

Temporal Reference in Mandarin Chinese

ABSTRACT

Unlike Indo-European languages which express distinctions of times in terms of verbal inflections, i.e., grammatical tense, Chinese is often cited as an example that lacks tense. It is thus curious what devices the Chinese language employs to express the notion of time. In this paper, I briefly review the previous studies of Chinese temporal reference in the past decade, showing that they are inadequate not only because description of the data is not wide and deep enough but also because there is no formal theory that may systematically account for the data. Thus, in discussing the formal devices that express temporality in Chinese, I provide as much data as possible and as complete as I can so that the theory that I propose has a solid empirical foundation. I show that not only temporal adverbials and aspectual markers may influence temporal reference in Chinese but many other factors such as situation types, lexical semantics, interpretations of noun phrases, pragmatics, inference rules and world knowledge, etc., also help resolve Chinese temporal reference.

0. Introduction

The study of temporal reference in natural language has been one of the most important issues in the history of linguistic research. This is especially the case for Indo-European languages such as English, because distinctions of times in these languages are directly encoded by verbal inflections. In fact, tense and aspect in these languages have been studied for almost twenty-five hundred years since at least the time of the ancient Greeks and the results are very fruitful as Binnick's (1991) book *Time and the Verb*—a complete guide to grammatical tense and aspect—has shown us. In contrast to Indo-European languages, works on temporal reference in Chinese are relatively meager and the breadth and depth of research are far behind those of Indo-European languages. One reason for this, undoubtedly, is that the Chinese language, unlike Indo-European languages, does not have the same kind of verbal inflections to indicate distinctions of times. Of course, not having finite verb forms does not mean that Chinese is not able to express the notion of time. When hearing a Chinese sentence, any native speaker can immediately tell whether the situation described by that sentence holds at a past time, a future time or the speech time. Moreover, the processing of temporal reference in Chinese seems to be no more difficult than that in a language that has finite verb forms. The questions then arise as to how temporal reference in Chinese is determined and to what extent the

mechanisms that the Chinese language uses are different from those used in Indo-European languages. In this paper, due to space limit I will not be able to probe into the second question thoroughly but I will attempt to give a very detailed answer to the first question. To this end, in section 1, I will first review the history of the study of Chinese temporal reference, showing that the previous studies are inadequate not only because they are not observationally adequate but also because they lack a formal theory that may systematically account for the data. In discussing the formal devices that express temporality in Chinese, I will provide as much data as possible and as complete as I can so that the theory that I will propose has a solid empirical foundation. The remaining sections of this paper are organized as follows. Section 2 examines the relation between aspect, tense and temporal reference of simplex Chinese sentences. Section 3 discusses how temporal adverbials contribute to sentence meanings. Section 4 to section 7 are devoted to temporal reference of subordinate clauses such as verb-complement clauses, relative clauses and adverbial clauses. Section 8 concludes this article.

1. A Review of the Literature¹

Most, if not all, studies of temporal reference in Chinese focus on the notions of tense and aspect: two grammatical categories that are closely connected with time of natural language. Tense is usually understood as a means of locating the time of a situation in the past, present or future in time axis, whereas aspect is about temporal constituency of a situation (Comrie (1976)). The earliest discussion of tense

in Chinese literature that I know of is Li's (1924) grammar book, which takes time adverbs and auxiliaries as tense forms corresponding to English inflectional changes.² Later Wang (1943) thinks that the Chinese language emphasizes the length of duration of time of an event as well as the inception or completion of the event but does not care much about when the event occurs. Therefore, Chinese only has aspect but no tense, a view later echoed by Gao (1948). Lü (1942), on the other hand, suggests that the notion of times in Chinese is expressed by time words and that verbal suffixes such as *-le* and *-zhe* are phase markers. In 1950's, however, the view that Chinese has aspect but no tense is challenged by Zhang (1957) and two Russian Chinese linguists Dragunov (1952) and Yahontov (1957). Zhang has argued that though Chinese does not have absolute tense, it has relative tense. Dragunov (1952) and Yahontov (1957) think that verbal suffixes in Chinese have functions of both tense and aspect and should be analyzed as a blend of tense and aspect.

¹ Some articles or books cited in this section are not available to me. My use of those materials is based upon Jin and Zhang's (1998) and Li's (1999) summaries.

² Li's auxiliaries such as *-le*, *-zhe*, *qilai* are what we take to be aspectual markers today

As explicated above, from 1920-1960, the studies of temporal reference in Chinese are mainly concerned with the distinction between tense and aspect and the issue of whether or not Chinese has tense. In this period, no detailed description of linguistic data is available; nor is there any serious theoretical analysis proposed. A wider observation of linguistic data and deeper analysis of individual aspect markers have begun to emerge since late 1980's. For example, Liu's (1988), Shi's (1990), Ross's (1995) and Lin's (2000b) analyses of *-le*, Light's (1989) and Lin's (2000a) analyses of *-zhe*, Kong's (1986), Liu's (1988) and Yeh's (1996) analyses of *-guo*, Magione and Li's (1993) analysis of *-guo* and *-le*, Huang's (1987), Dai's (1994) and Li's (1999) analyses of *-zhe*, *-le*, *-guo*, Klein, Li and Hendrik's (2000) study of *-zhe*, *-le*, *-guo* and *zai*, among many others, all shed inspiring new lights on the grammatical meanings of these words. In addition to individual aspect markers, several more systematic studies of temporal system in Chinese also appear in this period. For example, Chen (1988) proposes that temporal system for Chinese consists of three components; namely, phase structure, tense structure and aspect structure and that tense should be separated from aspect. But this paper does not give a detailed analysis of Chinese tense and aspect. Li (1990), on the other hand, suggests that Chinese have its own tense category, which can be realized by analytic forms such as verbal suffixes and time adverbs or by a zero form. He proposes that Chinese has both absolute tense system and relative tense system and on the basis of this he lists eleven (semantic) tenses for Chinese. He also takes the verbal suffix *-guo* and the sentence final *le* as tense markers rather than aspect markers. His discussion of Chinese tenses, though in some detail, is only a description of the data. We do not find a theoretical analysis of the data. In contrast to Li (1990), Gong (1991, 1995) thinks that Chinese does not have a grammaticalized tense category. According to him, the tense meaning in Chinese is expressed via lexical expressions. Like Li (1990), he names many tense types but on the basis of the interaction of speech time, event time and reference time. However, Gong's discussion of Chinese tense is still inadequate in that no theory is proposed that may systematically account for how a Chinese sentence obtains its tense meaning. Zhang's (1998a,b) recent articles represent a great improvement over the previous studies of Chinese temporal reference in this respect. According to him, the tense structure of Chinese is based on the distinction between future tense and non-future tense. On his analysis, future tense is a marked construction. Thus, unless a sentence contains a future modal auxiliary such as *jiang* 'will', *hui* 'will' or temporal adverbials such as *mingtian* 'tomorrow', the sentence must be construed as a non-future tense sentence. Of non-future tense sentences, the tense interpretation is resolved by excluding one of the other two non-future tenses. The exact execution of this idea is related to the aspectual properties of the sentence. According to Zhang, when an event is viewed as

a whole—i.e. the sentence is perfective, that event must have already happened before the speech time or have not happened yet at the speech time. Consequently, perfective sentences do not have a present tense interpretation. Thus, if a sentence is perfective and does not have a marker indicating future time, it must be understood as a past tense sentence. In contrast, imperfective sentences—i.e. sentences describing situations viewed from inside—may have any of the three tenses. Imperfective sentences without any marker indicating future time or past time must be construed as having a present tense interpretation by default. Zhang’s analysis of Chinese temporal reference is very inspiring despite its informal nature. Indeed, many virtues of his analysis will be kept in my own analysis of Chinese temporal reference. But it is a pity that Zhang’s tense system does not say anything about subordinate clauses. In fact, except for Li’s (1999) book which discusses temporal reference of *-zhe*, *-le*, *guo* in subordinate clauses, no article or book that I know of has described how temporal reference in Chinese subordinate clauses works. I will show later that determination of temporal reference of Chinese subordinate clauses greatly differs from that of matrix clauses. So the problem of subordinate clauses should not be overlooked in the study of Chinese temporal reference.

Although my above brief review of the literature on Chinese temporal reference certainly cannot do justice to every previous research endeavor, three things seem quite clear about them. First of all, one central debate about Chinese temporal reference is whether or not Chinese has tense. I will make my comments on this debate later. Second, the most detailed description of temporal reference seems to center around aspectual markers such as *-zhao*, *-le*, *-guo*. Other phenomena of temporal reference, in contrast, have received few attention. For example, discussion of temporal reference in subordinate clauses is infertile. Even for *-zhao*, *-le*, *-guo*, many subtle and crucial distinctions are not made clear yet. Third, most works of Chinese temporal reference are descriptive studies rather than theoretical analysis of the data. This is in contrast to studies of temporal reference in Indo-European languages which have proposed many different theories, be they formal or informal, that may systematically predict how and why a certain sentence has which tense.

Now let me make some comments on the debate about whether Chinese has the tense category or not. I believe that the debate is a result of two factors. One is that different people often have understood tense in a different way. The other is whether or not markers such as *-guo* and *-le*, are tense or aspect markers. I discuss these two factors in turn below.

Traditionally, the word “tense” can represent the content as well as the forms which express it. The content can be called semantic tense. Semantic tense refers to the temporal location of a situation with respect to some other reference time, usually the

speech time. A situation may hold at a time anterior or posterior to that reference time or coterminous with it. Any (declarative) sentence describes a situation, and since situations must occupy some location in time, any sentence should have a semantic tense. Thus, semantic tense is a universal concept that every natural language has. In this sense, Chinese must have (semantic) tense and this notion of tense is some Chinese linguists', for example, Li's (1990), notion of tense.

Semantic tenses can be denoted by grammatical markings that express a certain temporal relation between the speech time and the situation time or between the speech time and a reference (topic) time at which the assertion is made. These markings are called grammatical tenses. When a fixed grammatical form obligatorily accompanies a semantic tense, tense is said to be grammaticalized. On this notion of tense, Chinese does not have tense, because we cannot find any grammatical form that obligatorily accompanies a certain semantic tense.³ Even a zero-form can be used in past, present or future situations, as illustrated in (1)-(3).

- (1) Zhangsan dapuo boli (past situation)
 Zhangsan break glass
 'Zhangsan broke glass.'
- (2) Wo zhidao daan (present situation)
 I know answer
 'I know the answer.'
- (3) Ni shenme shihou zou (future situation)
 you what time leave
 'When will you leave?'

The above notion of grammaticalized tenses is the notion of tense in many Chinese linguists' minds when they claim that Chinese has no category of tense. I agree with them. Thus when I use the word "tense" in this paper, I refer to semantic tense, not grammaticalized tense.

The problem with verbal suffixes such as *-guo* and *-le* is more complicated. Are they markers for tense or aspect? The answer to this question relies heavily on the exact semantics of these two expressions. So although I believe that they are aspect markers rather than tense markers, I will pend for my arguments until the next section.

2. Aspect and Chinese Temporal Reference

The notion of aspect in the literature often lumps two related temporal phenomena

³ Some people have suggested that *-le* represents a relative tense in Chinese. I will argue that *-le* is better treated as an aspect marker rather than a tense marker in terms of its semantics.

which were long confused.⁴ One is the inherent temporal property of the situations themselves expressed by verbs and other lexical items. This notion of aspect is also called lexical aspect or Aktionsart. The other notion of aspect refers to different ways of presenting situations as a completed whole, viewed as if from outside or as an ongoing, incomplete action or state, viewed as if from inside. The former is called perfective aspect and the latter imperfective aspect. The perfective vs. imperfective distinction is often realized through grammaticalized affixes or auxiliaries. In this section, I will discuss the relationship between these two notions of aspect and Chinese temporal reference.

2.1 Aktionsart, Aspect and Temporal Reference

Since Vendler's (1957) classification of aktionsarten as states, activities, achievements and accomplishments, many linguists have reexamined the criteria of classifying them and revised the ontology of aktionsarten accordingly (Mourelatos (1978), Dowty (1979), Bach (1986), Moens and Steedman(1987), Smith (1991), Verkuyl (1972, 1993), and others). In this paper, I will stick to the original Vendler four classes of situations. These four classes can be characterized with three conceptual features, namely, [\pm Static], [\pm Durative], and [\pm Telic] (Smith 1991). The feature [\pm Static] distinguishes stative situations from dynamic events. The feature [\pm durative], on the other hand, characterizes situations as durative or instantaneous. Finally situations can be characterized as telic situations, which are directed toward a natural end point, and atelic situations, which do not have such an inherent end point.⁵ The feature system of the four Vendler classes is as follows (Smith 1991).

(4) Situations	Static	Durative	Telic
States	[+]	[+]	N.A.
Activity	[-]	[+]	[-]
Accomplishment	[-]	[+]	
Achievement	[-]	[-]	[+]

Notice that there is no one-to-one correspondence between lexical aspect and grammatical aspect. Except for achievements that can only be viewed perfectly because they are nondurative and hence cannot be viewed from inside, all the other three types of situations are durative and can be viewed perfectly or imperfectly.

⁴ See Binnick (1991) for a very detailed discussion of this.

⁵ According to Smith (1991), the feature [\pm telic] is only relevant to events, not states. But I think that it does no harm to classify states as [-telic].

Chinese stative sentences without any aspectual markers are construed as imperfective sentences and have a present tense interpretation. Examples are the following:

- (5) Wo you yi da bi qian
 I have one big CL money
 ‘I have a big amount of money.’
- (6) Wo xiangxin ni
 I believe you
 ‘I believe you.’

However, if a perfective aspectual marker such as *-guo* or a temporal adverbial such as *congqian* ‘before’ is added, stative sentences can be viewed perfectly and are construed as past states. This is illustrated by (7) and (8).

- (7) Wo (cengjing) you-guo yi da bi qian
 I once have-GUO one big CL money
 ‘I once had a big amount of money.’
- (8) Wo xiangxin-guo ni
 I believe-ASP you
 ‘I believed you.’

The future tense of stative sentences usually requires the presence of an overt modal auxiliary such as *hui* ‘will’ or expressions with a modal force such as *yiding* ‘certainly’. A mere temporal adverbial alone is sometimes unable to license a future tense interpretation.

- (9) a. Ta hui xiangxin wo shuo de hua ma
 he will believe I say REL word Q
 ‘Will he believe what I will say?’
- b. *Ta mingtian xiangxin wo shuo de hua ma
 he tomorrow believe I say REL word Q
 ‘Will he believe what I will say tomorrow?’

Activity sentences are durative and can be viewed perfectly or imperfectively. To express an imperfective situation, the durative marker *-zhe* or the progressive marker *zai* must be used; to express a perfective situation, *-guo* or *-le* is used. Like other situation types, the future tense interpretation of activity sentences must be

accompanied by a future modal auxiliary or temporal adverbial.

- (9) a. Ta zai chang ge
he in sing songs
'He is singing songs.'
- b. Ta chang-guo ge
he sing-GUO songs
'He sang songs.'
- c. Ta jijiang chang ge
he be-going-to sing songs
'He is going to sing songs.'

Without any temporal markers, activity sentences usually are construed as habitual sentences as (10) shows.

- (10) Q: Ni tongchang zuo shenme xiaoqian
you usually do what entertainment
'What do you usually do for entertainment?'
- A: Wo chang ge
I sing song
'I sing songs.'

Since habitual sentences can be regarded as stative sentences, they are like standard lexical stative sentences in not needing an aspect marker to express the present tense meaning. Also like lexical statives they need an overt marker to express future or preterit tense.

Interestingly, some activity sentences can be viewed perfectly and do not need any marker to describe past situations. This is particularly true when the object of the verb is the first person pronoun *wǒ* 'I', as is illustrated by (10).

- (10) Ta da/ma/ti/pian wo
he hit/scold/kick/cheat
'He hit/scolded/kicked/cheated me.'

I do not know what the rule is.

As for accomplishment sentences, an aspectual marker and/or temporal adverbial seem to be obligatory for the past tense interpretation, whether the sentence is viewed perfectly or imperfectly, unless the verbal phrase contains some phrase

indicating the goal. The same is true of the future tense interpretation. Illustrating examples are given below.

- (11) a. *Ta gai yi-dong fangzi⁶
 he build one-CL house
 ‘He builds/built a house.’
- b. Ta zai gai yi-dong fangzi
 he in build one-CL house
 ‘He is building a house.’
- c. Ta gai-guo yi-dong fangzi
 he build-GUO one CL house
 ‘He has build a house.’
- d. Ta jijiang gai yi-dong fangzi
 he be-going-to build a-CL house
 ‘He is going to build a house.’
- (12) a. Ta gai yi-dong fangzi song wo
 he build one-CL house give me
 ‘He build a house and gave it to me.’
- b. Ta zoulu dao xuexiao
 he walk to school
 ‘He walked to school.’

Finally, as mentioned, achievement sentences only have a perfective viewpoint. When the verb is intransitive, a perfective aspectual marker or a modal auxiliary is obligatory. But when the verb is transitive, a perfective aspectual marker or modal auxiliary can be optional. As is usual, the future tense interpretation of achievement sentences is a marked construction, so a future modal auxiliary or a temporal adverbial is obligatory.

- (13) a. Ta si-le
 he die-LE
 ‘He has died.’

⁶ When properly embedded, the sentence will become grammatical, but the meaning is shifted to a generic reading, as (i) below shows.

- (i) Ta gai yi-dong fangzi xu duojiu de shijian?
 he build one-CL house need how much time
 ‘How much time does it take for him to build a house?’

The embedded sentence *ta gai yi-dong fangzi* has a generic interpretation, not a single-event interpretation.

- b. Zhe-zhi laoshu hui si
 this-CL mouse will die
 ‘This mouse will die.’
- (14) a. Ta faxian-(le) yi-ge hairen de mimi
 he discover-LE one-CL appalling DE secret
 ‘He has discovered an appalling secret.’
- b. Yi-ge hairen de mimi bei faxian-*(le)
 one-CL appalling DE secret PASS discover-ASP
 ‘An appalling secret was discovered.’

Summarizing what I have discussed so far, not every aktionsart is compatible with both perfective and imperfective aspect.⁷ Instantaneous situations, i.e., achievements, can only be referred to by a perfective viewpoint, whereas other durative situations such as states, activities and accomplishments can be referred to by a perfective or imperfective viewpoint. We also have observed that present tense is expressed by an imperfective viewpoint.⁸ Typical imperfective sentences are lexical stative sentences. Non-stative sentences must make use of the progressive marker *zai* or the durative/stativized marker *-zhe* to express imperfectivity. Imperfective sentences may refer to past or future situations but presence of a temporal adverbial or modal auxiliary is obligatory. As for perfective aspect, a perfective marker such as *-guo* or *-le* is usually obligatory, though there are some exceptions. Without a future modal auxiliary or temporal adverbial, a perfective aspect must be construed as a past tense sentence.⁹

2.2 Formal Semantics of Aspect

In this section, I will discuss the temporal semantics of aspect in more formal terms. First of all, some theoretical assumptions are necessary. Following Needham (1975)

⁷ See also Vogel (1997).

⁸ This accords with Comrie’s (1976) discussion of a number of West African languages.

⁹ Note also that non-declarative clauses such as questions or imperative sentences do not necessarily follow the conclusion summarized here. For example, sentence (i), a question and sentence (ii), an imperative sentence, are both understood as having a future tense, but there is no expression that clearly refers to the future.

(i) Ni shenme shihou zou
 you what time leave
 ‘When will you leave?’

(ii) Wo lai bang ni
 I come help you
 ‘Let me help you.’

and Ogihara (1996), I will incorporate the existential quantifier, time variables into the logical language that I will be using. (See also Davidson (1967).) Thus, a sentence like (15) has a notation like (16).

(15) John cried.

(16) $\exists t[t < \text{now} \ \& \ \text{cry}'(j')(t)]$

Apart from the above notational system, I will assume with Stump (1985) that sentences translate as “temporal abstracts”, i.e., sets of intervals at which the sentences are true, represented as $\lambda t[\dots t \dots]$. With the introduction of time variables to the argument structures of verbs, I need to assume that in addition to the normal semantic types e (entity) and t (truth value), there is a semantic type i , standing for intervals. These types will enter recursive definition of semantic types so that if α and β are any types, then $\langle \alpha, \beta \rangle$ is a type. Usually, I will use the subscripted t_1, t_2, t_3 , etc., to stand for time variables and ‘Now’ to stand for the speech time.

In addition, following Stump (1985) and Ogihara (1996), I assume that a general existential closure rule introduces an existential quantifier to close the temporal abstract. As will become clear later, the existential closure rule will not only close the situation time variable but a reference time variable (introduced by aspect) as well.

For the syntax, I assume that above VP is AspP. The perfective vs. imperfective distinction is stated at the head of AspP. Also I assume that there is no tense node in Chinese, though this assumption is not absolutely necessary. My discussion will show that even without tense node there is no difficulty in deriving temporal reference for Chinese sentences. Finally, I adopt the VP-internal subject hypothesis as proposed in Kitagawa (1986) and Kopman and Sportiche (1991).

As mentioned, imperfective aspect expresses that an action or state is incomplete, unbounded or viewed from inside, whereas perfective aspect describes an action or state as completed, bounded or viewed from outside. Klein (1994) finds these definitions unprecise and proposes a temporal relation to replace them. On his view, aspect relates the topic time (= the reference time) to the situation time.¹⁰ I accept this view and following him I propose that perfective aspect state that the situation time is contained in the reference time, whereas imperfective aspect is the other way around.¹¹ In formal terms, the semantics of perfective and imperfective aspect can be formulated as follows:

¹⁰ On Klein’s (1994) analysis, tenses connect the speech time with the topic time and aspect connects the topic time with the situation time.

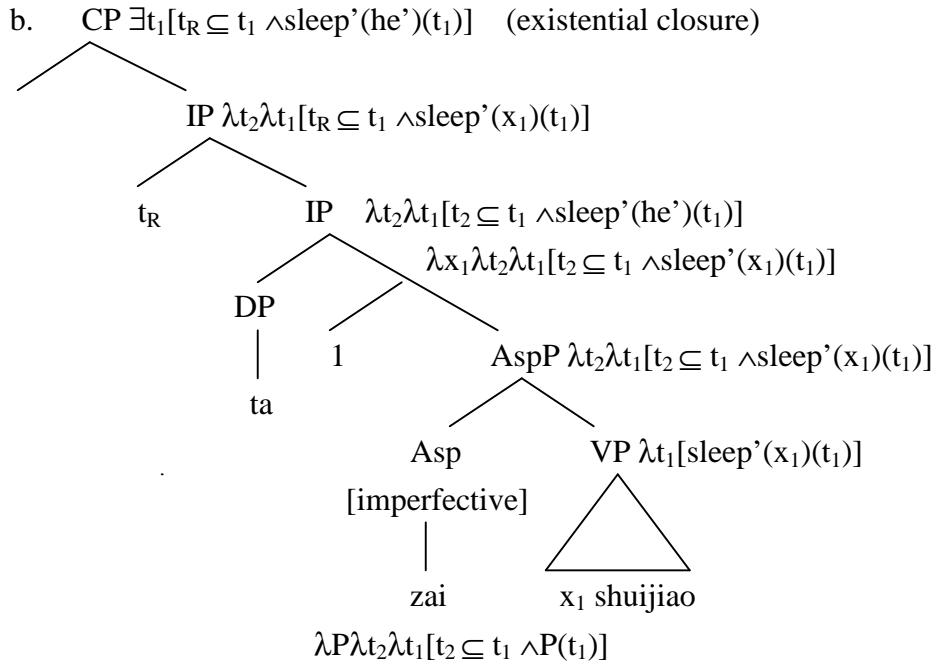
¹¹ Klein’s (1994) original definition of perfective aspect is more complicated than what is stated here. For the purpose of this paper, a simpler definition will suffice.

- (17) a. perfective aspect = $\lambda P_{\langle i,t \rangle} \lambda t_2 \lambda t_1 [t_1 \subseteq t_2 \wedge P(t_1)]$
 b. Imperfective Aspect = $\lambda P_{\langle i,t \rangle} \lambda t_2 \lambda t_1 [t_2 \subseteq t_1 \wedge P(t_1)]$

Although it is usually assumed that imperfective aspect involves an inclusion relation, Kamp and Reyle (1993: 513-514) give evidence that the time at which a state holds and the reference time might involve an overlap instead of inclusion relation. I refer the reader to them for evidence. For the purpose of this paper, the inclusion relation is used when no confusion arises; but when it is necessary, I will replace the inclusion relation with an overlap relation as when I discuss the semantics of *-zhe* later.

To apply the semantics in (17) to concrete examples, first consider (18a), which is viewed imperfectively. The semantic computation of (18a) is given in (18b).¹²

- (18) a. Ta zai shuijiao
 he PROG sleep
 ‘He is sleeping.’



I assume that if no overt time adverbial appears in the sentence serving as a reference time, an implicit time adverbial, recoverable from the context of utterance, is always in the structure. Such an implicit time adverbial, represented as t_R , is adjoined to IP and denotes the speech time at default case, unless the context provides other time adverbial. The semantics of temporal adverbials will be discussed in detail in section

¹² Following Heim and Kratzer (1998), I assume that the index of a moved constituent functions as a lambda abstractor. That is why we have the number 1 next to the moved subject *ta* ‘he’, whose original position is in [SPEC,VP].

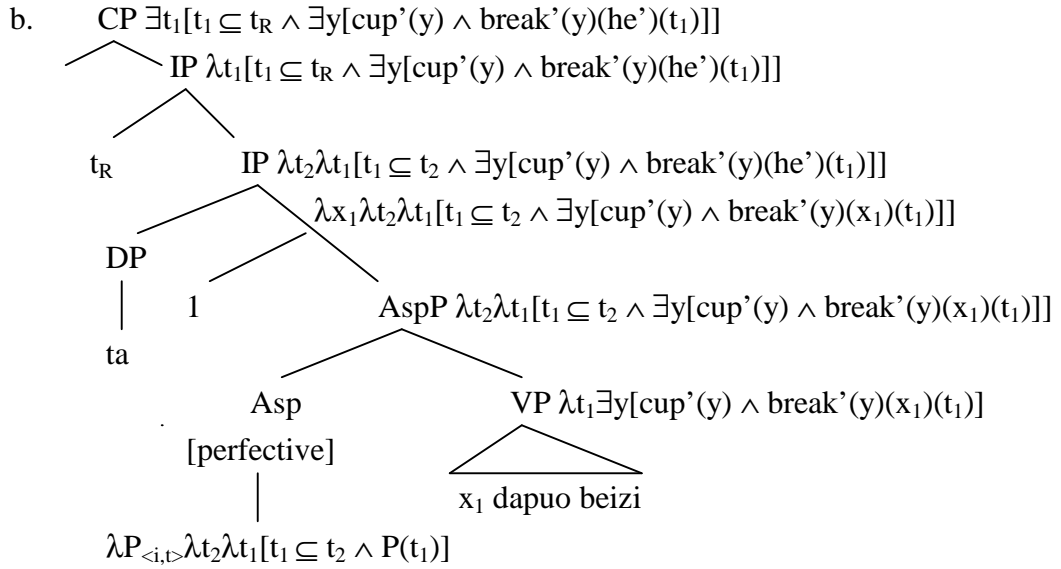
3. For the time being, it suffices that they denote an interval that may serve as a reference time. Thus, (18b) is equivalent to saying that the speech time is contained within the time at which he sleeps. In other words, (18b) has a present tense interpretation, which is a correct result.

Next, consider a perfective sentence such as (19a), which denotes a punctual situation.

(19) a. Ta dapuo yi-ge beizi

he break one-CL cup

‘He broke a cup.’



As mentioned, punctual situations can only be viewed perfectly, so (19a) must have a perfective aspect. The resulting truth conditions in (19b) state that there is a time t_1 at which he breaks a cup and t_1 is included within the reference time t_R . Since the construction does not contain any overt future marker, we infer that t_R cannot be a future time. But can t_R be the default speech time? Clearly the answer must be NO, because the sentence has a past tense interpretation. But why? As we know, punctual situations have no duration. Therefore, when one utters an achievement sentence to describe a punctual situation, that situation must have had happened before the speech time or has not happened yet before the speech time. We can incorporate this temporal property of achievement verbs into their lexical semantics. One way to do this is to say that the denotations of all achievement verbs contain a condition to the effect that the event time cannot be included within the speech time.¹³ For example, the denotation of *dapuo* ‘break’ is (20a) instead of (20b).

¹³ Alternatively, it is also possible to require that the event time for an achievement be not the speech time. For the purpose of this paper, it is not important to decide which analysis is the correct one.

- (20) a. $[[\mathbf{dapuo}]] = \lambda y \lambda x \lambda t_1 [\text{break}(y)(x)(t_1) \wedge \neg t_1 \subseteq \text{Now}]$
 b. $[[\mathbf{dapuo}]] = \lambda y \lambda x \lambda t_1 [\text{break}(y)(x)(t_1)]$

As a consequence, if t_R in (19b) denotes the speech time, a contradiction will arise as is shown in (21).

- (21) $\exists t_1 \exists y [t_1 \subseteq \text{Now} \wedge \text{cup}'(y) \wedge \text{break}'(y)(\text{he}')(t_1) \wedge \neg t_1 \subseteq \text{Now}]$

This then accounts for why (19a) cannot be interpreted as an on-going event at the speech time. It also follows from this that t_R can only refer to a past time. Therefore, (19a) must have a past tense interpretation.

Activity and accomplishment sentences are very similar. Imperfective aspect for both situation types is a marked construction. Thus, unless the construction contains the progressive marker *zai* or the durative/stativized marker *-zhe*, the sentence is viewed perfectly. I illustrate this with (21).

- (21) a. Baba song wo yi-feng liwu
 father give me one-CL present
 'Father gave me a present'
 b. $\exists t_1 \exists y [t_1 \subseteq t_R \wedge \text{present}'(y) \wedge \text{give}'(y)(\text{me}')(\text{father}')(t_1)]$

Since (21a) does not have an imperfective aspect maker¹⁴, it must be a perfective sentence. Accordingly, (21a) translates as (21b). Like (19b), the temporal location of the situation should be determined by t_R . t_R cannot be a future time because future tense in Chinese requires overt marking. Nor can t_R be the speech time, because giving someone a gift is not instantaneous. Therefore, the event time for a gift-giving action is a priori not able to be included within an instant such as the speech time. Again, this can be lexically determined in a way similar to achievement verbs. Namely, it can be lexically specified that the event time of a durative verb is not included within the speech time. If this is a right analysis, it follows that t_R in (21b) can only be a past time interval recoverable from the utterance context.

2.3 The Semantics of Aspectual Markers

In the last subsection, I discussed how the temporal reference of a sentence without an overt aspectual marker is resolved in terms of the perfective vs. imperfective

¹⁴ In fact, one cannot add the imperfective aspect marker *zai* or *-zhe* to (21a), an accomplishment sentence. I don't know the reason why.

distinction. In this subsection, I will examine how individual aspectual markers such as *-zhe*, *-le*, *-guo* contribute to tense resolution.

First, let us discuss the verbal suffix *-le*, which has often been characterized as a perfective aspect marker (e.g. Li and Thompson 1981). Sentences with *-le* often describe past events, as is illustrated by (22).

- (22) Ta chi-le yi tiao jinyu
 he eat-ASP one-CL gold-fish
 'He ate a goldfish.'

According to Magione and Li (1993), sentences such as (22) do not describe just any past event but a past event that occurs within a certain reference time understood in the context. The temporal meaning of (22) is somewhat similar to Partee's (1973) famous example *I didn't turn off the stove*, where the past tense does not refer to any past time but a specific past time understood in the context. Although sentences with *-le* usually have a past tense interpretation, *-le* is actually compatible with a present tense interpretation as the following example shows (cf. Lin 2000b).

- (23) Ta yang-le yi tiao jinyu
 he raise-ASP one-CL goldfish
 'He has been raising a fish.'

The syntactic construction of (23) is almost identical to that of (22) in every aspect except the verb, but the meaning of (23) is much different from that of the latter. Unlike (22), the event referred to in (23) is not a completed event but an on-going event at the speech time. More precisely, (23) can be paraphrased as follows: He started raising a goldfish sometime before the speech time and at the speech time the raising event is still on going. This example clearly indicates that the verbal suffix *-le* is not an absolute past tense marker.

On the other hand, if we replace *-le* in (22) and (23) with *-guo*, we find that both sentences are interpreted as describing a completed past event. Moreover, in contrast to *-le*, *-guo* has an indefinite past reading. This is illustrated by (24) and (25).

- (24) Ta chi-guo yi tiao jinyu
 he eat-ASP one-CL goldfish
 'He ate a goldfish (before).'
- (25) Ta yang-guo yi tiao jinyu
 he raise-ASP one CL goldfish

‘He raised a goldfish (before).’

Thus, *-guo* is more like a past tense marker than *-le* is. But like *-le*, *-guo* cannot be an absolute tense marker, either, because *-guo* is compatible with a future tense interpretation as (26) shows.

- (26) Deng ni ting-guo ta tan gangqin yihou, ni jiu hui zhidao ta de jiqiao you
 wait you hear-ASP he play piano after you then will know he DE skill have
 duo hao
 how good
 ‘After you have heard him play the piano, you will know how good his skill is.’

Although *-guo* in (26) is not construed as an absolute past tense marker, it still expresses relative anteriority; namely, the event described by the subordinate clause containing *-guo* must precede the event described by the matrix clause. In fact, just like *-guo*, *-le* may also appear in a clause with a future tense interpretation as in (27).

- (27) Deng ni bi-le ye yihou, wo hui mai yi-bu che gei ni
 Wait you graduate-ASP after I will buy one-CL car for you
 ‘After you have graduated, I will buy a car for you.’

Just like *-guo* in (26), *-le* in (27) also expresses relative anteriority (Dai 1994, Lin 2000b).

As for *-zhe*, which is often referred to as a durative or stativized marker, let us compare (28) with (29).

- (28) Ta tui-zhe yi-liang jiaotache
 he push-ASP one-CL bicycle
 ‘He is pushing a bicycle.’
 (29) Ta dai-zhe yi-ding maozi
 he wear-ASP one-CL hat
 ‘He wears a hat.’

(28) means that at the time of utterance the action of pushing a bicycle is on going. So (28) has a present tense interpretation. But (29) is a little bit different. For (29) to be true, the action of hat-wearing should be completed before the utterance time, but the resulting state of the hat being on the head must obtain at the speech time. Of course, Chinese is able to express an on-going hat-wearing event at the utterance time. The

preverbal aspectual marker *zai* has exactly this function. Compare (29) with (30).¹⁵

- (30) Ta zai dai (??yi-ding) maizi
 he PROG wear one-CL hat
 ‘He is wearing a hat.’

From the above discussion, it is clear that the combination of different aspectual markers with different kinds of VP results in different interpretations of temporal reference. The next step is to spell out the semantics of those aspectual markers so that one can see clearly how they each contribute to the understanding of Chinese temporal reference.

2.3.1 The temporal semantics of *-guo*

First, let us consider *-guo*. As we saw from (24), (25) and (26), the temporal meaning of *-guo* expresses relative anteriority. In simplex sentences, *-guo* requires that the event time precede the utterance time, whereas in complex sentences it requires that the event time of the subordinate clause containing it precede the event time of the matrix clause. Notice that the rule applies not only to adverbial clauses but also to verb-complements and relative clauses, as the following examples indicate.

- (31) Zhangsan shuo ta qu-guo meiguo
 Zhangsan say he go-ASP America
 ‘Zhangsan said that he had been to America.’
- (32) Ta mai-le yi jian Daianna chuan-guo de yifu
 she buy-ASP one CL Diana wear-ASP REL dress
 ‘She bought a dress that Diana had worn.’

In (31), the event of going to America must precede the event of saying; in (32), the event of wearing must precede the event of buying. The above discussion indicates that the temporal meaning of *-guo* is something like (33), as Li (1999) has suggested.

(33) *-guo* expresses relative anteriority. The event time t_1 of the clause containing

¹⁵ It is not clear to me why (30) is somewhat odd when the numeral and classifier are present. But there are examples where the presence of a numeral and classifier is perfectly O.K., as is illustrated in (i) below.

- (i) Ta zai gai yi dong da-lou
 he PROG build one CL mansion
 ‘He is building a mansion.’

Clearly, in (i), it is the action of building that is on-going, not the resultant state.

–*guo* must precede a reference time t_2 . When –*guo* is embedded in a subordinate clause, t_2 refers to the event time of the dominating clause. When –*guo* is in the matrix clause, t_2 is the speech time.

To capture the above descriptive statements, I propose the following temporal semantics of –*guo*, using one single definition.

(34) The temporal semantics of –*guo*

$$[[-\mathbf{guo}]] = \lambda P_{\langle i, t \rangle} \lambda t_2 \lambda t_1 [t_2 < t_{\text{pro}} \wedge t_1 \subseteq t_2 \wedge P(t_1)]$$

In (34), the conditions “ $t_1 \subseteq t_2$ ” and “ $P(t_1)$ ” represent the standard semantics of perfective aspect. It says that the event time t_1 is included within a reference time t_2 . But in addition to this perfective meaning, I propose that –*guo* adds an additional condition $t_2 < t_{\text{pro}}$, which expresses relative anteriority. In plain English, (34) says that the event time t_1 is included within a reference time t_2 and t_2 precedes another time t_{pro} . Notice that t_{pro} is not bound by a lambda-abstractor in (34). This is because t_{pro} is not a normal time variable. I intend it to be a pronoun-like free variable, whose value is determined by the context of utterance. Thus, it may deictically refer to the speech time or be anaphoric to another time in the context of utterance. On this analysis, when –*guo* appears in the matrix clause, it picks up the default speech time as its value. A concrete example of semantic computation with –*guo* is given in (37) below.

(37) [[**Ta chi-guo yi-tiao-jinyu**]]

1. [[AspP]] = $\lambda P_{\langle i, t \rangle} \lambda t_2 \lambda t_1 [t_2 < t_{\text{pro}} \wedge t_1 \subseteq t_2 \wedge P(t_1)] (\lambda t_1 \exists y [\text{goldfish}'(y) \wedge \text{eat}'(y)(\text{he}') (t_1)])$
2. [[IP]] = $\lambda t_1 \exists y [t_{\text{R}} < t_{\text{pro}} \wedge t_1 \subseteq t_{\text{R}} \wedge \text{goldfish}'(y) \wedge \text{eat}'(y)(\text{he}') (t_1)]$
3. [[CP]] = $\exists t_1 \exists y [t_{\text{R}} < t_{\text{pro}} \wedge t_1 \subseteq t_{\text{R}} \wedge \text{goldfish}'(y) \wedge \text{eat}'(y)(\text{he}') (t_1)]$

In the last line of (37), t_{pro} refers to the speech time. Thus, t_{R} must precede the speech time. Since the event time t_1 is included within t_{R} , it follows that t_1 is before the speech time. Therefore the sentence has a past tense interpretation. Although I will not argue for it, I assume that when –*guo* does not occur with an overt temporal adverbial, t_{R} is something equivalent to an implicit temporal adverbial much like *before* in force.

The above analysis of –*guo* predicts that when –*guo* is embedded in a subordinate clause, t_{pro} may take the event time of the matrix clause or the speech time as its value. This prediction seems to be correct as (38) and (39) show.

(38) Wo ganggang dique shi yong-le ta de shouyinji, ni keyi bie gaoshi ta

- I just-now surely be use-ASP he DE radio you may not tell him
 wo yong-**guo** ta de dongxi ma
 I use-ASP he DE thing Q
 ‘I did use his radio just now, but can you not tell him that I have used his stuff?’
- (39) Wo xiang jieyong yixie ta de shouyinji, keshi deng ta hui-lai shi,
 I want borrow-use a moment he DE radi but wait he come-back when
 ni keyi bie gaoshi ta wo yong-guo ta de dongxi ma?
 you can not tell him I use-ASP he DE thing Q
 ‘I want to use his radio for a moment, but when he comes back, can you not tell
 him that I have used his stuff?’

In (38), the telling event is in the future but the using event is in the past, whereas in (39) both the telling event and the using event will take place in the future. In other words, the value of t_{pro} in (39) should be the event time of the matrix clause, but that in (38) can be the speech time. However, one may argue that the evidence here is not decisive. It seems that the value of t_{pro} for *-guo* in (38) can still be the event time of the matrix clause rather than the speech time, because when a time t_1 precedes another future time t_2 , it does not exclude the possibility that t_1 is located in the past. Therefore, (38) does not really prove that t_{pro} in a subordinate clause may take the speech time instead of the event time of the matrix clause as its value. The example in (40), however, is decisive.

- (40) Wo renshi yi-ge chi-guo she de ren
 I know one-CL eat-ASP snake REL man
 ‘I know a man who has eaten a snake.’

In (40) *-guo* is embedded in a relative clause. Now if the t_{pro} in the relative clause can only take the event time of the matrix clause as its value, (40) must describe the following situation: The man that I know ate a snake at a time before I know him. Indeed, (40) can describe such a situation. But it is also compatible with a situation where the snake-eating event takes place at a time after I came to know the man but before I utter the sentence. The latter situation is a case where t_{pro} refers to the speech time rather than the situation time of the matrix clause. From this, I conclude that t_{pro} is better analyzed as a free variable rather than a syntactically controlled element as might be imagined.

2.3.2 The temporal semantics for *-le*

Next, let us consider the meaning of *-le*. As we saw above, temporal reference of

sentences containing *-le* is sensitive to the type of VP that *-le* is combined with. When the VP is of a type such as *chi-yi-tiao-yu* ‘eat a fish’ or *mai-yi-ben-shu* ‘buy a book’, the sentence is construed as having a past tense. But when the VP is of a type such as *yang-yi-tiao-jinyu* ‘raise a goldfish’ or *zu-yi-jian-gongyu* ‘rent an apartment’, the sentence seems to have a present tense interpretation. Moreover, like *-guo*, *-le* also has a meaning of relative anteriority. The problem now is what is anterior to what. Clearly, it cannot be the case that the event time of the clause containing *-le* is anterior to a reference time, because if this were the case, there would be no distinction between *-guo* and *-le*. To account for the distinction between (22) and (23), I will utilize the notion of target state or target phase discussed by Parsons (1990), Klein (1994) and Kratzer (1994) is involved.

Parson (1990) has differentiated two kinds of states of events-- target states and resultant states. He says

It is important not to identify the Resultant-state of an event with its “target” state. If I throw a ball onto the roof, the target state of this event is the ball’s being on the roof, a state that may or may not last for a long time. (Parsons 1990: 235)

In other words, target states are equivalent to resulting states when the aktionsarten is an accomplishment or achievement. We can further assume that not only accomplishments and achievements have target states but states and activities have target states as well, and their target states are equivalent to the situations they represent (cf. Lin 2000a, 2000b).

Further illustrating Parson’s notion of target states, Kratzer (1994) has cited many examples to show that different predicates may impose different requirements on the target states of the events they classify.

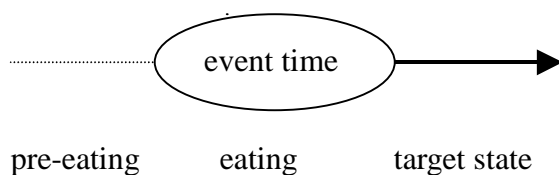
- | | |
|-----------------------------|---|
| (37) The sacs are unloaded. | The state comes into existence as soon as the sacs have been unloaded and lasts for a little while. |
| (38) The theorem is proven. | The state comes into existence as soon as the theorem has been proven and lasts forever. |
| (39) The door is bolted. | The state comes into existence as soon as the |

door has been bolted and lasts until it is unbolted again.

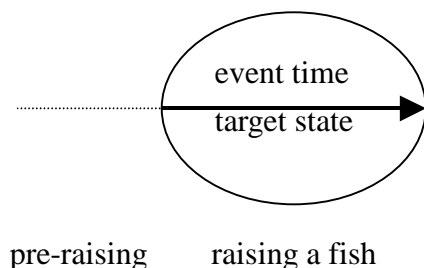
- (40) The lobster is consumed. The state comes into existence as soon as the lobster is gone, and lasts for God knows how long.

With the notion of target state in mind, we can now distinguish VPs such as *eat-yi-tiao-jinyu* ‘eat a goldfish’ from VPs such as *yang-yi-tiao-jinyu* ‘raise a goldfish’ as follows:

- (41) a. eat a goldfish: The target state comes into existence as soon as a goldfish is eaten and will last for God knows how long.



- b. raise a fish: The target state comes into existence as soon as the raising begins and will last for some time until the raising ends.



As we can see from the above two diagrams, the target state of *eat a goldfish*, represented by the bold-faced arrow, will come into existence only when the whole event is completed, whereas the target state of *raise a goldfish* will come into existence as soon as the event of raising starts and will end any time when the raising stops.

Having discussed what target states are, I now proceed to discuss the semantics of *-le*. To begin with, let me define what initial and final subintervals are.

- (41) Let I' be a member of $[T]$. I is a (PROPER) SUBINTERVAL OF I' if and only if

$I \in [T]$ and $I \subseteq I'$ ($I \subseteq I'$ and not $I = I'$). I is an INITIAL SUBINTERVAL OF I' if and only if I is a subinterval of I' and there do not exist $t' \in I' - I$ and $t \in I$ such that $t' < t$. I is a FINAL SUBINTERVAL of I' if and only if I is a subinterval of I' and there do not exist $t' \in I' - I$ and $t \in I$ such that $t < t'$.

Bennet and Partee (1978: 12)

Besides the notion of initial subinterval, I need to define a function f_{target} , which when applied to a situation yields the target state of that situation, and another function f_{initial} , which when applied to an interval, gives the initial subinterval of that interval. With the above definitions, I propose that the anteriority relation expressed by *-le* is between the initial subinterval of a target state and a reference time t_{pro} , and the former precedes the latter. The status of t_{pro} for the meaning of *-le* is completely the same as the t_{pro} for the meaning of *-guo*, as discussed earlier. In addition to this anteriority relation, like the meaning of *-guo*, *-le* also incorporates the standard meaning of perfective aspect as part of its semantics. Thus, the denotation of *-le* is (42).

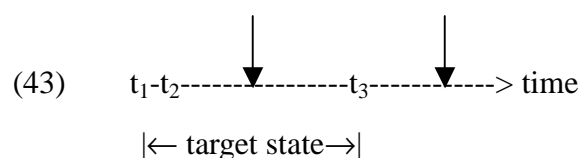
(42) The temporal semantics of *-le*

$$[[\text{-le}]] = \lambda P_{\langle i, t \rangle} \lambda t_2 \lambda t_1 \exists t_3 \exists t_4 [t_3 < t_{\text{pro}} \ \& \ t_3 = f_{\text{initial}}(t_4) \ \& \ f_{\text{target}}(P)(t_4) \ \& \ P(t_1) \ \& \ t_1 \subseteq t_2]$$

Now let us apply the semantics of *-le* as stated in (42) to (22) and (23). (42) requires that the initial subinterval of the target state corresponding to *Zhangsan chi yitiao jinyu* 'John eat a goldfish' precede a reference time t_{pro} . t_{pro} in this case must be the speech time. So according to (42), (22) means that the initial subinterval of the target state of Zhangsan's eating a goldfish is before the speech time. Since the target state of Zhangsan's eating a goldfish exists only when the eating event is completed, this amounts to claiming that the eating event must take place and end before the speech time. Therefore, (22) has a past tense interpretation.

Next consider (23). Like (22), t_{pro} for (23) should be the speech time. Therefore, the target state of Zhangsan's raising a fish must come into existence before the speech

time. From this, however, it does not follow that the event of raising a fish must end before the speech time. As we saw in (41b), the initial point of the target state of the predicate *raise a fish* is also the initial point of the raising event itself. Therefore, after the target state of Zhangsan's raising a fish comes into existence before the speech time, the event of Zhangsan's raising a fish can still go on for some time after the speech time. If this is the case, then (23) is not about a past event but about an on-going event. Notice, however, that the fish-raising event may also end before the speech time but the anteriority condition of *-le* is still satisfied, as the diagram in (43) indicates.



In (43), the interval $[t_1, t_3]$ represents the target state of *Zhangsan's* raising a fish and $[t_1, t_2]$ the initial subinterval of the target state. The two arrows indicate two possible positions of the speech time. As we can see from the diagram, no matter whether the speech time is located at the left arrow or the right arrow, it is after the initial subinterval of the target state. But these two positions of the speech time correspond to two different interpretations. If the speech time is located at the left arrow, the event of raising a fish must be understood as an ongoing event, because the speech time is included within the state of the activity (= the target state). In contrast, if the speech time is located at the right arrow, the whole event must be completed, because the speech time follows the interval at which the target state is true. Indeed, (23) permits the two different interpretations, depending upon the context in which it appears. Note the following two dialogues.

(44) Speaker A: ni qunian you-mei-you yang shenme chongwu?
 you last year have-not-have raise what pet
 ‘Did you raise any pet last year?’

Speaker B: wo yang-le yi tiao yu

I raise-LE one CL fish

‘I raised a fish.’

(45) Speaker A: ni xianzai you-mei-you yang shenme chongwu?

you now have-not-have raise what pet

‘Are you raising any pet now?’

Speaker B: Wo (xianzai) yang-le yi tiao yu

I now raise-LE one CL fish

‘I am raising a fish now.’

The above dialogues show that the interpretation of *-le* is context-sensitive. But uttered out of blue, (23) is preferably construed as an on-going event, i.e., a present tense interpretation.

The fact that a sentence with *-le* may have a present tense interpretation raises a very interesting issue. As mentioned, previous studies of aspect have shown that a strong correlation exists between imperfective aspect and a present tense interpretation. However, the verbal *-le* is traditionally characterized as a marker of perfective aspect because sentences with *-le* usually have a past tense interpretation as (22) indicates. Thus, the fact that (23) has a present tense interpretation raises the question of what kind of grammatical aspect the verbal *-le* in (23) has. Does it represent imperfective aspect or perfective aspect? One hypothesis is that perhaps the verbal *-le* is ambiguous between imperfective aspect and perfective aspect (e.g. Liu 1997). When it occurs in sentences like (22), it represents perfective aspect; when it occurs in sentences like (23), it represents imperfective aspect. Another hypothesis is that wherever the verbal *-le* appears, it has a unifying semantics of marking perfectivity. I prefer the latter hypothesis and would like to show that it is possible to unify the usage of *-le* in (22) and that in (23) by putting them under the same category of perfective aspect.

Recall that Kleinian style of aspectual semantics has defined aspect in terms of a pure temporal relation. Namely, perfective aspect dictates that the event time is included within the reference time, whereas imperfective aspect requires that the reference time is included (or overlapped) with the situation time. The perfective meaning of *-le* in (22) needs no comment here, because this sentence describes a past event. What really needs explaining is this: How does the present tense meaning of (23) fit perfective aspect, if *-le* in this example is really a perfective marker? As noted, perfectivity requires that the situation time is included within the reference time. We already know what the situation time is for (23)—it is an interval at which the event

of his raising a goldfish holds. But what is the reference time for (23)? Although there is no overt temporal adverbial to indicate the reference time for (23), I propose that this sentence actually contain an implicit time adverb much close to the adverb *xianzai* ‘now’ in meaning as is usual. This hypothesis is very plausible, because the truth conditions of (23) are completely identical to the truth conditions of (46).

- (46) Ta xianzai yang-le yi-tiao jinyu
 he now raise-ASP one-CL goldfish
 ‘He is raising a goldfish now.’

Although it has been customary for linguists to identify the temporal adverb *now* with the speech time, how long an interval is meant by *now* actually has to be calculated by the participants in actual contexts.¹⁶ Consider the following sentences.

- (47) a. Ni xianzai jiu gei wo zou
 you now JIU give I leave
 ‘You leave now.’
 b. Wo xianzai hen mang
 I now very busy
 ‘I am busy now’
 c. Ta xianzai hai shi ge xuesheng
 he now still be CL student
 ‘He is still a student now.’

In (47a), *xianzai* ‘now’ can be understood as an instant; in (47b), the length of time that *xianzai* ‘now’ denotes is intuitively longer than an instant; finally in (47c), *xianzai* ‘now’ seems to denote an interval that can last for even longer. No matter how long the time adverb *xianzai* ‘now’ denotes, it always includes the moment of speech. Let us call this interpretation of *now* ‘flexible now’. If we take this ‘flexible now’ as the reference time of (23), then the final translation of (23) should be something like (48), where P represents the propositional content of *he raise a gold-fish*.

- (48) $\exists t_1 \exists t_3 \exists t_4 [t_3 < t_{\text{pro}} \ \& \ t_3 = f_{\text{initial}}(t_4) \ \& \ f_{\text{target}}(P)(t_4) \ \& \ P(t_1) \ \& \ t_1 \subseteq \text{flexible-now}]$

t_{pro} in (48) must refer to the speech time. So (48) amounts to the claim that the target state of *he raise a gold-fish* must obtain before the speech time and the whole event of

¹⁶ In fact, deictic expressions have the common property of flexible denotations. For example, the spatial deictic expression *here* can be used to refer to a country, a city, a room, a part of a room, etc.

his raising a gold-fish is included within the interval of a flexible now. Under this analysis, the status of (the implicit) *xianzai* ‘now’ in (23) or (46) is completely parallel to that of *qunian* ‘last year’ in (49).

- (49) Ta qunian yang-le yi-tiao jinyu
 he last-year raise-ASP one-CL goldfish
 ‘He raised a goldfish last year.’

The flexible-now analysis of the implicit time adverb *xianzai* ‘now’ thus enables us to claim that all occurrences of *-le* represent the same temporal inclusion relation and hence the same perfective aspect. Interestingly, if this analysis of (23) is correct, it also indicates that a time-relational analysis of aspect as proposed in Klein (1994) is superior to definitions of aspect using the notions of ‘looked from inside’ and ‘looked from outside’, because if we adopted the latter definitions, we would be forced to say that *-le* has two meanings, one expressing perfectivity as in (22) and the other imperfectivity as in (23).

The proposed analysis of *-le* in (42) may also apply to its occurrences in subordinate clauses. The process is the same as that for *-guo*. Two illustrating examples are (50) and (51).

- (50) Zhangsan shuo ta chi-le yi tiao jinyu
 Zhangsan say he eat-ASP one CL goldfish
 ‘Zhangsan said that he ate a goldfish.’
- (51) Wo zao jiu liaodao ta hui shu-le na-chang qiu
 I early then predict he will lose-ASP that-CL game
 ‘I predicted that he would lose the game.’

(50) and (51) contrast in a very interesting way. For (50) to be true, the event described by the verb-complement must take place before the matrix clause event; for (51) to be true, the situation is the other way around. But both cases permit the use of *-le*. The contrast has a very simple explanation on my analysis of *-le*: t_{pro} in (50) takes the event time of the matrix clause as its value but t_{pro} in (51) takes the speech time as its value. Notice here that if t_{pro} in (51) took the event time of the matrix clause as its value, the losing event would precede the predicting event, which contradicts the meaning of the matrix predicate *yuliao* ‘predict’. So (51) is a strong piece of evidence that t_{pro} for the meaning of *-le* in an embedded clause may take the speech time instead of the event time of the matrix clause as its value.

2.3.3 The temporal semantics for *-zhe* and *zai*

In this section, I will show that the meaning of *-zhe* involves the notion of target state just as the meaning of *-le* does. Recall that (29), reproduced below, does not describe the on-going process of putting a hat on the head but the continuing result state of a hat being on the head.

- (29) Ta dai-zhe yi-ding maozi
 he wear-ASP one-CL hat
 ‘He wears a hat.’

The emphasis on the result state rather than the process of the action can be easily captured in terms of the notion of target state. I define the meaning of *-zhe* as follows.

$$(52) [[\text{-zhe}]] = \lambda P_{\langle i, t \rangle} \lambda t_1 \exists t_3 [t_{\text{pro}} \text{O } t_3 \wedge P(t_1) \wedge f_{\text{target}}(P)(t_3)]$$

The symbol “O” in (52) represents an overlapping relation. What (52) says is that when *-zhe* applies to a proposition P, the familiar free variable t_{pro} overlaps with the interval at which the target state corresponding to P holds. Take (29) for example. The final translation of (29) under my system should be (53).

$$(53) \exists t_1 \exists t_3 \exists y [t_{\text{pro}} \text{O } t_3 \wedge \text{hat}'(y) \wedge \text{wear}'(y)(\text{Zhangsan}') (t_1) \wedge f_{\text{target}}(\lambda t_1 \exists y [\text{hat}(y) \wedge \text{wear}'(y)(\text{Zhangsan}') (t_1)]) (t_3)]$$

As usual, t_{pro} in a simplex sentence picks up the speech time as its value. Therefore (53) amounts to saying that the speech time overlaps with the interval at which the target state corresponding to the proposition ‘Zhangsan wear a hat’ holds. For the target state to be true, it is necessary that the hat is already on the head. Consequently, (53) implies that the action of putting on the hat is completed before the speech time but the result state is on going at the speech time. The analysis that *-zhe* expresses a temporal relation between a reference time and the time of a target state thus correctly predicts the temporal meaning of (29).

The case of (28) is similar. Assume that the target state of an activity is the state of being in that activity. Then according to (53), (28) claims that the speech time overlaps with the time of the activity. Therefore, (28) expresses a meaning of on-going activity at the speech time.

When *-zhe* occurs in an embedded clause, its behavior is much similar to that of *-le* or *-guo* in that t_{pro} may take the speech time or the event time of the matrix clause as its value. This is illustrated by the following two examples, respectively.

- (54) Zhangsan jijiāng gēn liú-zhē cháng tóufā de nà-ge nǚhái jiéhūn
 Zhangsan be-going-to with wear-ASP long hair REL that-CL girl marry
 ‘Zhangsan is going to marry the girl who wears long hair.’
- (55) Guì-zhē de rén dōu zhān-lè qǐlái (Li 1999:55)
 knee-ASP REL people all stand-up-ASP
 ‘The people that kneeed on the group all stood up.’

First, consider (54). For (54) to be true, it is not necessary that the girl must have long hair at the time of marriage. It might be the case that she likes to be a shorthair bride. So she decides to cut her hair before the marriage. In this situation, it is clear that t_{pro} must refer to the speech time, not the time of marriage. Therefore, we can only infer that the girl has long hair at the speech time but not necessarily at the time of the marriage. Next, consider (55). On the intended past tense reading of the sentence, people are not kneeling on the ground at the speech time, so the speech time cannot be the value of t_{pro} . But it is possible to argue that there is an overlap relation between the time of kneeling and the time of standing up, however short the overlapping instant might be. In this case, the time of standing up is the value of t_{pro} . It is worth noting here that it is impossible to claim that the interval at which the people stood up is included within the interval at which they kneeed on the ground. So, examples like (55) clearly show that imperfective aspect involves an overlap relation, as Kamp and Reyle (1991) have observed for state sentences in English.

Before turning to the sentence-final *le*, I would like to make a brief comparison between *-zhe* and the preverbal *zai*. As we saw from (29) and (30), both *-zhe* and *zai* are imperfective aspect markers, but their meanings are different. We have seen that for *-zhe*, it is the target state corresponding to the proposition described by the sentence that is imperfective, but for *zai*, it is not the result state or target state of an event that is imperfective but the action of the event itself that is imperfective. In other words, *zai* has the standard semantics of imperfective aspect as the English *-ing*. It expresses a temporal inclusion (or overlap) relation between a reference time and an event time. I define its temporal semantics as follows.

$$(56) [[\text{-zai}]] = \lambda P_{\langle i, t \rangle} \lambda t_1 [t_{\text{pro}} \subseteq t_1 \wedge P(t_1)]$$

The application of (56) to concrete examples is straightforward. For example, when (56) applies to an example such as *Tā zai gāi yì-dòng dàlǒu* ‘He is building a mansion’, the truth conditions are such that the speech time is included within the event time of building. In other words, the semantics of *zai* focuses on the process of

an event rather than the result of that event.

It is interesting at this point to make a brief comparison of *-guo*, *-le*, *-zhe*, and *zai*. From what I have discussed above, these four aspect makers can be divided into two groups. One group, *-guo* and *zai*, involves the notion of event, while the other group, *-zhe* and *-le*, involves the notion of target state. If this is correct, then event and target state are two dimensions to which the semantics of aspect in Chinese is sensitive.

2.3.4 The temporal semantics of sentence-final *le*

In addition to appearing as a verbal suffix, *le* may also appear in sentence-final position as a particle. Compare (57a) with (57b).

- (57) a. Zhangsan mai-le yi-bu xin che
 Zhangsan buy-ASP one-CLnew car
 ‘Zhangsan bought a new car.’
 b. Zhangsan mai yi-bu xin che le
 Zhangsan buy one-CL new car ASP
 ‘Zhangsan has bought a new car.’

The distinction between the verbal *-le* and the sentence-final *le* has been traditionally characterized as follows: The former describes perfectivity of a situation (Wang 1965, Chao 1968, Li and Thompson 1981, Margione and Li 1993), whereas the latter signals inchoativity, change of state (Teng 1975, Chan 1980, Zhu 1982) or current relevance (Li, Thompson and Thompson 1984). Although several pieces of evidence have been adduced to support the two-*le* distinction, it is not agreed by everyone that *-le* as a verbal suffix and *le* as a sentence-final particle are two different *le*'s. For example, Shi (1990) has analyzed the two *le*'s as having the same temporal meaning. In this paper, I will not go into the debate, so I will not review the relevant arguments. Instead, in what follows I will explicate my own view of the sentence-final *le*. If my analysis to be proposed is correct, it implies that the meanings of the two *le*'s are not completely the same.

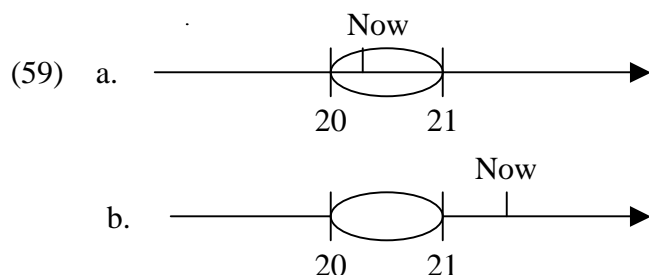
To begin with, let us reconsider (57a) and (57b). Looking at these two sentences alone, we are not able to tell what the difference is between (57a) and (57b) in a very precise way. Both examples require that before the speech time the event of buying a car be completed. So the truth conditions for the two sentences seem to be the same. But the situation changes when *-le* or *le* occurs in a stative sentence with a measure adverbial such as *ershi nian* ‘twenty years’. Compare the following two examples.

- (58) a. Wo zai meiguo zhu-le ershi nian, cong mei tingshuo-guo zhe-zhong shi

he in America live-ASP twenty year never hear-say-ASP this-kind thing
 ‘I (have) lived in America for 20 years and (have) never heard this kind of
 thing.’

b. Wo zai meiguo zhu ershi nian **le**, cong-meì tingshuo-guo zhe-zhong shì
 he in America live twenty year ASP never hear-say-ASP this-kind thing
 ‘I have lived in America for 20 years and have never heard this kind of thing.’

Intuitively, (58a) is compatible with a situation in which I still or no longer live in America at the speech time, but (58b) is only compatible with a situation in which I still live in America at the moment of speech. The seeming ambiguity of (58a) can be easily accounted for by my previous analysis of *-le*. The two readings are simply a reflection of the position of the speech time in the time axis. If the time at which the target state of the proposition **I live in America for 20 years** obtains is far away from the speech time, we get the second reading. On the other hand, if a subinterval of the time at which the target state holds overlaps with the speech time, we get the first reading. In either case, the initial subinterval of the interval at which the target state holds precedes the speech time. The two different readings of (58a) can be schematically represented as follows, where the circled parts represent the target states:



How is the sentence-final *le* different from the verbal *-le*? Li and Thompson (1984) and Mochizuki (2000) have analyzed *le* as expressing perfect aspect. I agree with them. Indeed, examples such as (58b) are best translated as a present perfect English sentence as the translation indicates. A very popular analysis of present perfect in English is that it expresses the relation of “extended now” (XN) (McCoard 1978, Dowty 1979, Von Stechow 1999a, 1999b, among others). On this analysis, an English sentence such as (60a) can be analyzed as (60b) according to which the state of living in America is predicated of XN. The definition of XN is given in (60c).

(60) a. Mary has lived in America since 1988.

b. $\exists t[\text{XN}(t, \text{now}) \wedge \text{Mary live in America at } t \wedge t \text{ is since 1988}]$

c. $\text{XN}(t, t') := t'$ is a final subinterval of t .

For English present perfect, it is widely assumed that the speech time is the final subinterval of XN. So (60b) implies that Mary lives in America at the moment of speech. However, we cannot assume that the Chinese sentence-final *le* is a marker for present perfect. Consider (61).

- (61) a. Dao wuye shiyi-dian, wo jiu zhengzheng zai meiguo zhu shi nian le
 until midnight eleven o'clock I then in-total in America live ten year ASP
 'Until 11 o'clock in the midnight I will have lived in America for exactly ten years.'
- b. Wo lai kan ni de-shihou, ni yijing zhengzheng shui ershi-ge xiaoshi le
 I come see you when you already in-total sleep twenty hour ASP
 'When I came to see you, you had already slept for 20 hours.'

In (61a), the final subinterval of the ten-year period is the coming eleven o'clock, not the speech time; in (61b) the final subinterval of the twenty-year period is the moment when I came to see you. These two examples clearly show that the sentence-final *le* is not a marker solely used for present perfect but can be used in future and past perfect as well, depending upon what the temporal adverbial in the sentence is. I therefore conclude that the final subinterval of the extended interval introduced by the sentence-final *le* is not always the speech time. In fact, I would like to further argue that even the speech time is not included within the XN interval introduced by *le*, when the sentence does not contain an overt temporal adverbial. Consider (62).

- (62) Wo zhan zai zheli wu-ge xiaoshi le
 I stand at here five-CL hour ASP
 'I have stood here for five hours.'

Intuitively, for (62) to be true, it is only required that the final subinterval of the five hour period abuts the utterance time—i.e., the utterance time is located right adjacent to the final subinterval of the five hour period. If the utterance time is included within the five-hour period, that means that when one utters (62), it is not five hours yet. But if it is not five hours yet, then one surely is not allowed to say (62). Therefore, the temporal relation between the extended interval introduced by *le* and the speech time is an abutting relation rather than an inclusion relation. A quite similar conclusion has been reached by Rathert (1999) for German present perfect constructions. (See also von Stechow 1999a.) In view of examples like (61) and (62), I would like to make the following changes for the perfect semantics of the sentence-final *le*. First, the XN

should be understood as an extended interval rather than an extended now interval, because the final subinterval of the extended interval does not always abut the speech time. Second, the inclusion relation between the final subinterval and the extended interval should be replaced with an abutting relation as proposed in Rathert (1999) and von Stechow (1999a). The definition of abutting is given in (63).

(63) t abuts t' ($t \gg t'$) iff $t < t'$ with exception of the border point.

Finally, the time which the final subinterval of the extended interval abuts is not always the speech time but should be a free variable. I will use the familiar variable t_{pro} to stand for it. Given these revisions, $\text{XN}(t, t')$ is now redefined as (64). Accordingly, the translations of (58b) and (61) are (65a) and (65b), respectively.

(64) $\text{XN}(t, t_{\text{pro}}) =: t_{\text{pro}}$ abuts the final subinterval of t .

(65) a. $\exists t_1 [\text{XN}(t_1, t_{\text{pro}}) \wedge \text{live}'(\text{America}')(\text{I}')(t_1) \wedge \text{dur}(t_1) = 20 \text{ years}]$ ($t_{\text{pro}} = \text{now}$)

b. $\exists t_1 [\text{XN}(t_1, t_{\text{pro}}) \wedge \text{live}'(\text{America}')(\text{I}')(t_1) \wedge \text{dur}(t_2) = 10 \text{ years}]$ ($t_{\text{pro}} = 11 \text{ o'clock}$)

Strictly speaking, (65a) does not assert that I live in America at the speech time. Instead, it claims that I have lived in America at an interval whose final subinterval abuts the speech time and that interval is 20 years. Since the final subinterval of the 20 years period abuts the speech time, (61) implies that I still live in America at the speech time.

If my above analysis of (58b) is correct, it should be very clear what the sentence-final *le* in (58b) contributes to the truth conditions of the sentence. It contributes an extended interval whose final subinterval abuts a contextually determined reference time (or alternatively a local evaluation time) and the stative sentence is predicated of that extended interval.

As for examples like (57b)), its translation should be rendered as (66) under the extended-interval analysis of *le*.

(66) $\exists t_2 \exists t_1 \exists y [\text{XN}(t_1, t_{\text{pro}}) \wedge \text{new-car}'(y) \wedge \text{buy}'(y)(\text{I}')(t_2) \wedge t_2 \subseteq t_1]$ ($t_{\text{pro}} = \text{now}$)

In other words, what the sentence-final *le* does in an eventive sentence is to introduce an extended interval within which the event time falls. At present stage, I do not know how to unify the perfect semantics of the sentence-final *le* in eventive and stative sentences.¹⁷

¹⁷ von Stechow (1999b) seems to have the same difficulty for English perfect sentences. Thus, he gives two different translations for English *have*, one for eventive sentences and the other for stative

It should be noted in passing that linguists such as Lü (1961) has pointed out that when *-le* appears as a verbal suffix as in (58), it has a different implication than when both *-le* and *le* appear simultaneously as in (67) below.

- (67) Wo zai meiguo zhu-le ershi nian le, cong mei tingshuo-guo zhe-zong shi
 he in America live-ASP twenty year never hear-say-ASP this-kind thing
 ‘I have lived in America for 20 years and have never heard this kind of thing.’

According to Lü, while examples like (58) implicate that I now no longer live in America, examples like (67) implicate that I will continue to live in America. However, this claim has been refuted by many linguists such as Zheng (1980), Liu (1988) and Lu (1993), among many others. They have shown that both (58) and (67) are compatible with a situation in which I want to continue to live in America or I do not want to continue to live in America. Which implication is true is a matter of pragmatics and depends highly on what sentence follows the sentence containing *-le* or *le*. So the implication cannot be part of the truth conditions for the sentence-final *le*. To save the space of this paper, I refer the reader to those articles for more detailed discussions on this issue.

2.4 Comments on Klein, Li and Hendriks (2000)

Extending Klein’s (1994) analysis of Aspect to Chinese, Klein, Li and Hendriks have recently proposed a new time-relational analysis for Chinese aspect markers *-le*, *-zhe*, *-guo* and *zai*. Since their analysis makes use of some notions close to my analysis, in this section, I will briefly review their analysis, pointing out some problems with it.

To begin with, let me clarify some important concepts of Klein, Li and Hendriks’ time-relational definitions of tense and aspect. They have distinguished three times: the time of utterance (TU), the time span at which a situation obtains (T-SIT or time of situation) and the time span about which an assertion is made (TT or topic time). On their analysis, tense does not express a temporal relation between TU and T-SIT as in the classical analysis, but one between TT and TU. Aspect, on the other hand, expresses a temporal relation between TT and T-SIT. They also distinguish several types of lexical contents. Expressions such as *Two plus two is four* are atemporal in the sense that “if they obtain at all, they obtain without temporal limits”. Such expressions are referred to as 0-phase contents. In contrast, for some verb contents, if they are true at some time *t*, then there is a contrasting time *t*’ at which they are not true. Such verb contents are referred to as 1-phase contents. Examples are *to sleep*, *to*

sentences. He assumes that *have* is lexically ambiguous.

be hungry, to work, etc. Still, some other verb contents may describe a change of state within a certain time span. That is, a situation may first obtain and then still within the same time span, does not obtain, or vice versa. The first phase in such a change-of-state situation is called the source phase and the second phase the target phase. Verb contents describing a change of state are referred to as 2-phase contents. Examples are *to arrive* or the Chinese resultative verb *ti-dao* ‘kick-fall’.

According to Klein, Li and Hendriks, a language-specific aspectual system is determined by the interaction of two dimensions in the semantics of aspect. One dimension spells out which temporal relations between topic (assertion) time (TT) and situation time (T-SIT) are grammaticalized in a language and the second dimension describes how the different types of situation times are exploited. Readers should be familiar with the first dimension which I have already made use of in this paper when I spelled out the semantics of perfective and imperfective aspect. The second dimension needs some more comments. According to Klein, Li and Hendriks, T-SIT of 1-phase expressions only involves one interval, so TT can only be related to this interval. But 2-phase expressions involve two distinct time intervals: the time interval for the source phase and that for the target phase. According to them, language may select, as a parametric variation, either of them as the time interval related to TT and treat it on a par with time interval of 1-phase expressions. They use the term “distinguished phase” (DP) to refer to the only phase in the case of 1-phase contents and the selected phase in the case of 2-phase contents. Specifically, they propose that in English, DP is the source phase, whereas in Chinese, DP is the target phase. Klein, Li and Hendriks’ notion of DP in Chinese corresponds to my notion of target state.

With the above definitions, Klein, Li and Hendriks (2000: 754) propose the following time-relational analysis of *-le*, *-zhe*, *-guo* and *zai*.

- (68) a. *le* TT OVL PRETIME T-DP AND T-DP
 b. *guo* TT AFTER T-DP
 c. *zai* TT in T-DP
 d. *zhe* TT in T-DP

According to the definition in (68a), *-le* requires that “TT overlaps with the distinguished phase as well as part of the time before the distinguished phase”. Although this definition successfully accounts for the temporal meaning of most sentences with *-le*, it runs into problems in some cases. (69) is a case in point.

- (69) Mingtian xiawu san dian de-shihou, ta yinggai yijing likai-le
 tomorrow afternoon three o’clock when he should already leave-ASP

Nanjing

Nanjing

‘By three o’clock tomorrow afternoon, he should have already left Nanjing.’

In (69), the assertion time—the time at which the proposition **ta yinggai yijing likai-le Nanjing** ‘He should have already left Nanjing’ is asserted—is three o’clock tomorrow afternoon. But this time apparently does not overlap with any part of the time before the distinguished phase. It only overlaps with the time at which the distinguished phase obtains. I will provide my own analysis of (69) in section 3 when I discuss the semantics of temporal adverbials.

Another similar problem with the definition in (68a) has to do with examples like (70).

(70) Zicong ba jiezhi huan gei ta de na yi shana kashi, wo jiu yijing si-le
 since BA ring return to him DE that one moment begin I then already die-ASP
 xin le
 heart ASP
 ‘Since the moment when I returned the ring to him, my heart has already been
 dead.’

The assertion (topic) time of (70) is the period that begins right from the moment when I returned the ring to him until the utterance time. The initial subinterval of this period is also the initial subinterval of the time at which the proposition **My heart is dead** obtains. In other words, the topic time does not include any pretime of the distinguished phase. Again, this example shows that the temporal semantics for *-le* as defined in (68a) is problematic.

Next, let us consider the semantics of *-guo*. The definition in (68b) indicates that *-guo* requires that the topic time falls into the posttime of the distinguished phase. Thus, no matter whether the verbal contents are 1-phase or 2-phase contents, we get a past tense interpretation for a situation, relative to the topic time. One interesting prediction of (68b), as noted by Klein, Li and Hendriks, is that the analysis in (68b) captures an important characteristics of *-guo* which is known as ‘discontinuity’ effect (Chao 1968, Smith 1991 and many others). This effect of *-guo* requires that the resulting state of an event no longer obtains at the topic time. For example, compare (71a) and (71b).

(71) a. Ta chu-guo-le
 he leave-country-ASP

‘He is abroad.’

b. Ta chu-guo-guo

he leave-ASP-country

‘He has been to other countries.’

While (71a) implies that he is still in some other country, (71b) implies that the resulting state of being in some other country no longer obtains. As mentioned, Klein, Li and Hendriks propose that the distinguished phase for a 2-phase content in Chinese is the target phase. Thus, according to the definition in (68b), the topic time of *-guo* must be a time at which the target phase is past already.

Although Klein, Li and Hendriks’ account for the ‘discontinuity’ effect of *-guo* is very appealing, I am conservative about incorporating the ‘discontinuity’ meaning into the truth conditions of *-guo*. First of all, though it is true that many sentences with *-guo* displays the ‘discontinuity’ effect, for some other sentences, the ‘discontinuity’ meaning seems cancelable. For example, the definiteness or indefiniteness of an object NP may influence the meaning of ‘discontinuity’, as the contrast between (72a) and (72b) shows.

(72) a. Wo (cengjing) yong-huai-guo zhe-bu shouti-diannao

I once use-broken-ASP this-CL portable-computer

‘I have once used this computer and as a result of my use, it was broken.’

b. Wo (cengjing) yong-huai-guo yi-bu shouti-diannao

I once use-broken-ASP one-CL portablecomputer

‘I have once used a computer and as a result of my use, that computer was broken.’

(72a) strongly implies that the portable computer has been fixed after it was broken, but (72b) does not have such an implication. According to my intuition and those of many other native speakers, (72b) is compatible with either a situation in which the portable computer has been fixed or one in which it has not. It can even be the case that the portable computer is not fixable at all and thus the resulting state—the state of a portable computer being broken—lasts forever. It seems to me that when the object NP is an indefinite NP, the status of the result state is simply not a focus of concern of the speaker. If the ‘discontinuity’ effect is part of the truth conditions that *-guo* contributes, there is no reason to expect the asymmetry between definite and indefinite object NPs as in Klein, Li and Hendriks’ analysis.

(73) below leads to the same conclusion.

- (73) Wo de tofa bei ta che-duan-guo
 my DE hair PASS him tear-off-ASP
 ‘(Some of) my hairs have been torn off by him.’

The Chinese verb *che-duan* ‘tear off’ is a resultative verb which expresses a 2-phase content. Our world knowledge tells us that once a hair is torn off one’s head, it should be torn off forever. Thus, the target phase of (73) is a state which will never cease to exist. Thus, according to the definition in (68b), it should be impossible to use *-guo* in (73), which is certainly false. Again, (73) indicates that it is too strong to put the ‘discontinuity’ meaning as part of the inherent meaning of *-guo*. Though it is not clear to me how the ‘discontinuity’ effect should be ultimately derived, I speculate that this is more a matter of pragmatics inference or presupposition than a matter of truth conditions as Klein, Li and Hendriks definition in (68b) suggests.

I also find that Klein, Li and Hendrik’s temporal semantics for *zai* and *-zhe* is problematic. On their analysis, these two aspectual markers have exactly the same temporal meaning. However, this can not be true. In particular, their temporal semantics for *zai* cannot be correct. According to their analysis, topic times for both *zai* and *-zhe* fall into the time span at which the distinguished phase obtains. This analysis thus predicts that in an accomplishment sentence such as (74) the topic time must be included within the interval at which the resulting state—i.e., the state of a house being built--obtains.

- (74) Ta xianzai zai gai yi-dong daxia
 he now PROG build one-CL mansion
 ‘He is now building a mansion.’

However, Klein, Li and Hendrik’s prediction is false in that (74) cannot refer to a situation in which a mansion is already built. Instead, it can only refer to the on-going process of a building event. In other words, the topic time in (74) should be included within the source phase rather than in the target phase. I speculate that examples like (74) are overlooked by Klein, Li and Hendriks, because under their analysis, 1-phase expressions and the target phases of 2-phase expressions are unified by the notion of ‘distinguished phase’, but they never thought of the possibility that the source phases of 2-phase expressions and 1-phase expressions may have the same behavior in some cases. In contrast to Klein, Li and Hendriks, my analysis requires that the topic time is included within the situation (event) time. So it correctly predicts that (74) does not refer to a state of a mansion being build but an on-going event of building.

2.5 Remarks on Aspect Markers as Tense Marks

As mentioned, simplex sentences with *-guo* or *-le* often have a past tense interpretation. It is thus tempting for one to suggest that *-guo* and *-le* be regarded as past tense markers. In this section, I will argue that it might not be appropriate to claim that they are pure tense markers.

As I have discussed, the meaning of *-le* is not to locate the situation time with respect to another reference time such as the speech time but to relate the initial subinterval of the target state of a sentence to another reference time. Moreover, we have seen that the distribution of *-le* is not restricted to sentences with a past tense interpretation but is compatible with a past, present or future tense interpretation. (See Lin 2000b, among others). So *-le* cannot be an absolute tense marker. However, some people have claimed that it is a relative tense marker (Shi 1990, Ross, 1995, Zhang 1998, Li 1999, Lin 2000b). I agree that *-le* expresses a relative anteriority relation as many people have argued. However, the question is: Is relative anteriority all there is for the meaning of *-le*? If my analysis of *-le* is correct, the answer is negative, because the meaning of *-le* involves the notion of target state and the initial subinterval of target state. In other words, the meaning of *-le* is much more than what is usually understood as tense, which expresses a temporal relation between a situation time and a reference time (or a reference time and the speech time according to Klein's definition). Since *-le* involves how a situation develops in time, it is better analyzed as an aspect marker than a tense marker. I want to emphasize here that aspect alone has its own temporal properties. Temporal precedence is just one possible relation that aspect markers may have. Some aspect markers such as *-zhe* expresses an overlap (instead of precedence) relation between two times, usually the situation time and the speech time. However, as far as I know, no one calls *-zhe* a relative present tense marker. The case for *-le* is completely parallel to the case for *-zhe*. Just as we do not want to call *-zhe* a relative present tense marker, we should not call *-le* a relative past tense marker.

As for *-guo*, I think that it should not be analyzed as a past tense marker, either. My reason is quite simple. Tense marking is insensitive to the distinction between perfective and imperfective viewpoint. Thus, the English past tense *-ed* may occur in a perfective or imperfective sentence. This is illustrated below.

- (75) a. John slept.
 b. John was sleeping.

However, *-guo* can only occur in a perfective sentence, but not an imperfective sentence, as witnessed by (76).

- (76) *Zhangsan zai chi-guo pingguo
 Zhangsan in eat-GUO apple
 ‘John was eating apples.’

Thus, it is more appropriate to treat *-guo* as a perfective experiential marker than a pure tense marker or the above fact will be left as an unexplained mystery. The same remarks seem to apply to the verbal *-le* as well.

Although I am certain that *-le* and *-guo* should not be analyzed as pure tense makers, I am not so sure whether it would be appropriate to claim that they are simultaneously an aspect and tense marker as in Ross (1995) and Lin (2000b). As noted, Klein (1994) has defined tense as a temporal relation between a topic time and the speech time and aspect a relation between a topic time and a situation time. Now, if we recall the semantics of *-guo* that I proposed, we find that it contains both types of temporal relation except that the speech time is replaced by a contextually determined reference time t_{pro} . In view of this, it is not unreasonable to say that *-guo* is a blend of tense and aspect. Similar remarks apply to *-le*, though the situation is even more complicated. In any event, I will not commit myself to the claim that *-guo* and *-le* are a blend of tense and aspect, leaving this issue for further research.

3. Temporal Adverbials

Temporal adverbials are another important source of temporal reference in Chinese. Chinese temporal adverbials can be syntactically simple or compound. Examples of the former type are *xianzai* ‘now’, *zuotian* ‘yesterday’, *gang* ‘just now’, *jiu* ‘then’ *mashang* ‘immediately’, etc. Compound temporal adverbials normally consist of a temporal operator and some governed element—an NP or an S. They can be further divided into three classes, depending upon the position of the temporal operator. Let us abbreviate temporal operators as TO and the governed element as X. The three types are the following:

- (a) TO X: *qian san nian* ‘the first three years’, *hou san nian* ‘the later three years’,
cong san dian dao wu dian ‘from three o’clock to five o’clock’
 (b) X TO: *san nian qian* ‘three years ago’, *san nian hou* ‘three years later’, *san dian (de)-shi-(hou)* ‘at three o’clock’, *san tian (zhi)-nei* ‘within/in three days’, *liu shi niandai yilai* ‘1960’s on onward’, *xinnian yiqian* ‘before the new year’
 (c) TO X TO: *zi xiatian yilai* ‘since from the summer’, *cong yi yue yi hao kaishi* ‘from January 1st’

Many of the first two types can be further preceded by the preposition *zai* ‘at/in’ without changing the meaning. For example, *san tian qian* ‘three days ago’ is equivalent to *zai san tian qian* ‘three days ago’, and *qian san nian* ‘the first three years’ is equivalent to *zai qian san nian* ‘in the first three years’.

Temporal adverbials can also be categorized according to their function. For example, Klein (1994) has listed 6 types of temporal adverbials:

- (a) positional temporal adverbials such as *yesterday, at five o’clock, in the night*
- (b) temporal adverbials of frequency such as *often, always, once in a while*
- (c) temporal adverbials of duration such as *for one hour, during the autopsy*
- (d) temporal adverbials describing inherent temporal properties of a situation such as *quickly, gradually, slowly*
- (e) temporal adverbials indicating the position of a situation such as *firstly, at last, eventually*
- (f) temporal adverbials fitting none of the above class such as *already* and *still*

In this study I will focus on positional temporal adverbials (abbreviated as PTAs).

Following many previous researches on PTAs, I assume that they single out some interval or a set of intervals determined by the lexical content. Moreover, the interval may specify the event time or the reference time of the event, depending upon the syntactic position of the PTA (Stump 1985, Klein 1994, Lin 2000b). The idea that PTAs may function as a reference time is suggested in Reichenbach (1947), Bennett and Partee (1978), Bäuerle (1979), Dowty (1982), Kamp and Reyle (1993), Klein (1994), among many others. The interval that a PTA denotes may be directly determined by the lexical specification as in the calendaric time *zai 1996 nian* ‘in the year of 1996’, or the lexical content of the PTA offers an open slot that allows ‘deictic rooting’ as in *jintian* ‘today’—the day which contains the speech time, or ‘anaphoric rooting’ as in *wu fenzhong hou* ‘five minutes later’—five minutes after some time given in the context. I refer the reader to Klein (1994) for a more detailed discussion of these three possibilities. Although the study of the ways by which PTAs determine their time span is very interesting of itself, this will not be the focus of this paper. The focus will be on how PTAs are semantically linked to the sentence that they modify.

The simplest hypothesis for the semantics of PTAs is that they denote nothing but intervals, i.e., entities of type e , as I assumed earlier. These intervals are identified with the reference time provided by Aspect when the PTAs are combined with the sentence they modify. On this hypothesis, a perfective sentence such as (77) is semantically computed as (78).

(77) *Zuotian ta dapuo wan*
 yesterday he break bowl
 ‘He broke a bowl.’

(78) a. [[**ta dapuo wan**]] =: $\lambda t_2 \lambda t_1 \exists y [t_1 \subseteq t_2 \wedge \text{cup}'(y) \wedge \text{break}'(y)(\text{he}')(t_1)]$

b. [[**zuotian ta dapuo wan**]]

=: $\lambda t_1 \exists y [t_1 \subseteq \text{yesterday}' \wedge \text{cup}'(y) \wedge \text{break}'(y)(\text{he}')(t_1)]$

c. Existential closure = $\exists t_1 \exists y [t_1 \subseteq \text{yesterday}' \wedge \text{cup}'(y) \wedge \text{break}'(y)(\text{he}')(t_1)]$

In plain English, the truth conditions in (78c) require that there be an interval t_1 at which he breaks a bowl and t_1 is included within the reference time yesterday’. Since the event time t_1 is included within a past interval, (77) is correctly understood as a past tense sentence.

Next, let us consider an imperfective sentence such as (79). Its truth conditions are given in (80).

(79) *San dian de-shihou ta zai shuijiao*
 three o'clock when he be sleep
 ‘He was sleeping at three o’clock.’

(80) a. [[**Ta zai shuijiao**]] =: $\lambda t_2 \lambda t_1 [t_2 \subseteq t_1 \wedge \text{sleep}(\text{he})(t_1)]$

b. [[**San dian de-shihou ta zai shuijiao**]] =: $\lambda t_1 [3\text{-o'clock}' \subseteq t_1 \wedge \text{sleep}'(\text{he}')(t_1)]$

c. Existential Closure =: $\exists t_1 [3\text{-o'clock}' \subseteq t_1 \wedge \text{sleep}'(\text{he}')(t_1)]$

The truth conditions in (80c) assert that the interval denoted by *san dian de-shihou* ‘at three o’clock’ is included within the interval t_1 at which he sleeps. From this, of course, we cannot conclude that the sleeping event described in (79) has ended, because the truth conditions do not say when the event time is located at the time axis. Indeed, (79) can be felicitously uttered in a situation in which the event is already completed before the speech time or a situation in which the event is still on going at the speech time. But generally (79) is preferably construed as denoting a past event. Before explaining why this is the case, let me first show that (79) is compatible with a situation where the event has not ended at the speech time. The evidence can be easily adduced by adding another sentence to (79) as in (81).

(81) *San dian de-shihou ta zai shuijiao, keshi xianzai shi-bu-shi hai zai shui,*
 three o'clock when he be sleep but now be-not-be still be sleep
wo jiu bu zhidao le
 I then not know ASP

‘He was sleeping at three o’clock. But I don’t know whether he is still sleeping now.’

In fact, all stative sentences display the same property. For example, sentence (82),

(82) Ta xiao shihou hen tiaopi
 he small when very naughty
 ‘He was naughty when he was a kid.’

when read alone, implies that he is no longer naughty at the speech time. But given a proper context, it does not exclude the possibility that he is still naughty at the speech time. This is illustrated by (83).

(83) Ta xiao shihou hen tiaopi, xianzai zhangda-le haishi zheme tiaopi
 he small when very naughty now grow-up-ASP still this naughty
 ‘He was naughty when he was a kid. Now he has grown up, but he is still as naughty as before.’

Do the truth conditions that my analysis assigns to imperfective sentences with a PTA denoting a past interval reflect the fact that such sentences usually imply that they have a past tense interpretation? On my analysis, the sentence (82) has the following truth conditions.

(84) $\exists t[\text{the-period-when-he-is-a-kid}' \subseteq t \wedge \text{naughty}'(\text{he}')(t)]$

(84) says that there is an interval t at which he is naughty and the period when he was a kid is included within t . From this, of course, one cannot conclude that the property of being naughty is restricted to the interval when he was a kid. But then why does (82) strongly imply that the state of being naughty is a past state? This question can be answered by the Maxim of Quantity, a conversation principle formulated by Grice (1975), which recommends speakers to say as much as he can. According to this maxim, if a speaker knows that someone is naughty at the utterance time, he should say it as such. The use of a time adverbial denoting a past interval then generates the implicature that the subject does not have the property of being naughty at the speech time. I conclude that the implicature as we saw in (79) and (82) is a suggested inference instead of part of the truth conditions. (See also Kamp and Reyle (1993) for relevant discussion.)

Although analyzing PTAs as entities of type e may successfully explain most

sentences with a PTA, this approach is in fact inadequate. The illustrating examples above all contain only one PTA, but it is well known that a sentence may contain more than one PTAs--i.e., time adverbials are recursive, as is illustrated in (85) and (86).

- (85) [Zuotian [sandian de-shihou [ta zai shuijiao]]]
 yesterday three-o'clock when he be sleep
 'He was sleeping at three o'clock yesterday.'
- (86) [Ta (shi) [zai 1994 nian [wuyue [diyige xingqi [qu meiguo (de)]]]]]
 he be in year May the-first week go America PAR
 'He went to America in the first week of May in 1994'

If (85) has the structure as indicated and each time adverbial denotes an interval of type e , then it should translate as (87), where the interval denoted by *san-dian de-shihou* 'at three o'clock' fills the reference time t_2 and the interval denoted by *zuotian* 'yesterday' fills the event time t_1 .

- (87) a. [[**ta zai shuijiao**]] =: $\lambda t_2 \lambda t_1 [t_2 \subseteq t_1 \wedge \text{sleep}(\text{he})(t_1)]$
 b. [[**san dian de-shihou ta zai shuijiao**]] =: $\lambda t_1 [3\text{-o'clock}' \subseteq t_1 \wedge \text{sleep}'(\text{he}')(t_1)]$
 c. [[**zuotian san dian de-shihou ta zai shuijiao**]]
 =: $[3\text{-o'clock}' \subseteq \text{yesterday}' \wedge \text{sleep}'(\text{he}')(\text{yesterday}')]]$

Unfortunately, the truth conditions thus yielded falsely predict the meaning of the sentence. For (85) to be true, the subject only needs to sleep at some subinterval t containing the interval of 3 o'clock and contained within yesterday. But this is not what (87c) says. (87c) says that (85) is true if and only if the subject was sleeping all day long yesterday and 3 o'clock is contained within the interval of yesterday. This is certainly false, because for (85) to be true, the subject does not need to sleep for the 24 hours yesterday. Also, the condition "3-o'clock' \subseteq yesterday'" does not provide any meaningful communicative information, because any interval within the 24 hours of a day is contained within that day.

A first solution to the above problem that comes to mind is to analyze *zuotian sandian de shihou* 'at three o'clock yesterday' as a single constituent with *zuotian* modifying *san dian de shihou* 'three o'clock'. That is, (85) has the structure (88).

- (88) [IP [DP zuotian sandian de shihou] [IP wo zai shuijiao]]

If the structure of (85) is as in (88), then the reference time of the sentence is the

3-o'clock of yesterday and the event time will be existentially closed as is usual. The problem thus seems to be avoided. This is not true, however, on closer inspection. Even if the bracketing in (88) is possible, evidence indicates that the constituents *zuotian* 'yesterday' and *sandian de shihou* 'three o'clock' need not always form a constituent, because they can be separated by the subject of the sentence, as illustrated by (89).

(89) *zuotian wo sandian-de-shihou zai shuijiao*
 yesterday I three-o'clock at sleep
 'I was sleeping at three o'clock yesterday.'

Thus, the original problem remains in (89) regardless of whether the constituent structure in (88) is correct or not.¹⁸

From the above discussion, it is clear that to solve the problem of multiple time adverbials, we have to make them semantically recursive. The question is how this is possible. Before answering the question, let us first consider how the same problem is tackled in the literature as in Dowty (1979) and Ogihara (1996). Let us assume that propositions are temporal abstracts of $\langle i, t \rangle$ type, i.e., sets of event times, and that temporal adverbials serve as a restriction upon (event) time variables, denoting objects of type $\langle \langle i, t \rangle, \langle i, t \rangle \rangle$, i.e., functions from properties of times to sets of time intervals. Now consider the example in (90), ignoring the problem of morphological tense.

(90) He broke a bowl at night.

The proposition 'he break a bowl' denotes the set of times at which he breaks a bowl, i.e., $\lambda t \exists y [\text{bowl}'(y) \wedge \text{break}'(y)(\text{he}')(t)]$. On the other hand, *at night* denotes $\lambda P_{\langle i, t \rangle} \lambda t [t \subseteq \text{at-night}' \wedge P(t)]$. The combination of these two is thus another object of type $\langle i, t \rangle$ as (91) shows.

(91) $\lambda P_{\langle i, t \rangle} \lambda t [t \subseteq \text{at-night}' \wedge P(t)] (\lambda t \exists y [\text{bowl}'(y) \wedge \text{break}'(y)(\text{he}')(t)])$
 $= \lambda t \exists y [t \subseteq \text{at-night}' \wedge \text{bowl}'(y) \wedge \text{break}'(y)(\text{he}')(t)]$

The newly created object of type $\langle i, t \rangle$ can then serve as the argument of another temporal adverbial of type $\langle \langle i, t \rangle, \langle i, t \rangle \rangle$. Thus, the denotation of the temporal

¹⁸ One might suggest that the NP *zuotian* 'yesterday' is moved to the topic position. Thus, at D-structure, *zuotian* 'yesterday' still forms a constituent with *sandian de shihou* 'three o'clock'. This analysis, however, should be excluded by an independently motivated syntactic principle which disallows extraction out of an adjunct NP.

adverbial *today* can be combined with the denotation of the proposition ‘he eat an hamburger at night’ without any problem, as is shown in (92) below.

$$(92) \lambda P_{\langle i, t \rangle} \lambda t [t \subseteq \text{today}' \wedge P(t)] (\lambda t \exists y [t \subseteq \text{night}' \wedge \text{bowl}'(y) \wedge \text{break}'(y)(\text{he}')(t)]) \\ = \lambda t \exists y [t \subseteq \text{at-night}' \wedge t \subseteq \text{today}' \wedge \text{bowl}'(y) \wedge \text{break}'(y)(\text{he}')(t)]$$

After existential closure, the truth conditions then require that there be a time t which is included within the night time and which is included within today and he breaks a bowl at t . The recursive problem of English temporal adverbials thus can be solved by analyzing them as objects of type $\langle \langle i, t \rangle, \langle i, t \rangle \rangle$.

The above approach, however, cannot be directly applied to Chinese under the assumptions of this current study. As I noted earlier, to correctly understand temporal reference in Chinese, the notion of aspect is crucial. Following Klein (1994), I have assumed that aspect is a relation between event times and reference times. Thus, what combines with a temporal adverbial is not simple properties of event times of $\langle i, t \rangle$ type but objects of $\langle i, \langle i, t \rangle \rangle$ type. Clearly, objects of type $\langle i, \langle i, t \rangle \rangle$ cannot serve as an argument of a function of type $\langle \langle i, t \rangle, \langle i, t \rangle \rangle$.

There is another reason not to adopt the above approach. Note that the illustrating example (90) is a perfective sentence. If a PTA is combined with an imperfective sentence, the above approach will not work. Consider (93a).

- (93) a. Zhangsan xiawu shenti bu shufu
 Zhangsan afternoon body not feel-well
 ‘Zhangsan did not feel well this afternoon.’
 b. $\exists t [t \subseteq \text{this-afternoon}' \wedge \neg \text{fell-well}'(\text{Zhangsan}')(t)]$

On the Dowty-Ogihara’s approach of PTAs, the situation time is always included within the reference time, no matter whether the sentence is perfective or imperfective. Thus, (93a) has the translation in (93b). However, this leads to an incorrect interpretation of the sentence, because as we have already mentioned, the relation between the situation time and the reference time for imperfective sentences is reverse to that of perfective sentences (Kamp and Reyle 1993 and Klein 1994, among others).

Although Dowty-Ogihara’s approach of PTAs cannot be adopted, its spirit, together with Dowty’s (1982: 31) comment in another article that “Time adverbials...are...sentence operators which semantically have the effect of asserting that the reference time t is located at a particular time, say within yesterday” suggests to us a new analysis. Instead of type $\langle \langle i, t \rangle, \langle i, t \rangle \rangle$, let us assume that PTAs are of type $\langle \langle i, \langle i, t \rangle \rangle, \langle i, \langle i, t \rangle \rangle \rangle$ with the following semantics.

(94) [[PTA]] =: $\lambda P_{\langle i, \langle i, t \rangle \rangle} \lambda t_2 \lambda t_1 [t_2 \subseteq \text{PTA}' \wedge P(t_2)(t_1)]$

In essence, what the semantics of (94) does is to locate the reference time t_2 within the time span singled out by the PTA. Since the semantic type of the argument of the function denoted by a PTA is the same as that of its resulting expression, the output expression can serve as the argument of another PTA. This explains why PTAs are recursive. Take (91) as an illustrating example. Its semantic computation is as follows:

(95) a. [[**ta zai shuijiao**]] =: $\lambda t_2 \lambda t_1 [t_2 \subseteq t_1 \wedge \text{sleep}'(\text{he}')(t_1)]$

b. [[**san dian de-shihou ta zai shuijiao**]]

=: $\lambda P_{\langle i, \langle i, t \rangle \rangle} \lambda t_2 \lambda t_1 [t_2 \subseteq \text{3-o'clock}' \wedge P(t_2)(t_1)] (\lambda t_2 \lambda t_1 [t_2 \subseteq t_1 \wedge \text{sleep}'(\text{he}')(t_1)])$

=: $\lambda t_2 \lambda t_1 [t_2 \subseteq \text{3-o'clock}' \wedge t_2 \subseteq t_1 \wedge \text{sleep}'(\text{he}')(t_1)]$

c. [[**zuotian san dian de-shihou ta zai shuijiao**]]

=: $\lambda P_{\langle i, \langle i, t \rangle \rangle} \lambda t_2 \lambda t_1 [t_2 \subseteq \text{yesterday}' \wedge P(t_2)(t_1)] (\lambda t_2 \lambda t_1 [t_2 \subseteq \text{3-o'clock}' \wedge t_2 \subseteq t_1 \wedge \text{sleep}'(\text{he}')(t_1)])$

=: $\lambda t_2 \lambda t_1 [t_2 \subseteq \text{yesterday}' \wedge t_2 \subseteq \text{3-o'clock}' \wedge t_2 \subseteq t_1 \wedge \text{sleep}'(\text{he}')(t_1)]$

After existential closure, (95c) is equivalent to saying that there is an event time t_1 at which he sleeps and a reference time t_2 , which is located within 3-o'clock of yesterday and t_2 is included within the event time t_1 . This interpretation of the sentence is not only correct but avoids the problem of the perfective-imperfective distinction because the semantics of PTAs as given in (95) only identifies the reference time with the time span singled out by the PTA but says nothing about the relation between situation time and reference time. The relation is expressed via aspect, not via PTAs.

In order to solve the recursive problem of PTAs, I have argued that they do not denote intervals of type i but are expressions of type $\langle \langle i, \langle i, t \rangle \rangle, \langle i, \langle i, t \rangle \rangle \rangle$. However, there is evidence showing that under certain circumstances temporal adverbials may function as type i expressions. Many authors have pointed out that *-le* cannot occur with a future time adverbial as is shown by (96).

(96) Wo mingtian (zhege shihou) likai-(*le) nanjing

I tomorrow this moment leave-Asp Nanjing

'I will have left Nanjing tomorrow.'

The ungrammaticality of (96) is quite straightforward under my analysis of *-le* and PTAs. The LF and translation of (96) are as follows.

- (97) LF: [[_{IP1} wo [_{IP2} mingtian [_{AspP} le [_{VP} likai Nanjing]]]]]
- a. [[VP]] =: $\lambda t[\text{leave}'(\text{Nanjing}')(x)(t)]$
- b. [[AspP]] =: $\lambda P_{\langle i, t \rangle} \lambda t_2 \lambda t_1 \exists t_3 \exists t_4 [t_3 < t_{\text{pro}} \ \& \ t_3 = f_{\text{initial}}(t_4) \ \& \ f_{\text{target}}(P)(t_4) \ \& \ P(t_1) \ \& \ t_1 \subseteq t_2] (\lambda t[\text{leave}'(\text{Nanjing}')(x)(t)])$
 =: $\lambda t_2 \lambda t_1 \exists t_3 \exists t_4 [t_3 < t_{\text{pro}} \ \& \ t_3 = f_{\text{initial}}(t_4) \ \& \ f_{\text{target}}(\lambda t[\text{leave}'(\text{Nanjing}')(x)(t)])(t_4) \ \& \ \text{leave}'(\text{Nanjing}')(x)(t_1) \ \& \ t_1 \subseteq t_2]$
- c. [[IP₂]] =: $\lambda P_{\langle i, \langle i, t \rangle \rangle} \lambda t_2 \lambda t_1 [t_2 \subseteq \text{tomorrow}' \ \wedge \ P(t_2)(t_1)] (\lambda t_2 \lambda t_1 \exists t_3 \exists t_4 [t_3 < t_{\text{pro}} \ \& \ t_3 = f_{\text{initial}}(t_4) \ \& \ f_{\text{target}}(\lambda t[\text{leave}'(\text{Nanjing}')(x)(t)])(t_4) \ \& \ \text{leave}'(\text{Nanjing}')(x)(t_1) \ \& \ t_1 \subseteq t_2])$
 =: $\lambda t_2 \lambda t_1 [t_2 \subseteq \text{tomorrow}' \ \wedge \ \exists t_3 \exists t_4 [t_3 < t_{\text{pro}} \ \& \ t_3 = f_{\text{initial}}(t_4) \ \& \ f_{\text{target}}(\lambda t[\text{leave}'(\text{Nanjing}')(\text{I}')(t)])(t_4) \ \& \ \text{leave}'(\text{Nanjing}')(\text{I}')(t_1) \ \& \ t_1 \subseteq t_2]]$
 =: $\exists t_2 \exists t_1 [t_2 \subseteq \text{tomorrow}' \ \wedge \ \exists t_3 \exists t_4 [t_3 < \text{Now} \ \& \ t_3 = f_{\text{initial}}(t_4) \ \& \ f_{\text{target}}(\lambda t[\text{leave}'(\text{Nanjing}')(\text{I}')(t)])(t_4) \ \& \ \text{leave}'(\text{Nanjing}')(\text{I}')(t_1) \ \& \ t_1 \subseteq t_2]]$

From the last translation in (97), it is clear that the logical form is a contradiction, because on the one hand it requires that the initial subinterval of the target state, i.e., t_3 must precede the speech time—i.e., I must have left Nanjing already by the speech time, but on the other hand it says that the event of leaving Nanjing is included within tomorrow. Similarly, if t_{pro} refers to tomorrow, another time that may be made salient by the context, a contradiction arises. (96) is thus correctly predicted to have no meaning at all under my analysis of *-le*.

Despite examples like (96), Dai (1994) has observed that the verbal *-le* may actually occur with a future time adverbial as illustrated in (98).

- (98) Mingtian (zhege shihou) wo yinggai yijing likai-le nanjing
 tomorrow this moment I should already leave-Asp Nanjing
 ‘I should have already left Nanjing by (this moment) tomorrow.’

The question is why (98) contrasts with (96) and how this contrast should be accounted for. Before explaining the contrast, I want to call the reader’s attention to an interpretational difference between the time adverbial in (96) and the one in (98). While *mingtian* ‘tomorrow’ in (96) is interpreted as an interval within which the event takes place, i.e., it modifies the event time¹⁹, the same adverbial in (98) is understood

¹⁹ This reading is confirmed when the time adverbial *mingtian* ‘tomorrow’ in (96) is replaced by a time adverbial indicating a past time such as *zuotian* ‘yesterday’.

as a reference point before which the event takes place, i.e., it fills the value of t_{pro} introduced by *-le*. Another point about (98) is concerned with the relative position between the time adverbial and the modal verb. When the time adverb in (98) is placed after the modal verb, the sentence becomes ill-formed. This is shown by (99).

- (99) *Wo yinggai mingtian (zhege shihou) yijing likai-le nanjing
 I should tomorrow this moment already leave-Asp Nanjing
 ‘I should have already left Nanjing by (this moment) tomorrow.’

Notice that time adverbials can actually appear after modal verbs but they must be construed as modifying the event time rather than serving as a reference point.

- (100) Ni yinggai mingtian (zhege shihou) likai nanjing
 Ni should tomorrow this moment leave Nanjing
 ‘You should leave Nanjing tomorrow at this time.’

Finally, to obtain a reference point reading for (98), the adverb *yijing* ‘already’ seems obligatory. Thus, if *yijing* ‘already’ in (98) is deleted, the sentence becomes ill-formed. This is shown by (101).

- (101) *Mingtian (zhege shihou) wo yinggai likai-le nanjing
 tomorrow this moment I should leave-Asp Nanjing
 ‘I should have left Nanjing by (this moment) tomorrow.’

But if the verbal *-le* in (101) is replaced by the sentence-final *le*, the sentence becomes acceptable and the time adverbial can be construed as the value of t_{pro} . In such cases, either a modal auxiliary or *yijing* ‘already’ is obligatory.

- (102) Mingtian (zhege shihou) wo yinggai likai Nanjing le
 tomorrow this moment I should leave Nanjing ASP
 ‘I should have left Nanjing by (this moment) tomorrow.’

Summarizing the above discussion, in Chinese, when a time adverbial is interpreted as a reference time before which an event occurs, it must be attached to a position higher than a modal verb or the sentence-final *le*. From this I conclude that Chinese temporal adverbials are ambiguous. They may have a meaning of type *i* as when they appear in examples like (98) and (102) or a meaning of type $\langle\langle i, t \rangle, \langle i, t \rangle\rangle$ as when they are construed as modifying the event time (cf. Stump 1985, Thompson

1994). Which interpretation they have seems to depend upon two factors: (i) their syntactic position in tree structure and (ii) the presence/absence of a modal auxiliary, *yijing* and/or sentence-final *le*. A type *i* interpretation of a temporal adverbial is possible only when there is overt evidence such as a modal auxiliary or *yijing* ‘already’ indicating that its position is high enough; otherwise, a temporal adverbial is obligatorily construed as modifying the event time, i.e., expressions of type $\langle\langle i, \langle i, t \rangle \rangle, \langle i, \langle i, t \rangle \rangle\rangle$.

4. Temporal Reference of Verb-complements

Temporal reference for Chinese subordinate clauses has received very few attention in the literature. The only relevant reference that I know of is Li’s (1999) book on Chinese tense. However, his examples are restricted to subordinate clauses with *-zhe*, *-le* or *-guo*. Briefly speaking, Li’s analysis of *-zhe*, *-le*, *-guo* is as follows. When these aspectual markers appear in simplex (or matrix) clause, their reference time is the speech time and their occurrences in these constructions should be taken as markers of absolute tenses. On the other hand, when they appear in a subordinate clause, their reference time is the event time of the matrix clause and they should be analyzed as markers of relative tenses. Li’s analysis of *-zhe*, *-le*, *-guo* is very inspiring²⁰, but as far as temporal reference for Chinese subordinate clauses is concerned, his analysis seems to see only the trees rather than the forest, because there are many subordinate clauses without *-zhe*, *-le*, *-guo* and Li’s analysis tells us nothing about them—of course, we should not blame this on him, because this is not the main focus of his book. In what follows, I will show that temporal reference of Chinese subordinate clauses to a great extent is constrained by the verb meaning.

Different verb types may impose a different constraint on temporal reference of Chinese subordinate clauses. Some verbs require that the event time of the subordinate clause follow that of the matrix clause, whereas some other verbs are the other way around. Still another type of verb requires that the event time of the subordinate clause overlap with that of the matrix clause. There are also verbs that do not impose any constraint on the temporal reference of their complement clause. Let us use t_1 to refer to the event time of the matrix clause and t_2 the event time of the subordinate clause. The different possibilities of temporal relations between the matrix and embedded clauses are illustrated by the following examples.

(103) $t_1 < t_2$

²⁰ However, I think it is wrong to claim that *-zhe*, *-le* and *-guo* are two-way ambiguous as suggested by Li (1999). As we saw above, the two different readings of these aspect markers are different choices of value for t_{pro} . But they have a single unifying semantics.

Ta qiangpu/jianyi wo kao daxue
 I force/suggest I take-examine university
 ‘He force/suggested that I (will) take the entrance exams for colleges.’

(104) $t_1 \text{ O } t_2$

a. Wo kanjian ta da Lisi

I see he hit Lisi

‘I saw him hit Lisi.’

b. Wo tingdao ta shuo huang

I hear he tell lie

‘I heard him tell lies.’

(105) $t_1 > t_2$

Ta hen houhui shuo huang

he very regret tell lie

‘He regrets that he told lies.’

(106) $t_1 = t_2 = \text{generic tense}$

a. Wo taoyan ta shuo huang

I hate he tell lie

‘I hate him telling lies.’

b. Wo xihuan ta chuan duan-chun

I like she wear short-skirt

‘I like her wearing a short skirt.’

(107) t_1 does not impose a constraint on t_2

a. Zhangsan shuo/renwei Lisi shuo huang $t_1 > t_2$

Zhangsan say/think Lisi tell lie

‘Zhangsan said/thinks that Lisi told lies.’

b. Zhangsan shuo/renwei ta zai xizao $t_1 \text{ O } t_2$

Zhangsan say/think Lisi PROG take-a-bath

‘Zhangsan said/thinks Lisi was/is taking a bath.’

c. Zhangsan shuo/renwei Lisi hui chuli $t_1 < t_2$

Zhangsan say/think Lisi will handle

‘Zhangsan said/thinks Lisi would/will handle it.’

d. Zhangsan shuo/renwei Lisi xihuan bangqiu (generic tense)

Zhangsan say/think Lisi like basketball

‘Zhangsan said/thinks that Lisi likes basketball.’

It should be emphasized here that all the subordinate clauses in the above examples do not contain any temporal adverbial or aspectual marker. So temporal reference for these clauses should be resolved in a way different from what I have discussed so far.

My idea is that temporal reference for Chinese subordinate clauses is basically determined by the inherent temporal relations that matrix verbs impose upon them as described above. The addition of a temporal adverbial or aspectual marker may make temporal reference more precise, but they cannot alter the inherent temporal constraint that a matrix verb imposes upon its complement clause. For instance, for verbs such as *jianyi* ‘suggest’ or *jueding* ‘decide’, the event time of the complement clause must follow the time of suggestion or decision. Therefore, aspect markers such as *-guo* or *-le* cannot appear in the complement clauses of these verbs, because they require that the time of the action described by the complement clause precede the time of the matrix clause event. This is illustrated by (108).

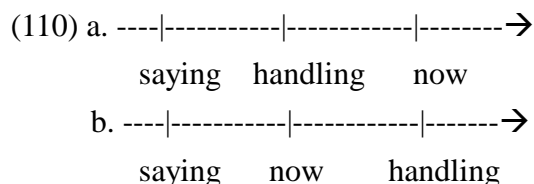
- (108) a. *Wo jianyi ni kao-guo daxue
 I suggest you take-exam-ASP university
 ‘*I suggest that you took the entrance exam for college.’
- b. *Wo jueding qu-le meiguo
 I decide go-ASP America
 ‘*I decided to have gone to America.’

Notice that the temporal constraint a matrix verb imposes upon its complement clause actually does not tell us whether the subordinate clause event takes place in the past, in the future or is ongoing at the utterance time. The exact location time of the subordinate clause event is an inference that one draws from the temporal relation that the matrix verb imposes upon the subordinate clause. The matrix clause does not have any time adverb or aspectual marker and it denotes a perfective event. It follows that the empty tense for (103) is a past tense. However, to satisfy the requirement of “ $t_1 < t_2$ ” that the matrix verb imposes upon the complement clause, t_2 can be in the past or in the future as long as it does not precede t_1 . This predicts that (103) is temporally ambiguous. Indeed, this prediction is correct. Similar remarks apply to (104). The matrix clause in (104) represents a perfective view of the situation. Due to lack of an aspectual marker or temporal adverbial indicating the future time, the matrix clause must be understood as denoting a past event. Since verbs such as *kanjian* ‘see’ or *tingdao* ‘hear’ require that the event time of the subordinate clause overlaps with that of the matrix clause, it follows that the event denoted by the embedded clause must have happened in the past, too. The case of (105) is reverse to that of (103). So I omit the discussion here. As for (106), I assume that verbs like *taoyan* ‘hate’ require that their complement clause have a generic operator just like the matrix clause. So both the matrix clause and the embedded clause have a generic tense interpretation. Finally, we have a class of verbs which do not impose a fixed temporal relation upon their

complement clause. However, even for this type of verb, the event time of the matrix clause can still be related to the temporal reference of the embedded clause in some way. Take (107c) for an example. The embedded clause contains the modal auxiliary *hui* ‘will’. So the embedded clause has a future tense interpretation. Notice, however, that the future meaning of *hui* ‘will’ in (107c) is compatible with a situation in which the action of handling took place in the past or a situation in which it will take place in the future as long as the time of handling follows the time of saying. A natural account for this fact is to say that the event time of the matrix clause is the reference time of the modal auxiliary *hui* ‘will’. To capture this idea, I propose that the semantics of *hui* ‘will’ be the following.

$$(109) \text{ [[hui]]} = : \lambda P_{\langle i, \langle i, t \rangle \rangle} \lambda t_2 \lambda t_1 [t_{\text{pro}} < t_2 \wedge P(t_2)(t_1)]$$

Applying (109) to (107c), we can let the time of saying, i.e., the event time of the matrix clause, be the value of t_{pro} . It follows from this that the time of handling must follow the time of saying. But there are two ways to satisfy this requirement, depending upon whether the time of handling is located before the speech time or after the speech time. The two possibilities are diagrammed as (110a) and (110b), respectively.



(110a) corresponds to a reading in which both the action of saying and the action of handling took place in the past. (110b), on the other hand, corresponds to a reading in which the action of saying happened in the past but the action of handling will take place in the future. Indeed, (107c) has both readings.

The case of (107b) is very similar. The progressive marker provides an overlapping relation (i.e., $t_1 \text{ O } t_{\text{pro}}$) and the event time of the matrix clause can be the value of t_{pro} . As for (107a) and (107d), these two sentences do not have any aspectual marker or modal auxiliary. So there is no t_{pro} in these two cases and the event time of the embedded clause is not directly linked to the event time of the matrix clause. Instead, it seems that the embedded clauses are interpreted as if they were unembedded.²¹

²¹ Even for such examples, one may sometimes infer a temporal relation between the event time of the matrix clause and that of the embedded clause. For example, in (107a), we still feel that the time of Lisi’s telling a lie must precede the time of Zhangsan’s saying so. Such inferences, I believe, are pragmatic inferences due to our world knowledge.

5. Temporal Reference of Relative Clauses

As is the case with verb-complements, temporal reference of Chinese relative clauses has received little attention in the literature. So the following discussion might be the first attempt to explain temporal reference of Chinese relative clauses.

I will start with a comparison between relative clauses and verb-complements. As noted, temporal reference of complement clauses can generally be determined by the temporal relation they bear to the matrix verb. This temporal relation can be seen as a semantic restriction that the matrix verb imposes upon the complement clause. Unlike complement clauses, relative clauses are not arguments of matrix verbs. So it is impossible for a matrix verb to directly impose a temporal restriction upon a relative clause. To illustrate, consider the following two examples.

- (111) a. Ta mai-le Zhangsan xie de shu
 he buy-ASP Zhangsan Zhangsan write REL book
 ‘He bought a book/books that Zhangsan wrote.’
 b. Mama na-zou-le wo nan-pengyou ji gei wo de xin
 mother take-away-ASP my boy-friend send to me REL letter
 ‘Mother took away letters/the letters that my boy sent to me.’

Because the arguments of the verb *mai* ‘buy’ and *na-zou* ‘take away’ are *shu* ‘book’ and *xin* ‘letter’, respectively, rather than *Zhangsan xie de* ‘which Zhangsan write’ and *wo nanpengyou ji gei wo de* ‘which my boyfriend send to me’, there cannot be a direct temporal relation between the matrix verbs and the relative clauses. Notice also that the relative clauses in (111) do not contain any time adverbial or aspect marker. So temporal reference for these relative clauses cannot be attributed to time adverbials or aspect markers. If temporal reference of relative clauses such as those in (111) cannot be inferred from a lexical temporal relation as in the case of verb-complements or from time adverbs and aspect markers, how is temporal reference for these relative clauses resolved?

One possible hypothesis is that the temporal reference of a relative clause is determined by a higher clause that dominates it. I will call this hypothesis Temporal Control Hypothesis (TCH). For instance, due to the use of *-le* in (111a) and (111b), the event time of the matrix verb refers to a past interval and therefore the relative clause also has a past tense interpretation. (112a) and (112b) below, where the matrix clause contains a modal auxiliary indicating a future time, may support the same hypothesis. According to TCH, the relative clauses in both (112a) and (112b) should have a future tense interpretation just like the matrix clauses. Indeed, one can

feliculously utter (112a) and (112b) if the events denoted by the relative clauses take place in the future.

- (112) a. Ta hui mai Zhangsan xie de shu (ma)
 he will buy Zhangsan write REL book Q
 ‘(Will) he (will) buy books that Zhangsan wrote/will write?’
 b. Mama hui na-zou wo nan-pengyou ji gei wo de xin
 mother take-away my boy-friend send to me REL letter
 ‘Mother will take away the letter that my boy sent/will to me.’

Notice, however, that (112a) and (112b) are also felicitous in a situation where the relative clauses have a past tense interpretation. Such interpretations of the relative clauses in (112a) and (112b) do not conform to the prediction made by the TCH.²² One way out of this problem is to say that the object NPs may optionally undergo quantifier raising (QR). Once an NP containing a relative clause has undergone QR, the relative clause will be outside the scope of the original dominating clause and hence its tense interpretation is no longer dependent upon the higher clause. Suppose we further assume that a relative clause not within the scope of the matrix clause receives its tense interpretation as if they were unembedded, then we can get a past tense interpretation for the relative clauses in (112). So the past tense interpretations of (112a) and (112b) are not problems to TCH.

Another example that might be used to support TCH is (113). In this example, the matrix verb is an individual-level predicate that is inherently generic according to Chierchia (1995). Very interestingly, the relative clause *Zhangsan xie de* ‘which Zhangsan writes’ in this example has a generic reading, in addition to a past tense reading. That is, (113) can be construed as: I like any poem that *Zhangsan* writes at any time. Again, we see that the temporal reference of a relative clause seems to depend upon that of the matrix clause.

- (113) Wo xihuan Zhangsan xie de shi
 I like Zhangsan write REL poem
 ‘I like poems that Zhangsan writes.’

Although TCH seems quite successful in accounting for the above data, it is not without problems. The first problem is that TCH is a device designed merely for temporal reference of relative clauses rather than a general hypothesis for temporal

²² In fact, (112a) can also be uttered in a situation where Zhangsan is still writing the book. I will come back to this reading later.

reference of all subordinating clauses. For example, it does not predict that though the matrix clauses in (114) and (115) have a future and present tense interpretation, respectively, the embedded clauses must have a past tense interpretation.

- (114) Ta yiding hui foun shi ta nazou wo de shu
 he definitely will deny be he take-away I DE book
 ‘He will definitely deny that it is he that ha took away my book.’
- (115) Zhangsan renwei Lisi shuo huang
 Zhangsan think Lisi tell lie
 ‘Zhangsan thinks that Lisi told a lie.’

Notice that the past tense interpretation of the embedded clauses in (114) and (115) cannot be rescued in the same way as we did for the relative clauses in (112), because verb complements are not NPs and hence will not undergo QR. Likewise, as will be discussed later, the tense interpretations of many adverbial clauses are not dependent upon the tense interpretations of the matrix clauses. Therefore, TCH is not a general hypothesis.

In addition to the problem of generality, TCH has empirical problems. In our above discussion, relative clauses are contained in NPs without a determiner. The addition, of a determiner, however, may change the interpretation of a relative clause. Compare (116a) and (116b) with (112b) and (113).

- (116) a. Mama hui na-zou wo nan-pengyou ji gei wo de na feng xin
 mother take-away my boy-friend send to me REL that CL letter
 ‘Mother will take away the letter that my boy sent to me.’
- b. Lisi xihuan Zhangsan xie de na shou shi
 Lisi like Zhangsan write REL that CL poem
 ‘Lisi likes the poem that Zhangsan wrote.’

Unlike (112b) and (113), (116a) is not ambiguous between a future tense and past tense interpretations. With the addition of the determiner *na feng* ‘that CL’, the future tense interpretation—the one predicted by TCH--disappears. Similarly, after the insertion of the determiner *na shou* ‘that CL’, (116b) does not have a generic reading. Instead, the relative clause now only has a past tense interpretation. The examples in (116a) and (116b) clearly show that temporal reference of Chinese relative clauses is not a pure matter of temporal control. The syntactic forms of the NPs also matter.

Given the above problems, I would like to pursue another approach to temporal reference of relative clauses in terms of pure semantics and pragmatics inference. To

begin with, I will make some comments on the semantics of bare nouns in Chinese. Chinese bare nouns may receive various interpretations depending upon the contexts in which they appear. Here are some examples.

- (117) Wo mai-le shu (le) Existential or Definite Interpretation
 I buy-ASP book ASP
 ‘I bought books/the book(s).’
- (118) Shu bu jian le Definite Interpretation
 book not see ASP
 ‘The book(s) is/are missing.’
- (119) Wo xihuan shu Generic interpretation
 I like book
 ‘I like books.’

The interpretational possibilities of Chinese bare nouns are much like English bare plurals as discussed in Carlson (1977) except that the former may get an additional definite reading (cf. Lin 1999). When a relative clause is used to modify a bare noun, the interpretational possibilities are the same. NPs of the form ‘relative clause + noun’ can therefore be analyzed as complex bare nouns.

Some further assumptions are needed before I can explain how relative clauses in Chinese obtain their temporal interpretations. Earlier I said that there is no direct selectional restriction between a matrix verb and a relative clause. However, a verb can directly impose some restriction upon its object NP argument that contains a relative clause. Take the verb *mai* ‘buy’ for instance. If you want to buy something, that something must have already existed before the time of the buying event or the action of buying is simply impossible.²³ Moreover, the life time of the thing that is bought seems to always longer than the time at which the buying event holds. Thus, instead of the usually simplified translation of *buy* as in (120), I translate it as (121).

$$(120) [[\mathbf{buy}]] = \lambda x \lambda y \lambda t \text{buy}'(x)(y)(t)$$

$$(121) [[\mathbf{buy}]] = \lambda x \lambda y \lambda t_1 \exists t_2 [\text{buy}'(x)(y)(t_1) \wedge \text{EXIST}(x)(t_2) \wedge t_1 \subseteq t_2]$$

²³ The existence presupposition sometimes does not seem to hold as in the following example.

- (i) Wo xiang mai yi-ben youguan wuaixing ren de shu
 I want buy one-CL about alien person DE book
 ‘I want to buy a book about alien people.’

The loss of the existence presupposition is due to the fact that the existential operator is embedded within the operator *xiang* ‘want’.

In (121) the predicate EXIST is introduced to predicate of the internal argument of *buy* and a further condition says that the buying event must be included within the interval at which the internal argument exists. The inclusion condition guarantees that the thing that is bought must exist before it is bought and that it can still exist after the buying event is completed. I will not try to discuss whether the existence predicate and the inclusion condition is a presupposition of the verb *buy* ‘buy’ or part of the truth conditions. It suffices for the purpose of this paper to assume that it is part of the truth conditions.

On the other hand, there are some other predicates which require that their internal arguments exist only after the event denoted by the verb is completed. Verbs of creation are of this type. Roughly following Kratzer (1994), I translate this type of verb as follows, where *e* represents the event argument.²⁴

$$(122) [[\mathbf{write}]] = \lambda x \lambda y \lambda e \lambda t_1 \exists t_2 [\text{write}(x)(y)(e)(t_1) \wedge \text{Exist}(x)(f_{\text{target}}(e))(t_2) \wedge t_2 \succ t_1]$$

In plain English, (122) is intended to mean that an object *x* exists in the target state of a writing event right after the writing event culminated.

As for the semantics of relative clauses, I will assume with Heim and Kratzer (1998) and many others that they translate as predicates and the combination of a relative clause with a head noun translates as a conjunction of both.

Now let us reconsider (111a). The object NP in this example has an indefinite reading. On this reading, (111a) is (roughly) translated as (123) within my system, ignoring irrelevant details.

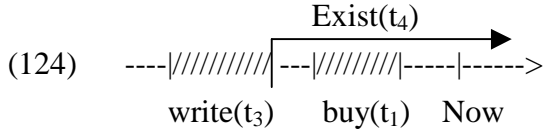
(111a) Ta mai-le Zhangsan xie de shu
 he buy-ASP Zhangsan write ASP book
 ‘He bought books/a book that Zhangsan wrote.’

$$(123) \exists t_1 \exists t_3 \exists t_4 \exists x \exists e [\text{book}'(x) \wedge \text{write}'(x)(\text{Zhangsan}')(e)(t_3) \wedge \text{Exist}(x)(f_{\text{target}}(e))(t_4) \\ \wedge t_4 \succ t_3 \wedge \text{buy}'(x)(\text{he}')(t_1) \wedge t_1 \subseteq t_4 \wedge \text{Now} > t_1]$$

From my previous discussion, it should be clear by now that the event time t_1 of the buying event must precede the speech time. Now if the buying event must be included within the interval t_4 at which the book exists, the book must have already existed

²⁴ von Stechow (2000) has a very detailed review of all the literatures concerning the representation of creation verbs. He has pointed out that Kratzer’s semantics for creation verbs is inadequate in some respects. However, in this paper I still assume Kratzer’s style of representing the semantics of creation verbs, because I do not want to go into too many technical details that are irrelevant to the point that I want to make. In any case, whatever version of semantics for creation verbs I adopt will not affect my point. So readers who are interested in the semantics of creation verbs are referred to von Stechow’s work.

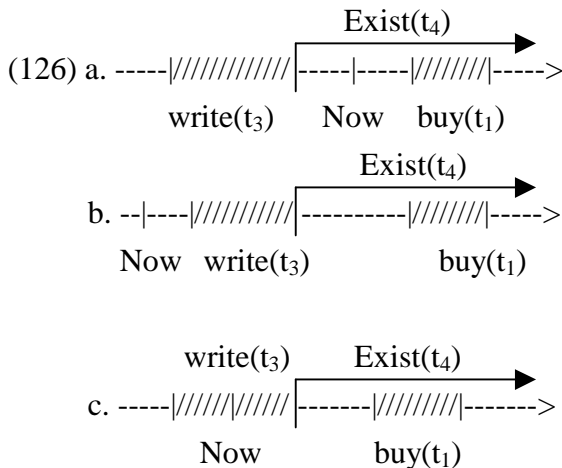
before the speech time too. It follows that the writing event must precede the speech time as well, because the writing event must precede the existence of the book. Therefore, the relative clause in (111a) has a past tense interpretation. The truth conditions in (123) are equivalent to the following diagram.



Next, let us reconsider (112a), which differs from (111a) in having a future modal auxiliary in the matrix clause instead of the aspect marker *-le*. The truth conditions of (112a) are minimally different from (123). We only need to reverse the temporal relation between Now and t_1 . The truth conditions of (112a) is (125).

$$(125) \exists t_1 \exists t_3 \exists t_4 \exists x \exists e [\text{book}'(x) \wedge \text{write}'(x)(\text{Zhangsan})(e)(t_3) \wedge \text{Exist}(x)(f_{\text{target}}(e))(t_4) \wedge t_4 > t_3 \wedge \text{buy}'(x)(\text{he})(t_1) \wedge t_1 \subseteq t_4 \wedge \text{Now} < t_1]$$

According to (125), the buying event, i.e., the time t_1 , must be located after the speech time, i.e., in the future and is included within the interval t_4 at which the book that Zhangsan writes exists. To satisfy these two conditions, there are three possibilities. The first possibility is that the writing event begins and ends before the speech time but the buying event is located after the speech time. Another possibility is that the writing event and the buying event are both located in the future. Finally, the writing event might begin before the speech time, continues to the future and end in the future but before the buying event. In these three possibilities, the writing event must end before the buying event or the condition “ $t_1 \subseteq t_4$ ” will not be satisfied. The three possibilities are represented as follows.



These three different possibilities to satisfy the requirement that the buying event must be included within the book's life span and the requirement that the buying event takes place in the future predicts that the relative clause in (112a) is compatible with a situation where the event denoted by the relative clause takes place in the past, in the future or is on-going. Indeed, this seems to be true.

The reading represented by (126c) is worth particular mentioning here. Earlier I mentioned that the relative clause in (112a) has both a future and past tense interpretation but in fact the sentence (112c) is also fully compatible with a situation in which he will buy the book that Zhangsan is still writing at the speech time. This reading is a great problem with TCH, because neither TCH nor quantifier raising predicts this reading.

Next, let us now reconsider (113), reproduced below as (127). Recall that this example seems to constitute a piece of evidence in support of TCH. In what follows, I will show that it is not necessary to resort to TCH to explain the fact that a relative clause contained in a complex bare NP has a generic reading when the matrix predicate is an individual-level predicate. The generic reading of the relative clause in (127) can be derived from a device independently needed by universal grammar.

- (127) Wo xihuan Zhangsan xie de shi
 I like Zhangsan write REL poem
 'I like poems that Zhangsan writes.'

To begin with, I assume Chierchia's (1995) treatment of individual-level predicates as generic polarity items which must be licensed by a Gen operator. The Gen operator is like an adverb of quantification in that it will partition the clause containing it into restriction and scope and can freely bind any free variable. Moreover, when there is no overt restriction on individual-level predicates, a general locative relation **in** is the restriction. Take (128a) as an example. It translates as (128b) on Chierchia's analysis.

- (128) a. John knows Latin.
 b. Gen s [in'(j,s)][know'(j,L,s)]

In plain English, what (128b) says is that whenever John is or might be located, he knows Latin.

It has been argued that bare plurals, like indefinites with the form 'a + N', may introduce free variables bound by an adverb of quantification (See Wilkinson (1991) for instance.) Therefore, a sentence such as (129a) may get a translation like (129b)

under Chierchia's analysis.

(129) a. John likes poems.

b. $\text{Gen } x, s [\text{poem}'(x) \wedge \text{in}'(j, s) \wedge \text{in}'(x, s)] [\text{Like}'(j, x, s)]$

Since the Gen operator induces universal readings for the variable x , so the bare plural *poems* in (129) has a universal force.

Returning to the Chinese example (127), we can assume that Chinese bare nouns may introduce free variables just as English bare plurals. Since an NP of the form 'relative clause + bare noun' can be seen as a complex bare noun, it may introduce a free variable just like a normal bare noun except that the variable introduced has an additional predicate contributed by the relative clause to restrict it. On the above assumptions, (127) can be analyzed as follows. Suppose that in addition to the *in* restriction, the Gen operator for the sentence (127) also selects the object NP as its restriction. Then, the relative clause contained in the object NP will become part of the restriction, because it is syntactically part of the object NP. Thus, the translation of (127) should be something like (130).

(130) $\text{Gen}_{x, s, s'} [\text{poem}'(x) \wedge \text{write}'(Z, x, s') \wedge \text{in}'(Z, s) \wedge \text{in}'(x, s)] [\text{like}'(I', x, s)]$

In (130), the Gen operator binds not only the variables x and s but the variable s' as well.²⁵ Given that the Gen operator is roughly equivalent to a universal quantifier, the meaning of (130) is something like the following: For any poem x that Zhangsan writes in any situation s' and for any situation s in which the poem x and I are located, I like x in s . Because the situation variables of the predicate *xie* 'write' and *xihuan* 'like' are bound by the Gen operator, both the matrix and relative clause obtain a generic reading. On this analysis, the fact that the relative clause in (127) has a generic reading is nothing but a side effect of the object NP being quantified over by the Gen operator.

I should note at this point that the situation variable s and s' in (130) can be replaced with time variables t and t_2 without affecting the original conclusion. One can also keep both the situation variable as well as the time variable. The result is still the same. Although this minor revision does not change anything, I mention it in order to make the picture more congruent with the theory of Chinese temporal reference that

²⁵ If Gen also binds s' , then Gen binds a variable in the restriction but does not bind the same variable in the scope. This problem can be avoided by the property of Conservativity associated with quantifiers/determiners. (See Barwise and Cooper (1981).) According to Conservativity, $Q(A, B)$ is equivalent to $Q(A, A \cap B)$. Thus, when the restriction is reproduced in the nuclear scope of the quantifier, the situation variable s' will appear in both the restriction and the scope. To simplify the

I am proposing.

Now recall that when an extra determiner such as *na* ‘that’ is added to modify the head noun of the object NP in (127), the relative clause must be understood as having a past tense reading instead of a generic reading. I reproduced the relevant example as (131).

- (131) Wo xihuan Zhangsan xie de na-shou shi
 I like Zhangsan write REL that-CL poem
 ‘I like the poem that Zhangsan wrote.’

Why must the relative clause have a past tense interpretation? The answer seems to have to do with the semantics of the definite determiner *na* ‘that’. When *na* ‘that’ is combined with a common noun, it implies existence of an individual satisfying the description of the common noun. Such a property is known as existence presupposition of definite descriptions in the literature. (See Heim (1982), for instance.) Applying this property to the definite description *Zhangsan xie de na-shou shi* ‘that poem that Zhangsan wrote’ in (131), this means that there must exist an individual that satisfies both the property of being a poem and the property of being written by Zhangsan. If a poem has already existed and is the product of Zhangsan’s writing, then the writing event must take place before the speech time, because verbs of creation such as *write* has an end product only when the event described by the verb is completed. Moreover, the determiner *na* ‘that’ also indicates that the writing event is an episodic event. I conclude that the past tense interpretation of the relative clause in (131) is an inference deriving from the existence presupposition and the verbal semantics of the verb *xie* ‘write’.

Another interesting property relevant to determination of the temporal reference of a relative clause is the life time effect of a proper noun (or a definite NP). Usually when a speaker mentions a proper name, he assumes that the referent denoted by the proper name is alive. However, in some cases, the referent of a proper name may be already dead at the speech time. The life time of a proper name has a deciding influence on the interpretation of its containing clause. For example, (132) below is completely the same as (127) except for the subject NP of the relative clause. However, since Lipai, a poet who lived in Tang Dynasty, is a dead man and can no longer writes poems at the utterance time, the relative clause in (132) must be understood as a past tense sentence.

- (132) Wo xihuan Lipai xie de shi

matter, I will leave the translation (130) as is.

I like Lipai write REL poem
 ‘I like poems that Lipai wrote.’

I believe that it is not difficult to incorporate the life time effect of an NP into my theory of temporal reference, though I will leave it open as to how this should be captured in formal semantics. (132), again, points to the conclusion that temporal reference of Chinese relative clauses is not a pure matter of syntactic tense control but involves many other factors such as the semantics of bare nouns, the semantics of verbs and even the life time of a noun phrase.

Before ending the discussion of relative clauses, I want to note briefly that when a relative clause contains an aspectual marker or a modal auxiliary as in (133)-(135), determination of temporal reference is more straightforward than when it does not contain such a marker. This is because aspectual markers or modal auxiliaries always provide a reference time t_{pro} for the relative clause, which bears a precedence or overlapping relation to the event time of the relative clause. I have shown how these aspectual markers or modal auxiliaries help determine temporal reference in Chinese. Therefore, I leave the tense interpretations of (133)-(135) as an exercise for the reader.

(133) a. Ta qiang-zou-le wo zheng zai kan de shu
 he take-away-ASP I right PROG read REL book
 ‘He took away the book that I was reading.’

b. Wo renshi chuang-zhe xizhang de na ge ren
 I know wear-ASP suit REL that CL person
 ‘I know the person that wears the suit.’

(134) a. Ta song wo yi jian ta chuan-guo de yifu
 he give me one CL he wear-ASP REL cloth
 ‘He gave a cloth that he had worn.’

b. Ni zai lu shang diao-le de na ge qianba yijing zha-dao-le
 you on road on lose-ASP REL that CL purse already find-back-ASP
 ‘The purse that you lost on the street was found already.’

(135) Ta gangcai qiang-zou-le wo zheng zai kan de zhe-ben shu
 he just-now take-away-ASP I right PROG read REL this-CL book
 ‘He took away a moment ago this book that I am reading.’

6. Temporal Reference of Adverbial Clauses

Temporal adverbials may also take the form of full subordinate clauses. Illustrated below are some examples.

- (136) a. Ta lai de-shihou, wo hui gaosu ta
 he come when I will tell him
 ‘When he comes, I will tell him.’
- b. Wo zhu zai meiguo de-shihou, chi-guo longxia
 I live in America when eat-ASP lobster
 ‘When I lived in America, I ate lobsters (I had the experience of eating lobsters).’
- c. Ta lai de-shihou wo (zheng) zai zhu fan
 he come when I right PROG cook rice
 ‘When he came, I was cooking.’
- (137) a. Wo qu zhiqian, (wo) hui xian da dianhua gei ni
 I go before I will first make phone-call to you
 ‘Before I go, I will call you first.’
- b. Wo qu zhiqian, da-guo yi-tong dianhua gei ta
 I go before make-ASP one-CL phone-call to him
 ‘Before I went, I made a phone call to him.’
- c. Ta lai meiguo zhiqian, shi ge yanyuan
 he come America before be CL actor
 ‘Before he came to America, he was an actor.’
- (138) a. Wo kaoshang yanjiushuo yihou, hui mai yi liang xin che
 I admitted graduate-school after will buy one-CL new car
 ‘After I am admitted to a graduate school, I will buy a new car.’
- b. Wo kaoshang yanjiushuo yihou, mai-le yi liang xin che
 I admitted graduate-school after buy-ASP one-CL new car
 ‘After I was admitted to a graduate school, I bought a new car.’
- c. Kao-wan shi yihou, ta-de xinqing hen qingsong
 examine-finish test after his mood very relaxed
 ‘After he finished the test, his mood was very relaxed/he has been relaxed.’

The subordinate clauses in (136)-(138) above contain neither an aspectual marker nor a temporal adverbial, but they all have a fixed temporal reference just as the matrix clauses do. To put the (c) examples aside for the moment, the (a) and (b) examples seem to indicate that temporal reference of an adverbial subordinate clause can be determined by that of the matrix clause. For example, the matrix clauses in the (a) examples have a future tense interpretation because of the use of the modal auxiliary *hui* ‘will’ and so do the adverbial clauses. Similarly, both the matrix and embedded clauses of the (b) examples receive the same past tense interpretation because of the use of *-le* or *-guo* in the matrix clauses. If we look at these two sets of examples alone,

it seems very tempting to suggest that a control theory--for example, something like the TCH mentioned in the last section, may account for temporal reference of Chinese adverbial clauses. That is, one first determines the tense of the matrix clause (as if the adverbial clause did not exist) and then assigns the same tense to the adverbial clause. Plausible as the above control theory might sound, it is not general enough to cover examples like the (c) examples in (136)-(138). An important difference between the adverbial clauses in the (a), (b) examples and those in the (c) examples is that the former have a perfective aspect, whereas the latter have an imperfective aspect. As I discussed earlier, an imperfective sentence, when not accompanied by a temporal adverbial or a perfective aspect marker, has a present tense interpretation. Thus, according to the control hypothesis, the matrix clauses in the (c) examples should have a present tense interpretation. The control hypothesis thus predicts that the adverbial clauses in (136)-(138) must have a present tense interpretation, too. But this prediction is completely wrong. In reality, the matrix and embedded clauses in the (c) examples in (136)-(138) have a past tense interpretation instead of a present tense interpretation. This clearly indicates that temporal reference of Chinese adverbial clauses must be determined by something other than the simple but incorrect control hypothesis such as the TCH. In what follows, I will pursue a completely different approach to account for the data in (136)-(138).

To begin with, let us consider an observation about prepositional phrases such as *in April* and *on Sunday* made by Kamp and Reyle (1993). They point out that these phrases cannot be used to refer to periods containing the utterance time. Thus, if today is Sunday and you know this, then you cannot utter the following sentence.

(139) Mary wrote the letter on Sunday.

They propose that this constraint be analyzed as a presupposition on the interpretation of such phrases. With this in mind, now let us consider the following Chinese sentences.

(140) Xingqisan zhiqian wo hui ba wenjian ji gei ni
 Wednesday before I will BA document send to you
 'I will send the document to you before Wednesday.'

The phrase *xingqisan zhiqian* 'before Wednesday' exhibits properties similar to those of temporal expressions such as *in April* or *on Sunday*. If today is Wednesday and you know this, you cannot felicitously utter (140). This fact suggests that expressions like *zhiqian* 'before' impose a constraint on the temporal expression preceding it in a way

similar to Kamp and Reyle’s proposed presupposition for phrases such as *in April* and *on Sunday*. Following Kamp and Reyle’s (1993) idea, I will capture this constraint in terms of a presupposition. Moreover, I assume that this presupposition applies not only to prepositional phrases such as *xingqisan zhiqian* ‘before Wednesday’ but to full adverbial clauses such as *ni lai zhiqian* ‘before you come’. Thus, I propose that *zhiqian* ‘before’ has either the translation (a) or the translation (b), depending upon whether the phrase preceding *zhiqian* ‘before’ is a noun phrase or a clause.²⁶ The condition ‘ ∂ [Now ζ t₁]’ represents the presupposition of *zhiqian* ‘before’.

- (141) a. [[**zhiqian**]] =: $\lambda t_1 \lambda T \lambda t_2 \lambda t_3 \exists t_4 [T(t_2)(t_3) \wedge t_4 < t_1 \wedge t_4 = t_2 \wedge \partial$ [Now ζ t₁]]
 b. [[**zhiqian**]] =: $\lambda R \lambda T \lambda t_3 \lambda t_4 \exists t_2 \exists t_1 \exists t_5 [R(t_2)(t_1) \wedge t_5 < t_1 \wedge t_5 = t_3 \wedge T(t_3)(t_4)$
 $\wedge \partial$ [Now ζ t₁]]

In plain English, what (141a) says is that an interval t_4 precedes an interval t_1 denoted by the time expression preceding *zhiqian* ‘before’ which does not contain the speech time and t_4 is identified with the reference time t_2 of the sentence that a *zhiqian*-phrase modifies. (141b) says something quite similar and need no further comments here. Applying (141a) to a concrete example, let us consider (140). On the analysis of (141a), the translation of (140) is (142) according to the temporal theory that I am adopting.

- (142) $\exists t_2 \exists t_3 \exists t_4 [\text{give}'(\text{the-document}')(\text{you}')(\text{I}')(t_3) \wedge t_3 \subseteq t_2 \wedge \text{Now} < t_2 \wedge$
 $t_4 < \text{Wednesday}' \wedge t_4 = t_2 \wedge \partial$ [Now ζ t₁]]

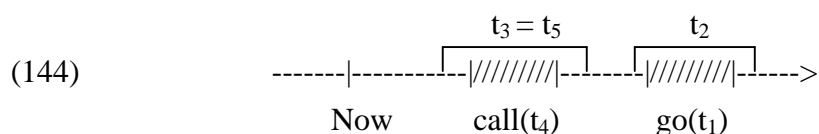
(142) says that I will give the document to you at a time t_3 , included within another time t_2 and t_2 , located after the speech time, is equivalent to t_4 , which is before a Wednesday. This amounts to saying that I will give the document to you at a time before a Wednesday that follows the speech time, which seems to correctly describe the meaning of (140).

The process of applying (141b) to the examples in (137) is similar. The translation of (137a) is (143). t_R in (143) refers to the interval denoted by an implicit time adverbial that I have assumed that a clause must have if no overt time adverb appears.

- (143) $\exists t_3 \exists t_4 \exists t_2 \exists t_1 \exists t_5 [\text{go}'(\text{I}')(t_1) \wedge t_1 \subseteq t_2 \wedge t_2 \subseteq t_R \wedge t_5 < t_1 \wedge t_5 = t_3 \wedge \text{call}'(\text{you}')(\text{I}')(t_4)$
 $\wedge t_4 \subseteq t_3 \wedge \text{Now} < t_3 \wedge \partial$ [Now ζ t₁]]

²⁶ Strictly speaking, presuppositions are not part of truth conditions. However, to make things simpler, I assume that they are part of the truth conditions.

What (143) claims can be represented by the following diagram.

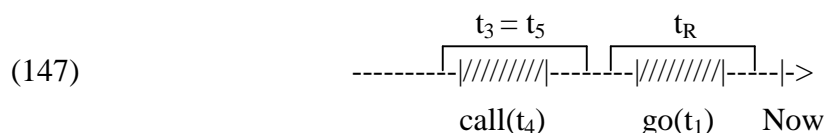
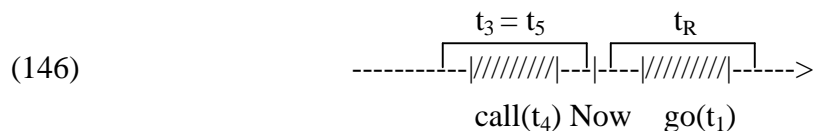


The above diagram clearly shows that the adverbial clause in (137a) must refer to a future event.

Next, consider (137b), which has a past tense interpretation for the matrix clause. Its translation is (145).

$$(145) \exists t_3 \exists t_4 \exists t_2 \exists t_1 \exists t_5 [\text{go}'(I')(t_1) \wedge t_1 \subseteq t_2 \wedge t_2 \subseteq t_R \wedge t_5 < t_1 \wedge t_5 = t_3 \wedge \text{call}'(\text{you}')(I')(t_4) \wedge t_4 \subseteq t_3 \wedge \text{Now} > t_3 \wedge \mathbf{\text{\textcircled{O}}[\text{Now } \mathbf{\text{\textcircled{C}}t_1}]}$$

The only difference between (145) and (143) is the precedence relation between Now and t_3 . Again, we can represent (145), using a diagram. However, unlike the case in (144), to satisfy the three conditions “ $t_5 < t_1$ ”, “ $t_5 = t_3$ ”, and “ $\text{Now} > t_3$ ”, we have two possibilities rather than one, if we don’t know what t_R is. These two possibilities are given in (146) and (147), respectively.



(147) gives a reading according to which both the calling event and the going event happened before the speech time and the latter event must follow the former event as is required by the meaning of *zhiqian* ‘before’. This is the reading that we want. In contrast, what (146) represents is that the calling event happened before the speech time but the going event will take place in the future. This is a reading that (137b) certainly does not have. The problem is why (137b) does not have this reading. Does this indicate that my analysis of the semantics of *zhiqian* ‘before’ is wrong? I want to argue that my analysis of *zhiqian* ‘before’ is correct but the reading provided by (146) is ruled out by an independent reason discussed in Kamp and Reyle (1991).

Kamp and Reyle (1991) have made a very interesting observation about the combinations of tenses in main and subordinate clauses in English. They point out that English sentences like the following are deviant.

(148) Bill will leave before Mary arrived.

(149) Bill left before Mary will arrive.

According to Kamp and Reyle (1991: 652), the oddity of (148) can be easily accounted for in terms of inconsistency because the word *before* requires that the event of the matrix clause is before the event of the subordinate clause but the tenses express the reverse. However, the same inconsistency account cannot be extended to (149), because a past event is certain to precede a future event. Despite this, they point out that what (148) and (149) have in common is that “their locating adverbs fail to produce a genuine constraint on the set of times compatible with the interpretation of tense”. Thus, they propose a “non-triviality constraint” to capture this. This constraint essentially says that “temporal adverbs must impose a genuine restriction on the location time”. This requirement is not satisfied in (149) because a past time is always before a future time. So there is no genuine constraint on the tenses and the meaning of *before*.

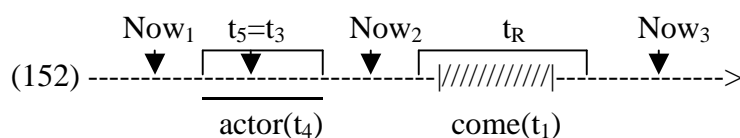
Although Chinese does not have morphological tenses, the situation in (146) and (147) is completely parallel to that in (148) and (149). Thus, I suggest that Kamp and Reyle’s Non-triviality Constraint not be taken as a constraint on morphological tenses but a universal principle on permissible temporal interpretations. This then excludes the possibility of representing (137b) as (146). It also predicts that when t_R is overt and refers to a future time, the sentence is deviant as (150) illustrates.

(150) *Wo mingtian qu zhiqian, yijing tongzhi-guo ta
 I tomorrow go before already inform-ASP him
 ‘I already informed him before I leave tomorrow.’

The case of (137c) is also very interesting. According to my analysis, the final translation of (137c) should be (151).

(151) $\exists t_3 \exists t_4 \exists t_2 \exists t_1 \exists t_5 [\text{come}'(\text{America}')(\text{he}') (t_1) \wedge t_1 \subseteq t_2 \wedge t_2 \subseteq t_R \wedge t_5 < t_1 \wedge t_5 = t_3 \wedge \text{actor}(\text{he}') (t_4) \wedge t_3 \subseteq t_4 \wedge \text{ò}[\text{Now } \mathfrak{C} t_1]]$

From the above translation, we can infer the following diagram.



I should mention here that the representation in (152) is actually not precise enough. For example, t_4 can be longer; in fact, it can even be extended to some point after t_1 , though this is not absolutely necessary. However, the diagram in (152) should be sufficient for the point that I will make. In my previous discussion of (137a) and (137b), I did not say much about the condition “ $\text{O}[\text{Now } \text{C}t_1]$ ”. This is because that condition was not that much relevant. However, for (151), this condition plays a role. Since the speech time cannot be included within t_1 , it must fall outside t_1 . This leaves us four possibilities, as indicated by the arrow symbol. Let us begin with the arrow falling within t_4 , i.e., the one without a subscript. If the speech time is included within t_4 , this means that he is an actor at the speech time. However, if this is the assertion that the speaker wants to make, he should use a more direct expression such as *xianzai* ‘now’ to indicate this rather than using the temporal adverbial clause *ta lai meiguo zhiqian* ‘before he come to America’, which does not have a fixed temporal reference. In other words, if the speech time falls within t_4 , the use of the construction in (137c) violates Grice’s (1975) Maxim of Quantity mentioned earlier. Next, let us consider the possibility of Now_2 . If Now_2 is the speech time, then (137c) should be equivalent to the English sentence *He was an actor before he will come to America*. However, I have shown that the semantics of such sentences violates Kamp and Reyle’s (1991) Non-triviality Constraint. How about Now_1 ? If Now_1 is the speech time, then both the event of coming to America and the state of being an actor should hold at a future time. As discussed earlier, if a matrix clause is to express futurity in Chinese, an overt modal auxiliary or temporal adverbial indicating a future time is obligatory. However, (137c) does not contain a modal auxiliary such as *hui* ‘will’ or any time adverb such as *weilai* ‘in the future’ clearly indicating a future time. Notice that though the adverbial clause *ta lai meiguo zhiqian* ‘before he come to America’ itself is a temporal adverbial, it is not that kind of temporal adverbial that inherently refers to a future time. In fact, such a phrase can be said to be tenseless. Its tense can only be determined with the help of something other than the semantics of the clause itself as we have already seen. The remaining possibility is Now_3 . If Now_3 is the speech time, then the state of being an actor and the event of coming to America should be both true before the speech time. In this case, the temporal precedence relation between t_4 and t_1 can also be genuinely constrained by the semantics of the subordinator *zhiqian* ‘before’. Indeed, this is the only interpretation which does not violate any principle on temporal reference. Therefore, (137c) can only be uttered in a situation where Now_3 is the utterance time. It follows that both the matrix clause and the adverbial clause have a past tense interpretation.

Before turning to the semantics of *de-shihou* ‘when’, I want to make some comments on the reference time of adverbial clauses. In my above discussion, I

assume that the adverbial clauses have an implicit time adverbial contributing the interval t_R but the matrix clause does not have a implicit t_R . Below I will show that this is a correct analysis. Consider the following examples.

- (153) a. *Mingtian wo qu ni nali zhiqian, wo hui xian da dianhu gei ni*
tomorrow I go you there before I will first make call to you
‘Tomorrow before I go to your place, I will make a call to you first.’
- b. *Wo mingtian qu ni nali zhiqian, wo hui xian da dianhu gei ni*
tomorrow go you there before I will first make call to you
‘Before I go to your place tomorrow, I will make a call to you first.’
- c. **Wo qu ni nali zhiqian, wo mingtian hui xian da dianhu gei ni*
I go you there before I tomorrow will first make call to you
‘Before I go to your place, I will make a call to you first tomorrow.’

The grammatical contrast between (153a,b) and (153c) indicates that when an overt temporal noun phrase appears, it must modify the adverbial clause rather than the matrix clause. The same remarks apply to the semantics of *de-shihou*-clauses ‘when-clause’ and *yihou*-clauses ‘after-clause’ to which I now turn.

The subordinator *de-shihou* ‘when’ has a semantics much similar to that of *zhiqian* ‘before’. In particular, it also has the presupposition that the speech time is not included within the event time of the adverbial subordinate clause. I propose that *de-shihou* ‘when’ is translated as follows:

$$(153) [[\mathbf{de-shihou}]] =: \lambda R \lambda T \lambda t_3 \lambda t_4 \exists t_2 \exists t_1 [R(t_2)(t_1) \wedge t_1 = t_3 \wedge T(t_3)(t_4) \wedge \mathbf{\delta}[\mathbf{Now} \mathbf{\zeta} t_1]]$$

On the above analysis of *de-shihou* ‘when’, (136a) should have the translation in (154).

$$(154) \exists t_3 \exists t_4 \exists t_2 \exists t_1 [\text{come}'(\text{he}')(t_1) \wedge t_1 \subseteq t_2 \wedge t_2 \subseteq t_R \wedge t_1 = t_3 \wedge \text{tell}'(\text{him}')(I')(t_4) \\ \wedge t_4 \subseteq t_3 \wedge \mathbf{Now} < t_3 \wedge \mathbf{\delta}[\mathbf{Now} \mathbf{\zeta} t_1]]$$

According to (154), the event time t_4 of the matrix clause is included within a reference time t_3 , which follows the speech time. Since t_3 is identified with the event time of the adverbial *de-shihou*-clause, it follows that not only the matrix clause has a future tense interpretation but the adverbial clause has a future tense interpretation as well.

Next, consider (136b). The translation of (136b) is identical to (154) except that the precedence relation between Now and t_3 is reversed.

$$(155) \exists t_3 \exists t_4 \exists t_2 \exists t_1 [\text{come}'(\text{he}')](t_1) \wedge t_1 \subseteq t_2 \wedge t_2 \subseteq t_R \wedge t_1 = t_3 \wedge \text{tell}'(\text{him}')(\text{I}')(t_4) \\ \wedge t_4 \subseteq t_3 \wedge \text{Now} > t_3 \wedge \text{ò}[\text{Now } \zeta t_1]]$$

From the discussion of (154), it should be clear that (155) requires that both the matrix clause and the embedded clause have a past tense interpretation.

As for (136c), it is much similar to (137c). Its final translation is (156).

$$(156) \exists t_3 \exists t_4 \exists t_2 \exists t_1 [\text{come}'(\text{he}')](t_1) \wedge t_1 \subseteq t_2 \wedge t_2 \subseteq t_R \wedge t_1 = t_3 \wedge \text{cook}(\text{I}')(t_4) \wedge t_3 \subseteq t_4 \wedge \\ \text{ò}[\text{Now } \zeta t_1]]$$

From the condition “ò[Now ζ t₁]” and “t₁ = t₃”, it follows that t₃ cannot be the speech time. Therefore, both the matrix and embedded clauses in (136c) cannot have a present tense interpretation. This leaves us two possibilities: either they have a past tense interpretation or a future tense interpretation. But future tense interpretation requires an overt expression indicating a future time. (136c) does not meet this requirement. Consequently, both t₁ and t₃ can only refer to a past time. Therefore, the adverbial clause in (136c) has the same past tense interpretation as the matrix clause.

Temporal reference of *yihou*-clauses ‘after-clauses’ is much similar to that of *yiqian*-clauses ‘before-clauses’. It should be noted, however, that unlike *yiqian* ‘before’ and *de-shihou* ‘when’, *yihou* ‘after’ doesn’t seem to have the presupposition that the interval denoted by the phrase preceding it cannot contain the speech time. This is proved by the fact that even if today is Moon Festival and you know this, you can still felicitously utter (157).

$$(157) \text{Zhongqiujié yihou tianqì jiù huì biàn liáng} \\ \text{moon-festival after weather then will turn cool} \\ \text{'After the moon festival, the weather will turn cool.'}$$

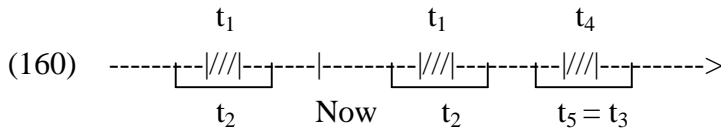
Thus, unlike *yiqian* ‘before’, the semantics of *yihou* ‘after’ does not have the presupposition “ò[Now ζ t₁]”. The presupposition aside, the semantics of *yihou* ‘after’ is the same as that of *yiqian* ‘before’ except for the temporal precedence relation between the reference time of the matrix clause and the time expressed by the adverbial clause. I propose that the semantics of *yihou* ‘after’ is the following.

$$(158) \text{ a. } [[\text{yihou}]] =: \lambda t_1 \lambda T \lambda t_2 \lambda t_3 \exists t_4 [T(t_2)(t_3) \wedge t_4 > t_1 \wedge t_4 = t_2] \\ \text{ b. } [[\text{yihou}]] =: \lambda R \lambda T \lambda t_3 \lambda t_4 \exists t_2 \exists t_1 \exists t_5 [R(t_2)(t_1) \wedge t_5 > t_1 \wedge t_5 = t_3 \wedge T(t_3)(t_4)]$$

Applying (158b) to (138a), we obtain the following translation.²⁷

$$(159) \exists t_3 \exists t_4 \exists t_2 \exists t_1 \exists t_5 [\text{be-admitted-to(the-graduate-school')}(I')(t_1) \wedge t_1 \subseteq t_2 \wedge t_2 \subseteq t_R \wedge t_5 > t_1 \wedge t_5 = t_3 \wedge \text{buy(a-new-car)}(I')(t_4) \wedge t_4 \subseteq t_3 \wedge t_3 > \text{Now}]$$

From the conditions “ $t_5 > t_1$ ”, “ $t_3 > \text{Now}$ ” and “ $t_5 = t_3$ ”, we can infer that there are two possible locations for t_1 , the event time of the adverbial clause; namely, it can either precede the speech time or follow it. We also know that t_1 must precede t_3 (because $t_3 = t_5$), an interval within which the event time of the matrix clause falls. This can be represented by the following diagram.



If t_1 precedes the speech time, then Kamp and Reyle’s Non-triviality Constraint is violated, because a time before the speech time always precedes a time after the speech time. But if t_1 follows the speech time, it does not necessarily precede another time located after the speech time, for example t_4 or t_3 in (160). Indeed, it is precisely because of this that we can meaningfully use the word *yihou* ‘after’ in (138a) without violating Kamp and Reyle’s Non-triviality Constraint. Therefore, t_1 must follow the speech time in (160). This explains why the adverbial clause in (138a) has a future tense interpretation.

Next, consider (138b). Its translation is (161), which differs from (159) only in the precedence relation between Now and t_3 .

$$(161) \exists t_3 \exists t_4 \exists t_2 \exists t_1 \exists t_5 [\text{be-admitted-to(the-graduate-school')}(I')(t_1) \wedge t_1 \subseteq t_2 \wedge t_2 \subseteq t_R \wedge t_5 > t_1 \wedge t_5 = t_3 \wedge \text{buy(a-new-car)}(I')(t_4) \wedge t_4 \subseteq t_3 \wedge t_3 < \text{Now}]$$

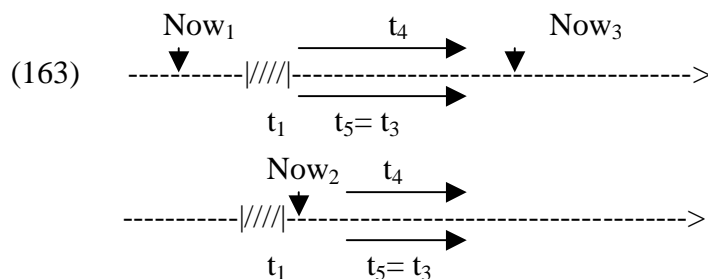
In (161), from the conditions “ $t_5 > t_1$ ”, “ $t_3 < \text{Now}$ ” and “ $t_5 = t_3$ ”, we can conclude that “ $\text{Now} > t_3 > t_1$ ”. It follows that the adverbial clause in (138b) has a past tense interpretation just as the matrix clause does.

As for (138c), it has the following translation.

$$(162) \exists t_3 \exists t_4 \exists t_2 \exists t_1 \exists t_5 [\text{take'(the-exam')}(he')(t_1) \wedge t_1 \subseteq t_2 \wedge t_5 > t_1 \wedge t_5 = t_3 \wedge t_2 \subseteq t_R \wedge \text{relaxed'(he')}(t_4) \wedge t_3 \subseteq t_4]$$

²⁷ To simplify the matter, I actually do not translate the indefinite *a new car* and ignore the scope problem between *hui* ‘will’ and the indefinite NP.

Like the case of (137c), the translation of (138c) does not directly tell us the temporal reference of the adverbial clause. However, from the possible locations of the speech time, we can still infer that the adverbial clause in (138c) must have a past tense interpretation. (163) is a diagram that can be inferred from (162).



In (163), if Now_2 is the speech time, (138c=162) will violate Kamp and Reyle's Non-triviality Constraint. If Now_1 is the speech time, the matrix clause must have a future tense interpretation. This requires an overt expression indicating a future time. But there is no such a phrase in (138c). Therefore, the only possibility is Now_3 . If Now_3 is the speech time, there are two possibilities, depending upon whether it overlaps with t_4 . If Now_3 overlaps with t_4 , then the state of being relaxed holds at the speech time. If there is no overlapping, then the state of being relaxed must end before the utterance time. Indeed, it seems to us that (138c) permits both readings, though the former reading seems to be the dominating reading.

We have seen above that *de-shihou* 'when', *yiqian* 'before', and *yihou* 'after' each hold a different temporal relation between the matrix clause and the adverbial clause. There is no doubt that this temporal relation helps determine the temporal reference of the adverbial subordinate clause they introduce. However, it should be pointed out that the subordinators in question do not directly specify what (semantic) tense the clauses they introduce must have. Unlike *de-shihou*, *zhiqian* and *yihou*, there are subordinators that lexically specify what tense the clauses they introduce must have. *Zicong...yihou* 'since' is a good case to illustrate this.²⁸ Consider the following two examples. The matrix clause of (164) is stative, whereas that of (165) is eventive.

- (164) *Zicong he-le na-bei cha yihou, wo duzi jiu hen bu-shufu*
 Since drink-ASP that-CL tea after my stomach then very uncomfortable
 'Since I drank that cup of tea, my stomach has been very uncomfortable.'

²⁸ We may treat *zicong...yihou* as a discontinuous constituent expressing the notion of the English word *since*.

- (165) *Zicong gen ta chaojia yihou, Lisi jiu ban chuqu zhu le*
 since with hi quarrel after Lisi then move out live ASP
 ‘Since Lisi had a quarrel with him, he has moved out to live.’

As the above translations indicate, the clause introduced by *zicong...yihou* ‘since’ must be construed as denoting a past event. The temporal meaning of (164) is thus something like: There was a time t_1 before the utterance time such that **I drink that cup of tea** held at t_1 and for all t_2 between t_1 and the utterance time **My stomach be uncomfortable** held at t_2 . As for (165), its temporal meaning is something like: There was a time t_1 before the utterance time such that **Lisi have a quarrel with him** held at t_1 and for some time t_2 between t_1 and the utterance time **Lisi move out** held at t_2 . In other words, a *zicong*-clause contributes an interval that begins right from the culmination point of the event denoted by the *zicong*-clause until the utterance time. Moreover, this interval seems to serve the same purpose as temporal adverbials such as *mingtian* ‘tomorrow’, which are identified with the reference time of the clause they modify.

Besides contributing an interval that serves as the reference time of the matrix clause, *zicong...yihou* also dictates that the eventuality denoted by the matrix clause follows the one denoted by the clause that *zicong...yihou* introduces. Arguably, this part of temporal meaning comes from the word *yihou* ‘after’. Another thing that should be noted is that when the matrix clause expresses a state, that state must hold at the utterance time. On the other hand, when the situation type of the matrix clause is an event, then that event is included within the reference time contributed by *zicong...yihou*. Thus, for (164) to be true, my stomach must be still uncomfortable at the utterance time and for (165) to be true, the moving event must be included in the reference time introduced by *zicong...yihou*. These requirements are much like the requirements of English perfect. It should be noted, however, that unlike English Chinese does not grammaticalize the notion of perfect as the English *have -en*. Thus, although the state expressed by the matrix clause of (164) does not contain any tense or aspect marker, the perfect meaning is still there.²⁹ But when the predicate of the matrix clause is eventive, the sentence-final particle *le* seems generally obligatory. Mochizukeiko (2000) has recently argued that the sentence-final particle *le* expresses exactly the meaning of perfect.

Before I spell out the truth conditions of a *zicong*-construction, one more thing needs to be clarified. Earlier I said that the clause introduced by *zicong...yihou* denotes a past eventuality. There is no problem with this claim when the aktionsarten

²⁹ The marker *jiu* ‘then’ has a temporal meaning, but it clearly does not express the meaning of perfect tense.

of the adverbial clause is an event as in (164) and (165). However, when the predicate of the complement clause is stative as in (166) and (167), the claim does not seem to hold.

- (166) Zicong ta zhidao na-jian shi yihou, ta xinqing jiu hen huai
 since he know that-CL matter after his mood then very bad
 ‘Since he came to know that matter, his mood has been very bad.’
- (167) Zicong ta shengbing yihou, ta jiu ban qu xiangxia zhu le
 since he sick-ASP after he then move go country live ASP
 ‘Since he got sick, he has decided to move to live in the country.’

In (166), the state denoted by *ta shengbing* ‘he sick’ not only holds of a past interval but is true of the utterance time as well. Similarly, in (167), the state of his knowing the matter must hold from a past interval until and including the utterance time. (166) and (167) thus seem to falsify the claim that the clause introduced by *zicong...yihou* denotes a past eventuality. This conclusion, however, is weakened when we think about the meanings of the predicates *zhidao* ‘know’ and *shengbing* ‘sick’ in (166) and (167) more carefully. On closer thinking, the two predicates under discussion don’t seem to describe unchanging states but expresses a change of state. This intuition is reflected in our translation of the two verbs as ‘came to know’ and ‘got sick’. A piece of evidence for the inchoativity of the two verbs in question comes from the observation that individual-level predicates in Chinese are incompatible with the verbal *-le* (Lin 2000). Thus, (168) below sounds very odd.

- (168) *Ta zhidao-le na-jian shi
 he know-ASP that-CL matter
 ‘He knows/knew that matter.’

Interestingly, however, *zicong*-constructions may exceptionally license the use of the verbal suffix *-le* for individual-level predicates as (169) shows.

- (169) Zicong ta zhidao-le na-jian shi yihou,...
 since he know-ASP that-CL matter after
 ‘Since he came to know that matter,...’

The ability of the verb *zhidao* ‘know’ to take the verbal suffix *-le* in (169) indicates that the focus of the clause introduced by *zicong...yihou* is on the change from a state of not knowing to a state of knowing. It is quite reasonable to claim that this kind of

change is an achievement event (cf. Szeto 1988). Analyzed this way, (166) is no longer a counterexample to the claim that *zicong...yihou* requires a fixed temporal reference for the clause it introduces, that is, past tense. Similar remarks apply to (167).

Given the above understanding of *zicong...yihou*, I propose that it has the following translation.

$$(170) \text{ [[zicong...yihou]]} =: \lambda R \lambda T \lambda t_3 \lambda t_4 \exists t_1 \exists t_2 \exists t_5 [R(t_2)(t_1) \wedge t_2 < \text{Now} \wedge \text{Ini}(t_5) \gg \text{Fin}(t_1) \wedge \text{Now} \subseteq t_5 \wedge t_5 = t_3 \wedge T(t_3)(t_4)]$$

Applying (170) to (164) and (165), we obtain (171) and (172), respectively.

$$(171) \exists t_3 \exists t_4 \exists t_1 \exists t_2 \exists t_5 [\text{drink}'(\text{that-cuo-of-tea}')(\text{he}')(t_1) \wedge t_1 \subseteq t_2 \wedge t_2 \subseteq t_R \wedge t_2 < \text{Now} \wedge \text{Ini}(t_5) \gg \text{Fin}(t_1) \wedge \text{Now} \subseteq t_5 \wedge t_5 = t_3 \wedge \text{uncomfortable}'(\text{my stomach}')(t_4) \wedge t_3 \subseteq t_4]$$

$$(172) \exists t_3 \exists t_4 \exists t_1 \exists t_2 \exists t_5 [\text{quarrel-with}'(\text{him}')(\text{Lisi}')(t_1) \wedge t_1 \subseteq t_2 \wedge t_2 \subseteq t_R \wedge t_2 < \text{Now} \wedge \text{Ini}(t_5) \gg \text{Fin}(t_1) \wedge \text{Now} \subseteq t_5 \wedge t_5 = t_3 \wedge \text{move-out}'(\text{Lisi}')(t_4) \wedge t_4 \subseteq t_3]$$

In (171) and (172), $\text{Ini}(t_5)$ stands for the initial subinterval of t_5 and $\text{Fin}(t_1)$ the final subinterval of t_1 . Readers should be familiar with the other conditions by now and should be able to tell that the translations in (171) and (172) reflect all the comments that I have made about *zicong...yihou* constructions.

7. Non-temporal Adverbial Clauses

Not all adverbial clauses bear a temporal precedence or overlapping relation to the matrix clauses as we saw in the last section. Consider the following examples.

- (173) a. Yinwei Xiaoming duzi er, suoyi mama zai bang ta zhu mian
 because Xiaoming stomach hungry so mother PROG help him cook noodle
 'Because Xiaoming is hungry, mother is cooking noodles for him.'
- b. Yinwei Xiaoming shou-shang le, suoyi mama zai bang ta mou
 Because Xiaoming get-hurt-ASP so mother PROG help him spread
 yao
 medication
 'Because Xiaoming got hurt, Mother is spreading medication for him.'
- c. Yiwei Xiaoming mingtian yao qu luxing, suoyi mama zai bang ta
 Because Xiaoming tomorrow want go travel so mother PROG help him

shoushi xingli

package luggage

‘Because Xiaoming will go travelling tomorrow, Mother is packaging his luggage for him.’

(174) a. Suiran Xiaoming hen congming, keshi ta bu yonggong

though Xiaoming very clever but he not study-hard

‘Though Xiaoming is very clever, he does not study hard.’

b. Suiran xiaoming na-le wo de dongxi, keshi wo yidian ye bu shengqi

though Xiaoming take-ASP I DE thing but I a-little also not angry

‘Although Xiaoming took my thing, I am not angry at all.’

c. Suiran baba mingtian cai huilai, keshi Xiaoming xingzai jiu hen

though father tomorrow CAI come-back but Xiaoming now then very xingfen le

excited ASP

‘Although father will come back not until tomorrow, Xiaoming is very excited now.’

The above two sets of examples show that when the matrix clause is a present tense, the adverbial clause can be any tense, be it a present, past or future tense. In fact, it can also be shown that the reverse is true, too. These facts indicate that unlike *yihou* ‘after’, *yiqian* ‘before’ or *de-shihou* ‘when’, subordinators such as *yinwei* ‘because’ or *suiran* ‘though’ do not have a fixed temporal relation to the matrix clause.³⁰ If temporal reference of these non-temporal adverbial clauses do not rely on the matrix clauses, how is their temporal reference determined? The answer is that their temporal reference is determined as if they were un-embedded.³¹ In other words, temporal reference of these clauses simply follows the usual rules and nothing special has to be said about them.

8. Conclusion

In his book *Hanyu Yufaxue* ‘Chinese Grammar’, Professor Fuyi Xing (1996), a traditional Chinese linguist, has pointed out that though research of Chinese grammar made a great progress in the past decade, Chinese linguistics is still far away from being mature in that many linguistic facts have not been really brought to light and

³⁰ The word *yinwei* ‘because’ expresses a causal relation. Although it is true that one must have a cause first in order to have a consequence, the causal relation is different from temporal relation. It is quite possible that a future event causes a state that holds at present.

³¹ Notice that the subordinators *yinwei* ‘because’ and *suiran* ‘though’ must appear in a pair with *suoyi* ‘so’ and *danshi* ‘but’, respectively. This fact leaves open the possibility that *yinwei*-clauses and *suiran*-clauses might not be embedded clauses at all but have the same independent status as *suoyi*-clauses and *danshi*-clauses.

many important phenomena have not been accurately accounted for. Therefore two main interrelated issues that research of Chinese grammar faces nowadays are (i) to make clear what the facts are and (ii) to construct theories that may accurately account for those linguistic facts. I agree with professor Xing. Without a clear understanding of what the facts are, theory construction and methodology renovation are simply an impossible task and without construction of theories it is impossible for a discipline to become mature. Indeed, what I have tried to do in this paper is to help achieve these two goals with respect to temporal reference in Chinese. On the one hand, I have described as many temporal phenomena as I can and as deep as possible. In fact, many of the facts discussed in this paper are perhaps described even for the first time in the literature. Of course, there are still many other interesting temporal phenomena that are not covered due to space limit, but I believe that the examples discussed in this paper are those that any temporal theory of Chinese sentences has to account for. On the other hand, I have attempted to account for the facts within a framework of model-theoretic semantics. This approach to temporal reference of Chinese, I believe, is the best candidate that meets professor Xing's requirement of accuracy. However, I have to admit that though logical semantics is very precise, in some cases they cannot directly tell what the tense of a Chinese sentence is. Nevertheless, as I have shown in the text, temporal reference of such examples can be resolved by inference rules. Another advantage of my approach to temporal reference in Chinese is that it provides a very good basis of comparison between temporal reference in Chinese and those in Indo-European languages, because abundant works in tense and aspect are written within the framework of model-theoretic logical semantics. A comparative study of temporal systems in different languages is a project that I will engage in the near future.

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