Li and Thompson 1981: 13; Lin 2003, 2006; Wu 2009a, etc.) and therefore tense does not play a role in determining temporal relations in Mandarin Chinese. In a series of studies on temporal relations in Mandarin Chinese, Wu (2003, 2007a, 2009b, 2010) examines how the temporal relations between sentences with aspect markers are determined, and, in his (2007b) book, Wu explores how the temporal relations between sentences/clauses with no aspect marker (and no temporal phrases) are decided. Following Asher and Lascarides (2003), he argues that, based on their semantics, aspect markers and situation types (Vendler 1957, Smith 1997, etc.) indirectly influence temporal relations via rhetorical relations in two ways: First, they specify a default rhetorical relation, which in turns determines a temporal relation, and second, they identify a temporal constraint, which must be obeyed by the temporal relations indicated by rhetorical relations.

In this paper, I would like to discuss how two evaluative modals jingran and guoran influences temporal relations. Wu (2008) proposes that guoran denotes that the proposition it presents converges with an expectation, while jingran expresses that the proposition it goes with diverges from an expectation. Based on their semantics, I argue that these two evaluative modals also influence temporal relations via rhetorical relations by indicating a default rhetorical relation and specifying a temporal constraint. By default, guoran indicates Explanation and jingran identifies Contrast. The temporal constraint they specify is that the proposition they present cannot temporally precede the expectation based on which these two modals are used.

In addition, guoran involves a ‘directionality’ issue. Suppose that α and β are both sentences/clauses and they occur in a discourse in the following order: α guoran(β), i.e. in terms of contextual order, α precedes β, and β is presented by guoran. Although guoran by default specifies Explanation, it depends on the inference pattern of guoran whether α explains β or β explains α. This ‘directionality’ issue is not observed in the previous studies on temporal relations in Mandarin Chinese. Directionality is not an issue for jingran because it makes no semantic difference whether α contrasts with β or the other way around.

This paper is organized as follows. Section 2 is literature review, where I, first, provide a brief introduction to SDRT, then review research on temporal relations in Mandarin

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1 In this paper, all rhetorical relations are italicized, with the first letter capitalized.
Chinese and on semantics of *jingran* and *guoran*. In Section 3, I present examples of *jingran* and *guoran* and demonstrate how they behave in terms of temporal relations. In Section 4, I provide an SDRT model. Section 5 concludes this paper.

2 Literature Review

2.1 A Brief Introduction to SDRT

Asher and Lascarides (2003) propose SDRT. The key ideas of SDRT include: First, the sentences in a coherent discourse are connected to each other by appropriate rhetorical relations, second, inter-sentential phenomena, such as temporal relations, anaphora resolution, and so on, are determined by rhetorical relations, and third, a sentence is not necessarily connected to its immediately preceding one. To put it another way, SDRT proposes that a discourse has a hierarchical rhetorical structure. Let’s look at the following example.

(3) a. Max experienced a fantastic evening.
 b. He had a wonderful evening.
 c. He ate salmon.
 d. He devoured a lot of cheese.
 e. He won a dancing competition.

Asher and Lascarides (2003) propose two ways to decide which rhetorical relation connects two sentences: cue phrases, such as *and then*, *because*, etc., and lexical information. In (3), there is no cue phrase and therefore we need to rely on lexical information.

Having wonderful meal is an example of experiencing a fantastic evening. This piece of lexical information decides that (3b) and (3a) are connected by *Elaboration*, which means (3b) elaborates on (i.e. provides more details about) (3a). (3c) and (3d) are one of the orders to serve dishes and therefore they are connected by *Narration*. Besides, (3c) and (3d) are examples of a wonderful meal and thus they are connected to (3b) by *Elaboration*, which means that (3c) and (3d) elaborate on (3b). Finally, (3e) is an example of a fantastic evening and as a result (3e) is connected to (3a) by *Elaboration*. In addition, (3b) and (3e) are connected by *Narration*, because they are two sequential events that comprise a fantastic evening. Please note that (3e) is attached to (3b), instead of the immediately preceding sentence (3d). The hierarchical structure for (3) is given in (4).

(4) (3a)
   (3b) Elaboration (3e)
   Narration
   (3c) Elaboration (3d)
   Narration

2 Please refer to Wu and Tseng (2008) for an SDRT account of zero anaphora resolution in Mandarin Chinese.
Given the rhetorical relations, temporal relations are determined. *Narration* indicates that the temporal order matches the contextual order. *Elaboration* specifies temporal inclusion.\(^3\) In (4), (3b) temporally precedes (3e), and (3c) temporally precedes (3d). (3b) and (3e) are temporally included in (3a), and (3c) and (3d) are temporally included in (3b).

### 2.2 Temporal Relations in Mandarin Chinese

In a series of research on temporal relations in Mandarin Chinese, Wu (2003, 2007a, 2009b, 2010) examine how the temporal relations between sentences/clauses with aspect markers are determined, and Wu (2007b) explores how the temporal relations between sentences with no aspect markers (and no temporal phrases) are decided.

Wu argues that aspect markers and situation types indirectly influences temporal relations via rhetorical relations in two ways: They specify a default rhetorical relation, which in turns determines a temporal relations, and they impose a temporal constraint, which must be obeyed by the temporal relations decided by rhetorical relations.

Let’s take the imperfective markers, i.e. the progressive *zai* and the durative *zhe*, as an example. Because these two markers do not present the endpoint of a situation, that is, it is unknown if the situation they present will come to an end, Wu (2007a) argues that these two imperfective markers in Mandarin by default specify that a sentence with one of them is connected to another sentence by *Background*, which in turn indicates temporal overlapping. See the example below.

\[(5)\]
\[
a. \text{ 美美 在 游泳}
\]
\[
\text{meimei zai youyong}
\]
\[
\text{Meimei Prg}\text{ swim}
\]
\[
\text{‘Meimei was swimming.’}
\]
\[
b. \text{ 小玲 看 了 忍不住 教 了 她 幾 招}
\]
\[
\text{xiaoling kan le renbuzhu jiao le ta ji zhao}
\]
\[
\text{Xiaoling see Pfv cannot help teach Pfv her several move}
\]
\[
\text{‘Xiaoling saw her and could not help but teach her several moves.’}
\]

In the example above, there is no cue phrase that indicates which rhetorical relation connects these two sentences together. Since (5a) contains the progressive *zai*, its default function applies and specifies that (5a) is connected to (5b) by *Background*, i.e. (5a) serves as a temporal background for (5b). Since *Background* indicates temporal overlapping, (5a) and (5b) temporally overlap. This matches native speaker’s intuition about the temporal relation in this mini discourse.

Wu (2007a) also discusses the temporal constraints these two imperfective markers impose. The progressive *zai* presents dynamic events only (Li and Thompson 1981; Smith 1997 etc.) According to the Imperfective Paradox (Dowty 1977, 1979: 133-138), it is

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\(^3\) Please note that in SDRT rhetorical relations need to be interpreted in the Satisfaction Schema, which spells out temporal relations based on meaning postulates for rhetorical relations. In order to provide a clear introduction to the most important ideas of SDRT, formalisms are not discussed in this section.

\(^4\) The abbreviations used in this paper include: CL for a classifier, DE for a modifier-modifiee marker, Deg for a degree marker, Pfv for the perfective marker *le*, Poss for a possessive marker, Prc for a particle, and Prg for the progressive marker *zai*.
unknown whether a situation presented by the progressive zai will reach its natural final endpoint. Because of this uncertainty, it is impossible for a situation to temporally follow a situation presented by the progressive zai.

On the other hand, the Imperfective Paradox does not affect the durative zhe because the durative zhe goes with atelic situations (Lin 2002; Yeh 1993; Wu and Kuo 2003, 2010) and an atelic situation does not have a natural final endpoint to reach. Besides, Wu (2007a) proposes the following: while both the progressive zai and the durative zhe can temporally overlap another event, only the durative zhe allows for the event it presents to occur with a temporally bounded event. When the event with the durative zhe occurs with a temporally bounded event, the event with zhe itself is temporally bounded by the temporal boundary of the event it co-occurs with. This is why the zhe event can be temporally followed by another event. See (6).

(6) a. 計老人 (*在看) 看著 她 把 牛奶 喝下 ji lao ren (*zai kan) kan zhe ta ba niunai he-xia
Ji old man (*Prg watch) watch Dur she Disp milk drink down
‘Old man Ji watched her finish drinking her milk.’

b. 又替她捲了捲被窩 you ti ta long le long beiwo
‘And then (he) tucked her in.’

In this example, the temporally bounded event ba niunai hexia ‘to finish drinking milk’ co-occurs with kan ‘to watch’, which the durative zhe presents. Since the ba niunai hexia ‘to finish drinking milk’ event is temporally bounded, the watching event also complies with the same temporal boundary. This is why the tuck her in event can temporally follow the event presented by the durative zhe. On the other hand, because the progressive zai presents an evening which is ongoing at an instant, there is no way that a temporally bounded event, such as ba niunai hexia ‘to finish drinking milk’, can cumulate at an instant. That is why the progressive zai cannot occur in a context such as (6).

To sum up, based on their semantics, the two imperfective markers in Mandarin indirectly influence temporal relations via rhetorical relations in the two ways presented above. The other aspect markers and situation types in Mandarin influence temporal relations in similar ways.

2.3 Semantics of Jingran and Guoran

Little attention, if any, has been paid to the semantics of evaluative modals in Mandarin. Hsieh (2005, 2006a, 2006b) examines evaluative modals, among the other modals in Mandarin, and proposes four points about their semantics. First, they express the speaker’s presupposition. Second, they predicate on known facts, which have happened. Third, they are antonyms. And finally, their semantics cannot be captured in terms of necessity and possibility.

Wu (2008) argues against the four points raised by Hsieh. First, jingran and guoran do not express presupposition because negation does not change presupposition, but negation...
changes the expectation which jingran and guoran require. Besides, the expectation is not necessarily the speaker’s, though by default it is.

Second, jingran and guoran do not have to predicate on known facts, which have happened. Even though the speaker relies on information which is not correct, he/she still can use jingran to describe a situation that contradicts the (incorrect) information and guoran to express that a situation matches the (incorrect) information.

As for the third point raised by Hsieh, since it is not clear how jingran and guoran affect the truth values of the propositions they present, it is very difficult to decide whether they are antonyms or not.

Refuting Hsieh’s analysis of jingran and guoran, Wu (2008) proposes formal semantics for jingran and guoran. First, he argues that what jingran and guoran requires is an expectation, which is defeasibly the speaker’s, instead of a presupposition or a known fact that has happened. Second, he makes the following observation. Suppose P is a proposition that serves as an expectation. Jingran(P) has a truth value opposite to that of P, while guoran(P) has a truth value the same as that of P. Then, he argues that the expectation serves as an evaluative conversational background, against which jingran and guoran evaluate a proposition. Along the line of Kratzer (1981 [2003]), he proposes the semantics of jingran and guoran as follows:

(7) Let B be the modal base for jingran and guoran, which an evaluative conversational background forms. 6
   a. $\text{jingran}(p)|^B_{w, w'} = 1$ iff for all $w' \in B(w)$ there is a $w'' \in B(w)$ with $w'' \leq_w w'$ such that $\text{JW}(w') = 0$.

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6 Professor Jowang Lin (p.c.) suggests that the semantics of jingran and guoran can be modeled along the same lines of the intentional semantics of verbs of attitude, such as expect, and then the semantics of jingan and guoran do not need the concept of necessity and of possibility. However, qidai ‘to expect’ behaves very differently from jingran and guoran. See the examples below.

(i) A: wo qidai xiaomei hui lai
   I expect Xiaomei will come
   ‘I expect that Xiaomei will come’
   B: caiguai ni cai bushi zheyang xiang de
   No way you not so think PrC
   ‘No way. You do not think so.’
   B ’: caiguai xiaomei bu hui lai
   No way Xiaomei not will come
   ‘No way. Xiaomei will not come.’

(ii) A: xiaomei guoran/jing hui lai
    Xiaomei GUORAN/JINGRAN will come
    ‘Xiaomei will come (as expected or contradictory to the expectation)!’
    B: caiguai ta bu hui lai
    No way she not will come
    ‘No way. She will not come!’
    B ’: ??’caiguai ni cai bushi zheyang xiang de
    No way you not so think PrC

(i) shows that when caiguai ‘no way’ is used to negate what A says, the negated part can be the matrix verb qidai ‘to expect’, as what B says, or the embedded clause, as what B’ says. However, for jingran and guoran, the only part that can be negated is the proposition, as what B in (ii) says. It is not possible to negate the expectation required for jingran and guoran, as shown in B’ in (ii). This difference shows jingran and guoran do not behave parallel to qidai ‘to expect’ in terms of semantics. I would like to thank Eric McCready for bringing these examples to my attention.
b. \( [\text{guoran}(p)]^{b,\leq,w} = 1 \) iff for all \( w' \in B(w) \) there is a \( w'' \in B(w) \) with \( w'' \leq_w w' \) and \( [p]^{w''} = 1 \).

By proposing the formal semantics for \textit{jingran} and \textit{guoran} as in (7), Wu (2008) also proves that the semantics of these two evaluative modals can be captured by means of necessity, contra what Hsieh (2005, 2006a, 2006b) suggests.

To sum up, the difference between the semantics of \textit{jingran} and \textit{guoran} lies in that a proposition \textit{guoran} presents matches the expectation, while a proposition \textit{jingran} presents contradicts the expectation.

### 3 Temporal Relations of Jingran and Guoran

Given the discussion of the semantics of \textit{jingran} and \textit{guoran} in Section 2.3, I argue that \textit{guoran} by default indicates \textit{Explanation}, which means that a sentence with \textit{guoran} is connected to another clause by \textit{Explanation}, because \textit{guoran} expresses that a proposition matches an expectation and naturally an expectation explains another event. As for \textit{jingran}, I argue that, by default, it specifies \textit{Contrast} because it denotes that a proposition contradicts an expectation and logically contrast surfaces. They both impose a temporal constraint: because both \textit{jingran} and \textit{guoran} rely on an expectation to evaluate a proposition, the proposition cannot temporally precede the expectation. Other rhetorical relations can connect a sentence with \textit{guoran}/\textit{jingran} as long as the temporal constraint is obeyed. In the following two sections, the examples of \textit{guoran} and of \textit{jingran} are presented separately to test the above hypothesis. The relationship between the semantics of \textit{jingran} and \textit{guoran} and their discourse function can be summarized in Table 1 below.

<table>
<thead>
<tr>
<th></th>
<th>Semantics</th>
<th>Discourse Functions</th>
<th>Default rhetorical relation</th>
<th>Temporal constraint</th>
</tr>
</thead>
<tbody>
<tr>
<td>jingran</td>
<td>A proposition contradicts the expectation</td>
<td>Contrast</td>
<td></td>
<td>The proposition \textit{jingran} or \textit{guoran} presents cannot temporally precede the expectation</td>
</tr>
<tr>
<td>guoran</td>
<td>A proposition matches the expectation</td>
<td>Explanation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 1**

### 3.1 Examples of Guoran

Let’s look at examples of \textit{guoran} first. Because \textit{guoran} expresses that a proposition matches an expectation, the most natural case is that the sentence presented by \textit{guoran} is explained, presumably, by the expectation. See (8).

\begin{align*}
(8) \ a. \ & \text{小明 本來 行為不檢} \\
& \text{xiaomin benlai xingweibujian} \\
& \text{Xiaomin originally misbehave} \\
& \text{‘Originally, Xiaomin misbehaved.’} \\
b. \ & \text{可是 他 很 聽 媽媽 的 話} \\
& \text{keshi ta hen ting mama de hua} \\
& \text{but he very listen mom Poss words}
\end{align*}
‘But he listened to his mom.’

c. 他 媽 媽 跟 他 談 了 幾 次
ta mama gen ta tan le ji ci
he mother with he talk Pfv several time
‘His mother talked to him several times.’

d. 果然 他 比較 有 改善 了
guoran ta bijiao you gaishan le
GUORAN he compare have improve Prc
‘As expected, his behavior improved.’

In (8), (8c) explains (8d). Because Xiaomin listened to his mom, one can infer that Xiaomin’s behavior would improve if his mom talked to him. His mother having talked to him, i.e. (8c), leads to the expectation that his behavior would improve. Therefore, in (8d), guoran is used to express that what happened in the real world matches the expectation. In other words, (8c) is the reason why the speaker claims (8d). Therefore, (8c) is connected to (8d) by Explanation.

An anonymous reviewer accurately points out that the contextual information in (8) has determined the rhetorical relation between (8c) and (8d) and hence guoran in (8d) does not play a significant role in this respect. Let’s look at (9), where the context does not provide any information, and under this circumstance, guoran (or jingran) solely determines the rhetorical relation.

(9) a. 小明 行為 不 檢
xiaomin xingwei bujian
‘Xiaomin misbehaved.’

b. 他 媽 媽 跟 他 談 了 幾 次
ta mama gen ta tan le ji ci
his mom with he talk Pfv several time
‘His mom talked to him several times.’

c. 果然/竟然 有 改善
guoran/jingran you gaishan
GUORAN/JINRAN have improve
‘As expected/unexpectedly, his behavior improved.’

In (9), there is no information regarding whether Xiaomin’s mom has influence on him, and therefore the context cannot determine which rhetorical relation connects (9b) and (9c). Here, guoran (or jingran) plays a key role. When guoran is used, the listener knows that what happened matches the speaker’s expectation. If jingran is used, the addressee knows that what happened contradicts the speaker’s expectation. (9) is a strong support for the proposal of this paper that guoran and jingran determine rhetorical relations, though defeasibly.

In (8), the expectation Xiaomin’s behavior would improve is inferred from (8c), given the premise (8b). When an expectation does not surface explicitly in the discourse, then the usual ways to decide a rhetorical relation kick in. See (10).
In (10), (10c) elaborates on (10b) because (10c) is about the contents of the speech described in (10b). That is, (10c) provides more details about (10b). Therefore, it can be decided that (10b) is connected to (10c) by Elaboration, which indicates temporal inclusion, i.e. (10c) is temporally included in (10b).

Where is the expectation for guoran in (10)? Obviously, (10a) is premise based on which one can infer the potential topics of President Li’s speech. Therefore, guoran in this example specifies that (10a) explains (10b-c).

An anonymous reviewer also suggests that guoran in (10c) does not play an important role because the context seems to have provided enough information to indicate that Explanation connects (10a-c). However, as shown in (10c’), if guoran is replaced by jingran, the discourse remains felicitous. That is, (10a) does not really determine a rhetorical relation for the discourse. Instead, (10a) is simply used to infer an expectation, i.e. President Li will talk about one of the three issues in a speech. However, what really happens in the world can match or contradict the expectation. To put it another way, guoran and jingran do play an essential role in determining which rhetorical relation connects (10a-c) or (10a-c’).

If we look at (8) and (10), we immediately find that the temporal relation between (8c) and (8d) is very different from that between (10a) and (10b-c). (8c) temporally precedes (8d). On the other hand, (10a) do not temporally precede (10b-c) but instead (10a) simply do not temporally follow (10b-c).

Asher and Lascarides (2003: 160) define two temporal relations for Explanation. They suggest that the cause temporally precedes the effect if the cause is an event (I refer to this one as the ‘strong’ version) and that the effect cannot precede the cause if otherwise (I refer to this one as the ‘weak’ version). However, this proposal is obviously inadequate. For example, if one says that ‘because Mom knew about this matter, he/she had to tell her...’
everything about it’, it is not only that the I had to tell her everything event cannot temporally precede the Mom knew about the matter event, but also that Mom certainly knew about the matter before the speaker told her everything! In this example, zhidao ‘to know’ is a state, and these two sentences are connected by Explanation due to the cue phrase yinwei ‘because’. But the temporal relation is not as Asher and Lascarides (2003: 160) suggest.

If (8) and (10) are examined more closely, it can be found that the weak version of temporal relation for Explanation is required when the premise based on which the expectation for guoran is inferred, is a generalizing sentence, and that the strong version applies when the premise is an event that has been realized. That is, Explanation specifies two types of temporal relations based on whether the explaining event is a generalizing sentence or an event that is anchored to a specific time.

One special behavior for guoran in terms of temporal relations is ‘directionality’. In Wu (2003, 2007a, 2007b, 2009b, 2010), aspect markers and situation types have a ‘forward’ influence in terms of determining a rhetorical relation. For example, as discussed in Section 2.2, a sentence with an imperfective marker by default serves as a temporal background for the sentence that follows it in the discourse, not for a sentence that precedes it. (5) is repeated below as (11) for the purpose of illustration.

(11) a. 美美 在 游泳
meimei zai youyong
Meimei was swimming.’

b. 小玲 看 了 忍不住 教 了 她 招
xiaoling kan le ren bu zhu jiao le ta ji zha o
Xiaoling saw her and could not help but teach her several moves.’

(11a) is a sentence with the progressive zai and it defeasibly serves as a temporal background for the sentence that follows it in the discourse, i.e. (11b). Let’s look at (11b). Xiaoling kan le ‘Xiaoling saw her’ is a telic event and according to Wu (2007b) a telic event by default specifies Narration. But again a telic event is connected, by Narration, to the sentence that follows it in the discourse, not to the sentence that precedes it. Hence, in (11), Xiaoling saw her is connected to (Xiaoling) could not help but teach her several moves by Narration, not to (11a).

Unlike the previous studies on the temporal relations in Mandarin Chinese, the influence of guoran can be ‘bidirectional’, not ‘unidirectional’ as the case in (11). In (8) and (10), the sentences presented by guoran denote the propositions that match the expectation and this is why (8c) is argued to explain (8d) and (10a) to explain (10b-c).

However, there are examples where the sentences guoran presents express the expectation based on which guoran is used. That is, instead of being explained, the sentence presented by guoran explains another sentence. See the examples below.

(12) a. 他 今天 回答 得 很 好
ta jintian huida de hen hao
he today answer Deg very good
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“Today, he answered very well.”

b. 果然 準備 充分
   ‘He prepared adequately (as expected).’

(13) a. 老師 終於 知道 這 件 事 了
   ‘Finally, the teacher knew about this matter.’

b. 果然 是 他 告 的 密
   ‘It was him who ratted the secret out (as expected).’

In (12), (12b) explain (12a). In (13), (13b) explains (13a). In examples like these two, a ‘backward’ reasoning is involved. Normally, one will think that adequate preparation results in good performance. Nevertheless, in (12), the speaker first observes that he answered very well and then infers that he must have prepared adequately. Guoran is used to express that what really happened matches the speaker’s expectation.

The same ‘backward’ reasoning applies to (13). Usually, one ratting a secret out leads to the teacher knowing about the secret. However, in (13), the speaker first learned about the information that the teacher finally knew about the matter and then infers that it must be him who ratted the secret out. And the fact matches the speaker’s expectation.

It is this kind of ‘backward’ reasoning that enables the sentence guoran presents explains another sentence, rather than being explained. The ‘directionality’ of reasoning affects the ‘directionality’ of explanation, which in turns influences temporal relations: In (8), (8d), which is a sentence presented by guoran, temporally follows (8c), while, in (12), (12b), which is a sentence guoran presents, temporally precedes (12a).

The two examples below can best demonstrate the “bi-directionality” of guoran because all of the comments are related to the same sentence genju xiban de jilu zhe bu diannao yijing bukanshiyong ‘according to the record of the department office, this computer already became unusable’. This point shows that the bi-directionality is not restricted to examples with a certain type of sentences.

(14) a. 根據 系辦 的 記錄 這 部 電腦 已經 不堪使用
   ‘Based on the record of the Dept. Office, this computer is already not useable.’

b. 果然 我一 打開 電源 單是 開機 就 要 十 分鐘
   ‘As expected, once I turned on the power, it took ten minutes for the computer to boost.’

c. 開啟 Word 也 要 五 分鐘
   ‘It also took five minutes to start the Word.’
d. 真的 该 汰舊換新 了
zhende gai taijiuhuanxin le
really should buy a new one to replace the old one.

(The Dept. Office) really should buy a new one to replace the old one.

(15) a. 根據 系辦 的 記錄 這部 電腦 已經 不堪使用
genju xiban de jilu zhe bu diannao yijing bukanshiyong
based on Dept. Office Poss record this CL computer already not useable.

‘Based on the record of the Dept. Office, this computer is already not useable.’

b. 果然 它的 借用 率 最高
guoran ta de jieyong lü zui gao
‘It is borrowed most often.’

c. 常遭 病毒 感染
chang zao bingdu ganran
‘It is often infected by viruses.’

d. 最重要的是 它已經有 八年 的歷史 了
zui zhongyao de shi ta yijing you ba nian de lishi le
‘Above all, it is already eight-year old.

(14) involves forward reasoning. When a computer becomes unusable, one expects all kinds of problems when using it. Therefore, (14a) explains (14b-d). On the other hand, (15) involves backward reasoning. The speaker first learns about the condition of the computer and expects that there must be some reasons for its current condition. Since (15b-d) are the most common reasons that damage a computer, the discourse function of (15b-d) is to explain (15a).

The temporal relations in these two examples deserve attention. To do this, we need to determine the situation type of 'bukanshiyong' ‘unusable’ first. I argue that it is a state, a stage-level one, because being unusable is not likely to be a permanent property of something. Wu (2005) proposes that a stage-level state has an initial point. Wu (2007b) argues that the initial point of a stage-level state can be temporally preceded or followed by another event.

(15) is straightforward because (15b-c) are facts before the computer became unusable. (14) is less clear because it seems that (14b-c) temporally overlap (14a). But, I argue that indeed there is a temporal precedence/following involved in (14): (14b-c) temporally follows the initial point of the state described by (14a). Since (14a) is a state and a state can hold for a period of time, (14b-c) also temporally overlap (14a). It is clear that the problems of the computer described by (14b-c) started after the computer became unusable. That is, Explanation does not specify temporal overlapping. The temporal overlapping in (14) is, as a matter of fact, the result of (14a) being a state.

Finally, let’s look at an example that violates the temporal constraint of jingran and guoran. An example of this type is infelicitous and the discourse becomes incoherent when the temporal constraint is not obeyed.
How Jingran ‘竟然’ and Guoran ‘果然’ Influence Temporal Relations

(16) a. 小明 本来 行为不检
   Xiaomin originally misbehave
   ‘Originally, Xiaomin misbehaved.’

b. 可是 他 很 聽 妈妈 的 話
   but he very listen mom Poss words
   ‘But he listened to his mom.’

c. 在 他 妈妈 跟 他谈 之前
   before he mom talk to him,
   ‘Before his mom talked to him,

d. 果然 行为 就有 改善 了
   ‘(As expected), his behavior improved.

In (16), because Xiaomin listened to his mom, one expects that his mom talking to him will result in the improvement of his behavior. However, (16c-d) say that his behavior improved before his mom talked to him. This statement violates the temporal constraint of guoran and therefore (16) is infelicitous.

To sum up, by default, guoran indicates Explanation. It also specifies a temporal constraint: the proposition guoran presents cannot temporally precede the proposition representing the expectation based on which guoran is used. The rhetorical relation specified by guoran has a ‘bidirectional’ behavior: that is, it depends on the inference pattern for guoran whether the proposition presented by guoran is explained or the other way around. I also propose that Explanation specifies a weak version of temporal relation and a strong version, based on whether the explaining proposition is a generalizing sentence or not.

3.2 Examples of Jingran

I argue that jingran by default specifies Contrast because it denotes that a proposition jingran presents contradicts an expectation. Contrast does not specify any temporal relation, as proposed in Asher and Lascarides (2003: 168-169). Let’s look at an example.

Assume the following scenario for (17). A younger brother admires his elder brother so much that he imitates his elder brother in every possible way. Whatever the elder brother eats, the younger brother will eat that as well. One can use jingran to indicate the contrast when the younger brother stops imitating the older brother for once. See (17).

(17) a. 哥哥  刚刚  吃 了 水饺
   elder brother just now eat PfV dumpling
   ‘The elder brother ate dumplings just now.’

b. 弟弟  现在  竟然  在 吃 牛肉面
   younger brother now JINGRAN PrG eat beef noodles
‘(Unexpectedly,) the younger brother is eating beef noodles now!’

c. 太稀奇了
tai xiqi le
‘It’s too rare.’

In (17), the sentence jingran presents, i.e. (17b), temporally follows (17a). This temporal relation is determined by the temporal adverbial ganggang ‘just now’ and xianzai ‘now’ in these two sentences. Jingran has nothing to do with the temporal relation.

Let’s look at another example. Assume the following scenario for (25). Xiaozhang is my classmate. He always does things more slowly than I do.

(18) a. 我 明天 才 開始 準備 期末考
wo mintian cai kaishi zhunbei qimokao
‘I will not start preparing for the final exam until tomorrow.’

b. 小張 竟然 已經 開始 了
xiaozhang jingran yijing kaishi le
‘Xiaozhang has already started (contrary to the expectation)!’

In the example above, (18b) is a sentence presented by jingran. However, (18b) temporally precedes (18a). Again, this temporal relation is determined by the temporal adverbials mintian ‘tomorrow’ and yijing ‘already’, not the evaluative modal.

The first two sentences in (17) are connected by Contrast and so are the two sentences in (18). But the temporal relations between them are just the opposite: in (17) the sentence jingran presents temporally follows the preceding sentence, while in (18) the sentence presented by jingran temporally precedes the previous sentence. These two examples show clearly show that jingran dose not have any temporal influence.

Let’s look at a few other examples of jingran and see how the temporal relations involving sentences with jingran are determined, in addition to the help of temporal adverbials.

(19) a. 陳 君 出身 某 國立 大學
chen jun chushen mo guoli daxue
‘Mr. Chen graduated from a national university.’

b. 其 妻 為 他 的 同班 同學
qi qi wei ta de tongban tongxue
‘His wife was his classmate.’

c. 當 他 赴 英 攻讀 博士 時
dang ta fu ying gongdu boshi shi
‘When he went to England to pursue a Ph.D. degree,’

d. 太太 竟然 紅杏出牆
taitai jingran hongxingchuqiang
‘wife JINGRAN a romantic affair’
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‘(his) wife had a romantic affair (contrary to the expectation)!’

In this example, jingran appears in (19d). The cue phrase dang ... shi ‘when’ indicates that (19d) is connected to (19c) by Background, which means that (19c) serves as a temporal background for (19d) and that (19c) and (19d) are temporally overlapping. This temporal relation is specified by the cue phrase and jingran plays no role here. Since the proposition that he went to England to pursue a Ph.D. degree is not an expectation required by the proposition in (19) presented by jingran, temporal overlapping is allowed.

Let’s look at another example.

(20) a. 當初 我們 考慮到 既然 是 鼓勵 辦法
dangchu women kaolüdao jiran shi guli banfa
at that time we take into consideration since be encouragement regulation
就 放寬 一些 限制
jiu fangkuan yixie xianzhi
then relax some constraint
‘At that time, we took it into consideration that some constraints were relaxed since it was an encouragement regulation.’

b. 沒想到 竟然 被 投機者 利用
meixiangdao jingran bei toujizhe liyong
unexpected JINGRAN Pass risker take advantage of
‘Unexpected, (the regulation) was taken advantage of by riskers.’

In the example above, (20b) is connected to (20a) by Result, i.e. (20b) is the result of (20a), because the relaxation of constraints leads to the regulation being taken advantage of. Result indicates temporal precedence, i.e. the cause temporally precedes the result. In this example, this rhetorical relation indicates that (20a) temporally precedes (20b). Since the expectation required by jingran does not surface here, the temporal constraint of jingran does not apply. Therefore, the temporal relation specified by Result is legitimate here.

Let’s look at an example of Elaboration.

(21) a. 大學生 擁有 電腦 的 比例 很高
daxuesheng yongyou diannao de bili hen gao
‘Many college students have computers.’

b. 理工 科系 更 幾乎 人手 一 台
ligong kexi gen jihu renshou yi tai
science and technology department especially almost everyone one CL
‘Especially, almost every student majoring in science or technology owns a computer.’

c. 很多 學生 的 設備 竟然 比 老師 還 強
ehenduo xuesheng de shebei jingran bi laoshi hai qiang
many student Poss equipment JINGRAN compare teacher still better
‘Many students’ equipment is even better than teachers’.

(21) is an example of a different kind of Elaboration. (21c) actually elaborates on the computers owned by students. This kind of elaboration is referred to as Elaborations in Wu (2007b), different from Elaboration discussed in Asher and Lascarides (2003), which indicates an elaboration on events.
Wu (2007b) distinguishes these two kinds of Elaboration by referring to the elaboration on NPs as Elaboration_{NP} and the one on events as Elaboration_{E}. Wu (2007b) also argues that Elaboration_{NP} is one of the rhetorical relations that do not specify any temporal relation, different from Elaboration_{E}, which specifies temporal inclusion. He also argues that if there is a temporal relation between two sentences connected by Elaboration_{NP}, the temporal relation is determined by other factors, such as temporal adverbials, sequence of events, etc.

In the example above, (21c) elaborates on the computers of students mentioned in (21b). This is a typical example of Elaboration_{NP}. Since this rhetorical relation does not specify any temporal relation, as we can see, no temporal relation can be observed between (21b) and (21c).

Let’s look at an example of Elaboration_{E}.

(22) a. 小張 剛剛 繞 著 校園 跑 了 一 圍
xiaozhang ganggang rao zhe xiaoyuan pao le yi quan
‘Xiaozhang just ran around the campus.’

b. 本來 以為 會 很 輕鬆
benlai yiwei hui hen qingsong
‘Originally, (he) mistakenly thought that it would be easy.’

c. 沒想到 竟然 被 狗 追 被 蜜蜂 叮 又 跌倒
meixiangdao jingran bei go zhui bei mifeng ding you diedao
‘Unexpectedly, he was chased by dogs, bitten by bees and fell down.’

d. 真是 太 慘 了
zhenshi tai can le
‘(It) was really too miserable.’

In (22), (22b-c) elaborate on the process of (22a). This is an example of Elaboration_{E} because what is elaborated on is the process of the Xiaozhang ran around the campus event. Obviously, (22b-c) are temporally included in (22a). This temporal relation is specified by Elaboration_{E} and matches native speaker’s intuition about the temporal relation in this example. Jingran does not play a role in the temporal relation here.

One might ask whether directionality is also an issue for jingran. As a matter of fact, it is not. This is because Explanation involves directionality whereas Contrast does not. Whether \( \alpha \) explains \( \beta \) or \( \beta \) explains \( \alpha \) makes a semantic difference because in the previous case \( \alpha \) is the cause and \( \beta \) is the effect and vice versa in the latter. Contrast does not have this distinction. It makes no semantic difference whether \( \alpha \) contrasts with \( \beta \) or \( \beta \) contrasts with \( \alpha \).

Finally, I provide an example where the temporal constraint for jingran is violated. Examples of this kind are infelicitous.

(23) a. 這 部 電腦 昨天 坏 了
zhe bu diannao zuotian huai le
‘This computer became broken yesterday.’
b. !前天 竟然 還有 人 借
!qiantian jingran hai you ren jie
the day before yesterday JINGRAN still there be person borrow
‘The day before yesterday, someone still borrowed it (contrary to the expectation)!’

(23) is not a coherent discourse. The reason for this incoherence is that the temporal constraint of jingran is violated. The computer became broken yesterday, as described by (23a). However, the computer was borrowed the day after tomorrow. Since the computer became broken yesterday, it does not make sense to expect that people would not want to borrow the computer the day before yesterday because the computer was still functional then! That is, the temporal constraint is not obeyed that the expectation required by jingran must temporally precede the proposition presented by jingran.

In sum, jingran by default indicates Contrast, which does not specify a temporal relation. It imposes the same temporal constraint as guoran: the proposition jingran presents cannot temporally precede the expectation based on which jingran is used. Jingran does not involve directionality because the rhetorical relation it specifies does not have this property. The other rhetorical relations can connect a sentence with jingran to another sentence as long as the temporal relations they specify obey the temporal constraint imposed by jingran.

4. An SDRT Model

In SDRT, one of the most important theoretical issues is to determine which rhetorical relation connects sentences together. Once a rhetorical relation is determined, a temporal relation follows from it. SDRT uses axioms to decide a rhetorical relation and meaning postulates to specify a temporal relation.

Based on the discussion in Section 3, I propose axioms, the temporal constraint and meaning postulates as below.

(24) Axioms for jingran and guoran:
Suppose that α, β, γ, δ are labels for sentences. B(w) is the modal base for guoran or jingran. For (24a) and (24c), either α ⊆ B(w) or α → δ and δ ⊆ B(w).
For (24b), either β ⊆ B(w) or β → δ and δ ⊆ B(w).

a. (?(α, β, λ) ∧ guoran(P)(β) ∧ (α→β)) > Explanation(β, α).
b. (?(α, β, λ) ∧ guoran(P)(β) ∧ (β→α)) > Explanation(α, β).
c. (?α, β, λ) ∧ jingran(P)(β)) > Contrast(α, β).

(25) Temporal Constraint for jingran and guoran:
Suppose that α, β, γ, δ are labels for sentences. B(w) is the modal base for guoran or jingran. Either α ⊆ B(w) or α → δ and δ ⊆ B(w).
(?(α, β, γ) ∧ guoran/guoran(P)(β)) → ¬(β < α)

(26) Meaning Postulates for Explanation
a. φExplanation(α, β) ⇒ (generalizing(β) → ¬(e_α < e_β))
b. φExplanation(α, β) ⇒ (¬generalizing(β) → e_β < e_α)

The premise of (24) says the following. α, β, γ, δ are labels for propositions. B(w) is the set of propositions representing expectation for jingran/guoran. For (24a), α is either an
expectation or an antecedent from which one can infer an expectation $\delta$. For (24b), $\beta$ is either an expectation or an antecedent from which one can infer an expectation $\delta$.

(24a) says that if $\alpha$ and $\beta$ are connected by an underspecified rhetorical relation to form a discourse $\lambda$, and $\beta$ is a sentence presented by guoran, then by default the explanation of $\beta$ is $\alpha$, i.e. $\alpha$ explains $\beta$. $\Rightarrow$ represents a default inference.

(24b) says that if $\alpha$ and $\beta$ are connected by an underspecified rhetorical relation to form a discourse $\lambda$, and $\beta$ is a sentence presented by guoran, then by default the explanation of $\alpha$ is $\beta$, i.e. $\beta$ explains $\alpha$.

(24a) and (24b) capture the directionality of guoran. The different inference patterns are represented by $\alpha \rightarrow \beta$ and $\beta \rightarrow \alpha$. $\alpha \rightarrow \beta$ represents “forward” reasoning and $\beta \rightarrow \alpha$ stands for “backward” reasoning. The difference in the directionality of reasoning results in the different directionality of Explanation, represented as Explanation($\alpha$, $\beta$) and Explanation($\beta$, $\alpha$) respectively in (24a) and (24b).

(24c) says that if $\alpha$ and $\beta$ are connected by an underspecified rhetorical relation to form a discourse $\lambda$, and $\beta$ is a sentence presented by jingran, then it is Contrast that connects $\alpha$ to $\beta$.

(25) says that if $\alpha$ and $\beta$ are connected by an underspecified rhetorical relation to form a discourse $\lambda$, and $\beta$ is a sentence presented by jingran/guoran, then the event described by $\beta$ cannot temporally precede the event described by $\alpha$.

(26a) is the weak version of temporal relation specified by Explanation and (26b) the strong version. (26a) says that, given that the explanation of $\alpha$ is $\beta$, if $\beta$ is a generalizing sentence, then the event expressed by $\alpha$ cannot temporally precede the event expressed by $\beta$. (26b) says that, given that the explanation of $\alpha$ is $\beta$, if $\beta$ is not a generalizing sentence, that is, it describes an event anchored to a specific time, then the event described by $\beta$ temporally precedes the event described by $\alpha$.

Next, I demonstrate how the axioms (24), the temporal constraint (25) and the meaning postulates (26) work to derive the temporal relations and to block infelicitous discourse. (8) is repeated below as (27).

(27) a. 小明 本來 行為不檢
xiaomin benlai xingweibujian
‘Originally, Xiaomin misbehaved.’

b. 可是 他 很 聽 媽媽 的 話
keshi ta hen ting mama de hua
‘But he listened to his mom.’

c. 他 媽媽 跟 他 談 了 幾 次
ta mama gen ta tan le ji ci
‘His mother talked to him several times.’

d. 果然 他 比較 有 改善 了
guoran ta bijiao you gaishan le
‘As expected, his behavior was improved.’

In order to avoid unnecessary complicated formalism, only the most relevant sentences
are formalized here and in the following examples. In (27), there is no information saying otherwise, and this is a case of forward reasoning. Therefore, (24a) is applied and it is decided that Explanation connects (27c) to (27d). Then, a Segmented Discourse Representation Structure (SDRS, henceforth) is formed, as in (28). And the rhetorical relation is interpreted in the Satisfaction Schema as in (29).

(28) \[ \pi_1, \pi_2 \\
\pi_1: \text{le}'(\text{talk}'(\text{Xiaomin}', \text{Xiaomin}'s\_mother')) \\
\pi_2: \text{guoran}'(\text{improve}'(\text{Xiaomin}'s\_behavior')) \\
\text{Explanation}(\pi_2, \pi_1) \]

(29) \[ (w, f) \models \text{Explanation}(\pi_2, \pi_1)_M(w', g) \iff (w, f) \models K_{\pi_1} \land K_{\pi_2} \land \Phi_{\text{Explanation}(\pi_2, \pi_1)}_M(w', g) \]

\( \pi_1 \) and \( \pi_2 \) are labels for sentences. In (28), \( \pi_1 \) represents (27c) and \( \pi_2 \) (27d). The Satisfaction Schema (29) says that Explanation(\( \pi_2, \pi_1 \)) is true if and only if the semantic content of \( \pi_1 \), represented as \( K_{\pi_1} \), the semantic content of \( \pi_2 \), represented as \( K_{\pi_2} \), and the meaning postulate for Explanation are all true. It goes without saying that \( \pi_1 \) (27c) and \( \pi_2 \) (27d) must be true because otherwise the discourse would contain false information and would become meaningless. Since \( \pi_1 \) is not a generalizing sentence, the meaning postulate (26b) applies and specifies that \( \pi_1 \) temporally precedes \( \pi_2 \).

Let’s look at an example with backward reasoning.

(30) a. 他 今天 回答 得 很 好 
   ta jingtian huida de hen hao
   ‘Today, he answered very well.’

b. 果然 准备 充分
   guoran zhunbei chongfen
   ‘He prepared adequately (as expected).’

Again, there is no information indicating otherwise, but this is a case of backward reasoning. So, the axiom (24b) applies and specifies that (30b) explains (30a). An SDRS for (30) is formed as in (31) and the Satisfaction Schema is given in (32).

(31) \[ \pi_1, \pi_2, e' \\
\pi_1: \text{answer}'(\text{he}, e') \land \text{well}'(e) \\
\pi_2: \text{guoran}'(\text{prepare}'(\text{he}, e') \land \text{adequately}'(e)) \\
\text{Explanation}(\pi_1, \pi_2) \]

\( ^7 \) For the same reason, formalisms for some structures are simplified. For example, possessive is represented the ways such as Xiaoamin’s\_mother in (35). Tense and pronouns are not fully represented either. These are simplifications. Readers’ attention is directed to the main issues discussed in this paper.
(32) \((w, f) [\text{Explanation}(\pi_1, \pi_2)]_M (w', g)\)
\hspace{1cm} \text{iff} \ (w, f) [K_{\pi_1} \wedge K_{\pi_2} \wedge \Phi_{\text{Explanation}(\pi_1, \pi_2)}]_M (w', g)\)

(32) is very similar to (29). But, because \(\pi_1\) and \(\pi_2\) represent different sentences, (29) and (32) have different semantics. (32) says that Explanation(\(\pi_1, \pi_2\)) is true if and only if the semantic content of \(\pi_1\), represented as \(K_{\pi_1}\), the semantic content of \(\pi_2\), represented as \(K_{\pi_2}\), and the meaning postulate for Explanation are all true. Needless to say, \(\pi_1\) (32a) and \(\pi_2\) (32b) must be true because otherwise the discourse would contain incorrect information and would become infelicitous. Since \(\pi_1\) is not a generalizing sentence, the meaning postulate (26b) applies and specifies that \(\pi_2\) temporally precedes \(\pi_1\).

Let’s look at an example of jingran.

(33) a. 哥哥 剛剛 吃 了 水餃
gege ganggang chi le shuijiao
‘The elder brother ate dumplings just now.’

b. 弟弟 現在 竟然 在 吃 牛肉 麵
didi xianzai jingran zai chi niurou mian
‘The younger brother is eating beef noodles now (contrary to the expectation)!’

c. 太 稀奇了
tai xiqi le
‘It’s too rare.’

There is nothing in (33) specifying otherwise, and hence the axiom (24c) applies and says that (33a) is connected to (33b) by Contrast. The SDRS for (33a-b) is formed as in (34). The Satisfaction Schema is give in (35). Since Contrast does not specify any temporal relation, the temporal phrases ganggang ‘just now’ and xianzai ‘now’ determines the temporal relation between (33a) and (33b).

(34) \[\pi_1 \pi_2 \ x \ y \ e \ e’\]
\[\pi_1: \text{dumpling’}(x) \wedge \text{eat’}(\text{the_elder_brother’}, x, e) \wedge \text{just_now’}(e)\]
\[\pi_2: \text{jingran’}(\text{beef_noodles}(y) \wedge \text{zai’}(\text{eat’}(\text{the_younger_brother’}, y, e’))\]
Contrast(\(\pi_1, \pi_2\))

(35) \((w, f) [\text{Contrast}(\pi_1, \pi_2)]_M (w', g) \text{ iff } (w, f) [K_{\pi_1} \wedge K_{\pi_2} \wedge \Phi_{\text{Contrast}(\pi_1, \pi_2)}]_M (w', g)\)

Finally, let’s look at an infelicitous example. The temporal relation between (36c) and (36d) is specified by the temporal phrase zai ... zhiqian ‘before …’ and the SDRS for (36c-d) is provided in (37).
How Jingran ‘竟然’ and Guoran ‘果然’ Influence Temporal Relations

(36) a. 小明 本来 行為不检
xiaomin benlai xingweibujian
‘Originally, Xiaomin misbehaved.’

b. 可是 他 很 听 媽媽 的 話
keshi ta hen ting mama de hua
‘But he listened to his mom.’

c. 在 他 媽媽 跟 他 談 之前
zai ta mama gen ta tan zhiqian
‘Before his mom talked to him,’

d. 他 比較 有 改善 了
he bijiao you gaishan le
‘As expected, his behavior improved.’

(37)
\[ \pi_1, \pi_2 \in t \]
\[ \pi_1; \text{talk}_\text{to}(\text{his}_\text{mom}), \text{him}, e \land t < e \]
\[ \pi_2; \text{guoran}('\text{improve}'(\text{his}_\text{behavior}')) \]
\[ \text{Background}(\pi_2, \pi_1) \]

In (37), the temporal phrase zai … zhiqian ‘before …’ provides the time before the his mom talk to him event as a temporal background, and this time is represented as \( t \) in \( t < e \) in (37). \( t \) serves as the temporal background for \( \pi_2 \), which means that \( \pi_2 \) temporally overlaps \( e^* \), i.e. the time before the his mom talk to him event. However, this temporal relation violates the temporal constraint (25) because one expects that his mom talking to him would result in the improvement of his behavior. The effect cannot temporally precede the cause. Therefore, this discourse is ruled out as infelicitous.

To sum up, in this section, I formalize the default functions of jingran and guoran as the axioms in (24). I also formalize the temporal constraint in (25) and propose meaning postulates to determine temporal relations in (26). I demonstrate how the axioms, the temporal constraint and meaning postulates function to derive temporal relations and to block infelicitous discourse.

5 Conclusion

In this paper, I argue that, by default, guoran indicates Explanation. It also specifies a temporal constraint: the proposition guoran presents cannot temporally precede the proposition representing the expectation based on which guoran is used. The rhetorical relation specified by guoran has a ‘bidirectional’ behavior: that is, guoran depends on the inference pattern for guoran whether the proposition presented by guoran is explained or the other way around. I also propose that Explanation specifies a weak version of temporal relation and a strong version.

On the other hand, I propose that jingran by default indicates Contrast, which does not specify a temporal relation. It imposes the same temporal constraint as guoran. Jingran does not involve directionality because the rhetorical relation it specifies does not have this property. The other rhetorical relations can connect a sentence with jingran to another
sentence as long as the temporal relations they specify obey the temporal constraint imposed by *jingran*.

Finally, I formalize the default functions of *jingran* and *guoran* as axioms. I also formalize the temporal constraint and propose meaning postulates to determine temporal relations. I also demonstrate how the axioms, the temporal constraint and meaning postulates function to derive temporal relations and to block infelicitous discourse.

The results of this paper presented above can be summarized in Table 2 below:

<table>
<thead>
<tr>
<th>Semantics</th>
<th>Discourse Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>jingran</strong></td>
<td>A proposition contradicts the expectation</td>
</tr>
<tr>
<td></td>
<td>(i) <strong>Contrast</strong></td>
</tr>
<tr>
<td></td>
<td>(ii) Axioms: (24a) and (24b) (two axioms to capture bidirectionality)</td>
</tr>
<tr>
<td></td>
<td>(i) The proposition <em>jingran</em> or <em>guoran</em> presents cannot temporally precede the expectation</td>
</tr>
<tr>
<td><strong>guoran</strong></td>
<td>A proposition matches the expectation</td>
</tr>
<tr>
<td></td>
<td>(i) <strong>Explanation</strong></td>
</tr>
<tr>
<td></td>
<td>(ii) Axiom: (24c)</td>
</tr>
<tr>
<td></td>
<td>(iii) Temporal relations induced by Explanation: (26a) and (26b).</td>
</tr>
<tr>
<td></td>
<td>(ii) Formalism: (25)</td>
</tr>
</tbody>
</table>

Table 2

This paper is consistent with Wu’s (2003, 2007a, 2007b, 2009b, 2010) research on temporal relations in Mandarin Chinese. *Jingran* and *guoran* behave parallel to aspect markers and situation types in terms of temporal relations: First, based on their semantics, they specify a default rhetorical relation, which in turns decides a temporal relation, and second, they impose a temporal constraint.

An anonymous reviewer suggests that a research should be conducted on *suiran* ‘although’, *biran* ‘necessarily’, *chengran* ‘it is true that’, *danshi* ‘but’, etc. These phrases are left for future studies and this study can serve as a foundation for the future studies.

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**6 References**


