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A PRAGMATICALLY ENRICHED TEMPORAL RELATION

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1 Introduction

The pre-verbal temporal phrases in Mandarin Chinese we study in this work are expressions formed by an optional occurrence of the preposition *zai* meaning 'at', followed by a measure DP expressing a temporal duration, and the post-position *li* or *nei*, both meaning 'in'. The two instantiations of the phrase are given in (1)[1], they are referred to as *zai* phrases in the paper.

(1) a. (zai) wushi tian li
zai fifty day li
during/within/over/for/in fifty days
b. (zai) wushi tian nei
zai fifty day nei
during/within/over/for/in fifty days

Syntactically, *zai* phrases are plain adjuncts. Like other temporal adverbials, their position is rather flexible. They can either occupy a sentence-initial position or adjoin to the predicate, illustrated in (2a). Semantically, they roughly, but not quite, behave like temporal durative adverbials, whose English counterparts are *for*-adverbials and *in*-adverbials, see the sentences presented in (2):

(2) a. (Mali) zai yi ge xiaoshi li/nei (Mali) yizhi zai lian gangqin.
Mary zai one CLF hour li/nei Mary all-the-time PROG practice piano
'Mary practiced the piano continuously for one hour.'

[1] Abbreviations used throughout in the glosses: BA=particle for introducing preposed object; CLF=classifier; DEM=demonstrative; DUR=durative; EXP=experiential; LNK=linker; MODE=mood; NEG=negation; PFV=perfective; PL=plural; PASS=passive; PRO=pronoun; PROG=progressive; PTCL=particle; SG=singular.

b. Mali zai yi ge xiaoshi li/nei xie-le zhe feng xin.
Mary zai one CLF hour li/nei write-PFV DEM CLF letter
Mary wrote this letter in one hour.

A characterization of the *zai* phrase should account for the similarities with both *for*-adverbials and *in*-adverbials, as suggested by (2), and for the differences that make *zai* phrases behave not quite like temporal durative adverbials. This is suggested by the fact that *zai* phrases in both sentences in (2) are acceptable without coercion effects, unlike what is observed in English. In this paper, we propose that the phrase '(*zai*)+measure DP+*li/nei*' introduces a discourse referent that is a temporal interval, and that the main clause it adjoins to is to be understood as providing an independent and maximally informative description for it. As a consequence, the time of the eventuality described by the main clause must have an overlap with the interval introduced by the *zai* phrase. However, the satisfaction of this temporal relation is a necessary but not a sufficient condition for characterizing the felicity of such a phrase.

This paper is organized as follows. In Section 2, we review the existing proposals on *zai* phrases and point out the problematic issues they raise. Specifically, we expose the limits of treating *zai* phrases as measure phrases or as purely temporal frame adverbials, as the marginal status of a number of examples would remain unexplained. More fully acceptable cases that were not predicted by the previous studies will be provided in Section 3. The more complex view of the distribution of *zai* phrases that emerges from our thorough review, leads us to propose an analysis that extends the overlap relation to all cases by modifying its nature from temporal to informational. In section 4, we propose that *zai* phrases introduce a time that is topical in the discourse. This role is captured by assuming that the main clauses convey a pragmatically relevant higher order form of predication that is maximally informative for the whole interval, and this form of predication is built as the effect of a conventional implicature associated with the construction. Section 5 concludes the discussion.

2 Previous studies and their shortcomings

2.1 Properties of *zai* phrases discussed in the literature

According to Xiao and McEnery (2004), *zai* phrases go with telic situations, not with atelic situations, in this case, they are the Chinese equivalents of *in*-adverbials. The contrast between (3) and (4) is taken to illustrate this point. The *zai* phrase is incompatible with the activity predicate of eating meat in (3), but it is compatible with the accomplishment predicate of reading five novels in (4).

(3) *Ta yi ge xiaoshi nei chi-le rou. (Wu, 2005)
PRO3SG one CLF hour nei eat-PFV meat
(4) Zhangsan san tian nei kan-le wu ben xiaoshuo. (Wu, 2005)
Zhangsan three day nei read-PFV five CLF novel
'Zhangsan read five novels in three days.'

The proposals by Wu (2005) and Peck (2011) converge in claiming that *zai* phrases only combine with telic situations. More specifically, Peck (2011) states that *zai* phrases are temporal

frame adverbials that specify a time scope within which the described delimited eventuality is asserted to take place. Wu (2005) states that the duration of an interval specified by a *zai* phrase must include the event time of the situation described by the main predicate. The semantic representation of sentence (4) he provides is reproduced in (5)[2]. The representation shows that *zai* phrases only modify a predicate that possesses a SigP. Since there isn't an appropriate linguistic context to identify the underspecified SigP of the activity predicate in (3), the sentence is ungrammatical.

(5) ∃e∃i∃x∃i' [[novel'(x) ∧ number(x)=5 ∧
read'(Zhangsan', x, e) ∧ i=[start(e), SigP(e)] ∧ i ≺ST] ∧
i'=[start(e), SigP(e)] ∧ i'< three days']

The representation in (5) also captures the fact that the event time of the situation is directly associated with the duration of the interval introduced by the *zai* phrase.

2.2 Problems related to these proposals

2.2.1 Telicity is neither sufficient nor necessary

First, consider example (6)[3]. This example illustrates that *zai* phrases can also combine with atelic imperfective predicates, like *for*-adverbials:

(6) Zai Zhang Xueliang bei ruanjin de shu shi nian li, shizhong
zai Zhang Xueliang PASS under house arrest LNK several ten year li always
peihu-zhe ta, zhongai-zhe ta. (CCL)
keep company-DUR PRO3SG love-DUR PRO3SG
'For the several decades that Zhang Xueliang was under arrest, (she) always kept him company and loved him.'

Furthermore, *zai* phrases are not compatible with all telic predicates, as is shown in (7). Sentence (7) sounds quite odd, although the telic situation of Lisi leaving took place within the time span of three hours, and therefore, the requirement of telicity proposed by previous studies is met.

(7) ??Zuotian zai Zhangsan chang ge de san ge xiaoshi li/nei, Lisi likai-le.
yesterday zai Zhangsan sing song LNK three CLF hour li/nei Lisi leave-PFV
Intended meaning: 'Yesterday, during the three hours that Zhangsan sang, Lisi left.'

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[2] The SigP is the significant point of a situation and is inferred (defeasibly for some situation types) from its situation type. (Wu, 2005:p.299) claims that 'The SigP of an achievement is its natural final endpoint. The SigP of an accomplishment is, by default, its natural final endpoint. The SigP of an activity is underspecified and an appropriate linguistic context can impose a SigP on an activity. The SigP of a stage-level state is its starting point and the SigP of an individual-level state is undefined.' The sign '<' represents the part-of-relation and '≺' means temporal precedence.

[3] This sentence is taken from the Center for Chinese Linguistics PKU (CCL) online corpus: ccl.pku.edu.cn:8080/ccl_corpus/.

These sentences are counter-examples to the existing proposals that claim that telicity is a sufficient and necessary condition for the felicity of sentences containing *zai* phrases.

2.2.2 Temporal inclusion is not required

While we agree with Wu (2005) and Peck (2011) that *zai* phrases locate the eventualities in a similar way to what is done by frame adverbial phrases, we do not agree with them on the condition of temporal inclusion between the eventuality and the interval. It may well be the case that the temporal trace of the eventuality denoted by the main clause is shorter than the interval introduced by the *zai* phrases, but this is by no means always the case, cf. (6). The states of keeping company and loving Zhang Xueliang at least fully overlap the interval denoted by the *zai* phrase, and can even exceed it.

2.2.3 *Zai* phrase is not directly related to the event time

From the proposal that a *zai* phrase corresponds to an *in*-adverbial in English (Xiao and McEnery, 2004), and from the semantic representation provided by Wu (2005), it follows in either case that a *zai* phrase measures the event time of the situation denoted by the main clause. In this section, we discuss three pieces of evidence against this proposal.

First, consider sentence (8). When the atelic verb *guancha* 'observe' is modified by the perfective marker experiential *-guo*[4], the duration of the situation of observing that frog must be shorter than the duration of two hours specified by the *zai* phrase. This provides evidence that the *zai* phrase does not directly measure the run time of the eventuality denoted by the main clause.

(8) Zai shang shengwu ke de liang ge xiaoshi li, Lisi guancha-guo na zhi qingwa.
zai follow biology course LNK two CLF hour li Lisi observe-EXP DEM CLF frog
'During the two hours that Lisi followed the biology course, he had the experience of observing that frog.'

Second, compare (9) with (10). In both sentences, there is a post-verbal measure DP *ershi fenzhong* 'twenty minutes'.

(9) *Lisi liang ge xiaoshi guancha-le na zhi qingwa ershi fenzhong.
Lisi two CLF hour observe-PFV DEM CLF frog twenty minute

(10) Lisi zai shang shengwu ke de liang ge xiaoshi li, guancha-le na zhi qingwa ershi
Lisi zai follow biology course LNK two CLF hour li observe-PFV DEM CLF frog
twenty minute
'During the two hours that Lisi followed the biology course, he observed that frog for twenty minutes.'

[4] It is well established in the literature that the perfective marker experiential *-guo* has the repeatability property. Hence, it cannot occur with once-only predicates such as *si* 'die', see (i).

(i) *Lisi si-guo.
Lisi die-EXP

As a quantificational phrase (Paris 1988; Huang 1998), the post-verbal measure DP applies directly to the eventuality of observing that frog. The unacceptability of sentence (9) indicates that a real pre-verbal measure DP cannot co-occur with a post-verbal measure DP in the same clause. This incompatibility can be explained by saying that an event cannot be measured by two independent measure DPs. On the contrary, we note that a *zai* phrase is compatible with the same temporally measured event, see the fully acceptable example (10). This supports our view that a *zai* phrase has different functions from a real pre-verbal measure phrase in (9). That is why the co-occurrence restriction does not apply to it. Our view is also distinct from what was proposed by Peck (2011) who claims that both *zai* phrases and pre-verbal measure DPs have the same denotation, despite the different forms.

Last, as measure phrases are non-referential, they cannot take modifiers such as restrictive relative clauses, as illustrated by (11) and (12), which contain a post-verbal measure DP and a pre-verbal measure DP respectively. However, it is shown in (13) that a restrictive relative clause can modify the measure DP in a *zai* phrase.

(11) Zuotian, Lisi xuexi-le (*Zhangsan gongzuo de) si ge xiaoshi.
yesterday Lisi study-PFV Zhangsan work LNK four CLF hour
'Lisi studied four hours yesterday.'

(12) Qu nian, Lisi (*Zhangsan gongzuo de) liang ge xingqi xie-le yi pian xiaoshuo.
last year Lisi Zhangsan work LNK two CLF week write-PFV one CLF novel
'Lisi wrote a novel in two weeks last year.'

(13) Lisi zai Zhangsan gongzuo de liang ge xingqi li xie-le yi pian xiaoshuo.
Lisi zai Zhangsan work LNK two CLF week li write-PFV one CLF novel
'Lisi wrote a novel during the two weeks that Zhangsan worked.'

The relative clause in (13) conveys information that identifies the particular interval denoted by the constituent it modifies. This provides new evidence that a *zai* phrase is different from real measure phrases that apply directly to the run time of the events denoted by the main clauses.

To sum up, we have shown that *zai* phrases do not work as measure phrases that measure the run time of the events denoted by the main clauses, unlike bare measure DPs either in pre-verbal position or in post-verbal position. This being said, *zai* phrases cannot be treated in the same way as *for*-adverbials or *in*-adverbials in English – both of which function as measures of eventualities (Kamp and Reyle 1993), although in some cases, they indeed seem to measure the duration of atelic situations cf. (2a) or telic situations, cf. (2b). Therefore, we are going to propose a different analysis from Klipple (1991), Xiao and McEnery (2004) and Wu (2005) who claim that a *zai* phase applies to the temporal trace of the event described by the main clause.

2.2.4 *Zai* phrase is not a simple temporal frame adverbial

As discussed above, *zai* phrases do not directly measure the run times of the events denoted by the main clauses. Rather, they resemble temporal frame adverbials, playing the role of locating the event. Presumably, this similarity is the reason why *zai* phrases have been frequently analyzed as *in*-adverbials in the literature. *In*-adverbials also sort of locate the event, because the duration of the telic situation cannot exceed the duration stated by the *in*-adverbial. However, we

contend that a *zai* phrase cannot be treated as a simple temporal frame adverbial.

On the one hand, note that *zai* phrases cannot locate all types of events, which is different from other temporal frame adverbials. If we compare (7) with (14), we see that a *zai* phrase cannot locate the Lisi-leaving-event in time, as (7) is unacceptable. However, the same event can be located by the temporal frame adverbial *zai...de shihou* 'when...'.

(14) Zuotian zai Zhangsan chang ge de shihou, Lisi likai-le.
yesterday zai Zhangsan sing song LNK moment Lisi leave-PFV
'Yesterday, Lisi left while Zhangsan was singing.'

On the other hand, different grammatical aspect markers can also affect the possibility of locating the situations via a *zai* phrase. Specifically, it is shown by (8) that a *zai* phrase can locate the event of observing that frog, when experiential *-guo* indicates that it is terminated. However, the *zai* phrase cannot locate the same type of event when it is terminated by the other perfective marker verbal *-le*, cf. (15):

(15) *Lisi zai shang shengwu ke de liang ge xiaoshi li guancha-le na zhi qingwa.
Lisi zai follow biology course LNK two CLF hour li observe-PFV DEM CLF frog
Intended meaning: 'During the two hours that Lisi followed the biology course, he observed that frog.'

Finally, notice that another temporal frame adverbial *zuotian* 'yesterday' can easily locate the same event when the latter is terminated by the aspectual marker verbal *-le*, e.g. (16). This variation in acceptability again cannot be accounted for by simply stating that the *zai* phrase is a temporal frame adverbial.

(16) Zuotian, Lisi guancha-le na zhi qingwa.
yesterday Lisi observe-PFV DEM CLF frog
'Lisi observed that frog yesterday.'

The next section will bring in previously unnoticed examples and will provide evidence that the event described by the main clause can be positioned within the interval introduced by the *zai* phrase or cover it. Therefore, the two temporal relations of covering and inclusion are needed to describe the data.

3 New data

In the literature on *zai* phrases mentioned above, the attention has mostly focused on the difference between activity situations and accomplishment situations, and only the perfective marker verbal *-le* has been considered, e.g. (3) and (4). This could be a reason why researchers have underscored the telicity and perfectivity constraints on the functioning of *zai* phrases, claiming that *zai* phrases combine only with telic predicates and that the eventuality described must be included in the time span. However, as was shown in Subsections 2.2.1 and 2.2.2, these two constraints are neither necessary nor sufficient for correctly predicting the distribution of *zai* phrases.

In this section we will present some new data in order to provide a more complete picture of

the distribution of *zai* phrases. We will investigate the interaction between different aspectual situations and the temporal *zai* phrase by taking into account the influence of different grammatical aspect markers. The full set of data will show that the interval introduced by a *zai* phrase is related to the event time of different aspectual situations. The hypothesis that we will defend is that a *zai* phrase identifies the (sub)interval of topic time.

Before going into details, we clarify that we are not going to discuss cases that are ruled out independently from the presence of a *zai* phrase. For instance, stative verbs are incompatible with verbal *-le* even in the absence of a *zai* phrase (17). Therefore, we will not deal with cases where these sentences combine with *zai* phrases.

(17) *Women baochi-le lianxi.
PRO1PLU keep-PFV contact

The combinatorics of *zai* phrase is provided in table 1, which is organized in terms of the temporal relations imposed by grammatical aspect. To the best of our knowledge, the situation in all its facets as collected in table 1 had not been taken into consideration by the previous literature.

SITUATION TYPES		perfective markers		imperfective markers	
		verbal *-le*	experiential *-guo*	durative *-zhe*	progressive *zai*
states			✓	✓ (6)	
activities		✗ (3)	✓ (8)		✓ (2a)
accomplishments		✓ (2b)	✓		✓ (20)
achievements	leave type	✗ (7)	✓		
	suspend type	✓ (22)	✓ (44)	✓	

Table 1: The combinatorics of *zai* phrases

The empty boxes correspond to cases that are out whether or not *zai* phrases are there, and we will not comment on them further. The check marks mean that the sentences containing these aspect markers and *zai* phrases in the boxes are grammatical. The crosses concern sentences containing relevant markers and disallowing the modification of *zai* phrases. The numbers correspond to the numbers of the relevant examples contained in this paper.

3.1 Perfective contexts

Following Smith (1991, 1997) and Klein (1994), we assume that in perfective contexts, the event time is included in the topic time. There are two perfective markers in Mandarin Chinese, namely verbal *-le* and experiential *-guo*. The formalization of perfective aspect in general, is provided in (18) by Lin (2003) (following Kratzer (1998)), where t_2 represents the topic time and τ stands for the temporal trace function that applies to an event and returns the interval corresponding to the interval during which it unfolds.

(18) Perfective aspect=: $\lambda P_{<s,t>} \lambda t_2 \lambda e[\tau(e) \subseteq t_2 \wedge P(e)]$ (Lin, 2003)

All the predicates[5] in the sentences that instantiate the boxes on the left half of the table 1 denote eventualities that are included in the interval to which the *zai* phrase refers, because of prefectivity. The predictions made by previous studies split the half-table in quadrants. They say that all the sentences corresponding to the top-left quadrant are problematic because of the presence of atelic verbs, and all the sentences corresponding to the bottom-left quadrant are acceptable because the predicates describe events with telic points. But the situation is more complex. First, consider the sentences that contain verbal *-le*. As we have mentioned previously, (3) and (4) show that *zai* phrases do not combine with atelic predicates but combine with telic predicates. These cases are correctly accounted for by previous studies. However, notice that a *zai* phrase is not compatible with all achievements, cf. (7), and this was not predicted by the previous work. Moreover, if we examine data concerning experiential *-guo*, the situation is that all aspectual classes can combine with *zai* phrases when this marker is present. This fact also challenges the previous studies and further explanation is necessary. We come back to it in Section 4.

3.2 Imperfective contexts

As is standardly assumed, the imperfective aspect requires that the event time covers the topic time. This is captured by the semantic representation in (19).

(19) Imperfective aspect=: $\lambda P_{<s,t>} \lambda t_2 \lambda e[t_2 \subseteq \tau(e) \wedge P(e)]$ (Lin, 2003)

There are several ways to construct an imperfective context in Mandarin Chinese. The most evident one is to resort to imperfective markers. There are two imperfective markers, namely durative marker *-zhe* and progressive marker *zai*.

The right hand side of the table shows that *zai* phrases can appear in sentences containing both imperfective markers and lead to grammaticality. In these cases, the event time of the situation described by the main clause at least covers the topic time introduced by *zai* phrases. For instance, when a telic accomplishment predicate is modified by the progressive marker, as in (20), it is the process phase leading to the culmination that overlaps the interval the *zai* phrase refers to, cf. (20).

(20) Zai Zhangsan gongzuo de liang ge xingqi li, Lisi zai xie yi pian xiaoshuo.
zai Zhangsan work LNK two CLF week li Lisi PROG write one CLF novel
'Lisi was writing a novel during the two weeks that Zhangsan worked.'

In addition to imperfective markers, imperfective contexts can be obtained in two other ways. First, some achievements are modified by verbal *-le*, and the resultant state obtained may also overlap the temporal span introduced by a *zai* phrase. Take the verb *ting* 'suspend', for instance, an achievement verb. Sentence (21) shows that it is incompatible with the progressive marker *zai*:

[5] We temporarily leave out the case of the achievement verb ting 'suspend' modified by verbal *-le*. We come back to it later.

(21) *Xuexiao zai ting tiyu ke.
school PROG suspend sport lesson

In the grammatical sentence (22) that contains the verb modified by verbal *-le* and the *zai* phrase, it is not that the telic situation of suspending the sports lessons is included in the temporal interval of two days, the available reading we get is rather that the resultant state of suspending the sports lessons covers the time span of two days.

(22) Zai tiyu laoshi bu zai de liang tian li, xuexiao ting-le ge ge nianji de tiyu ke
zai P.E. teacher NEG present LNK two day li school suspend-PFV each CLF grade LNK sports lesson
'During the two days that the P.E. teacher was absent, the school suspended the sports lessons of all grades.'

Second, the geometry of an imperfective context is also available when one negates the predicates. It has already been shown above that when verbal *-le* combines with the achievement verb *likai* 'leave', the whole clause is incompatible with *zai* phrases. However, the combination becomes acceptable when negation is added, as (23) illustrates. In such a case, the situation of absence of leaving events by Lisi fully overlaps the topic time.

(23) Zuotian zai Zhangsan chang ge de san ge xiaoshi li/nei, Lisi meiyou likai.
yesterday zai Zhangsan sing song LNK three CLF hour li/nei Lisi NEG leave
'Yesterday, during the three hours that Zhangsan sang, Lisi did not leave.'

Accordingly, we may conclude that *zai* phrases appear in all imperfective contexts.

3.3 The temporal relation expressed by grammatical aspect

Up to here, the data summarized in Table 1 contradicts 'some' of the clear cut predictions of the previous proposals. Indeed, the portion of the table that reports on acceptable sentences is not restricted to the bottom left quadrant. Moreover, no quadrant is entirely in or entirely out, rather counter-examples are found in each of them. The empirical data cast doubt on the relevance of a characterization cast exclusively in terms of telicity and perfectivity constraints.

The aspectual markers that have been discussed in Table 1 control two types of relations between the temporal trace of the eventuality introduced in the main clause and the interval, i) a relation of inclusion, imposed by perfective markers; and ii) a covering relation, which can be contributed by imperfective markers, by perfective verbal *-le* in combination with some achievements and also by negating the predicates. Table 1 indicates that although both inclusion relation and covering relation satisfy the truth condition imposed by the post-position *li/nei* 'in' contained in *zai* phrases, it is not true that all sentences meeting these temporal constraints can be modified and yield acceptable sentences.

By considering cases where the temporal relation of inclusion is involved, namely the left half of the table, we observe that the temporal inclusion is not sufficient to warrant the felicity of

constructions containing *zai* phrases, cf. the crosses. It follows that referring to the temporal location is not enough to account for the properties of *zai* phrases. As a result, we cannot treat *zai* phrases as a mere frame adverbial phrase, as is proposed by Peck (2011). On the contrary, sentences corresponding to cases on the right half of table 1 are grammatical. This means that the temporal covering relation is a sufficient condition for combining with *zai* phrases and yielding grammatical sentences. Building on this ground, we are going to put forward an analysis for *zai* phrases that is compatible with all these temporal relations of overlap and inclusion.

4 A new account – transforming the coverage from temporal to informational

4.1 A Thematic temporal interval

We have pointed out that *zai* phrases can never be understood as applying to the event described by the main clause, contrary to what is the case for other adjunct temporal measure phrases, recall examples (11) and (12). In this section, we plan to establish the role of a *zai* phrase as an expression referring to a temporal interval. Data are provided on two specific issues. First, it is shown that a *zai* phrase introduces a new referent in the form of a temporal interval, which is specific in most cases but not necessarily known. Second, this interval is shown to act as the topic time of the clause.

4.1.1 Reference to a specific interval

We assume that a *zai* phrase introduces a temporal interval as an entity that is independently identified. In other words, the temporal interval is not directly related to the run time of the event described by the main clause.

When examining attested data from CCL, we noticed that *zai* phrases are often modified by a restrictive relative clause, as is illustrated in (6), or a deictic modifier, as shown in (24). These modifiers make it clear that we are dealing with expressions that introduce an interval that is autonomously identified, instead of a duration that needs to be saturated by an event predicate so as to denote an interval, cf. pre-verbal and post-verbal measure DPs.

(24) Zai guoqu shi tian li, Youjin ke zhen chedi gaibian-le ta de shenghuo de
zai past ten day li Youjin yet really completely change-PFV PRO3SG LNK life
LNK jincheng. (CCL) process
'During the past ten days, Youjin did change his life process completely.'

Notice that the whole *zai* phrase denotes a specific interval,[6] even when the measure DP contained in a *zai* phrase is 'bare'. The first reason for specificity is illustrated by the data in (25). The interval to which the *zai* phrase refers, gets a specific reading because of the preceding

[6] The only exception we are aware of is cases when the interval is taken on the future. *Zai* phrases may be interpreted as denoting non-specific intervals in examples such as (26) for some speakers.

context. The interval of ten years refers to the duration of the event of their building fortification.

(25) Tamen xiu-le shi nian. (Zai) shi nian li, tamen ba zhualai xiu gongshi de
PRO3PL build-PFV ten year zai ten year li PRO3PL BA catch build fortification LNK
mingong quanbu mimi shahai. (CCL)
labourer all secretly kill
'They built for ten years. During those ten years, they secretly killed all the labourers who had been caught to build fortifications.'

The translation of a *zai* phrase in (25) requires a little comment for non-native speakers. In (25), the *zai* phrase is anaphoric, so it is translated as 'in those ten years'. However, notice that it is not appropriate to assume that the Chinese *zai* phrase corresponds to the *demonstrative+measure DP* in English under all circumstances. Specifically, the use of the demonstrative in the English expression legitimates the inference that the reference is known to both the speaker and the hearer. On the contrary, the Chinese expression by itself does not come with an assumption of knowledge on behalf of the hearer. In order to convey the specificity import of the *zai* expression in Chinese, in general, one valid way of translating it into English is by using the expression 'in *n* particular time'.

Second, compare a sentence containing a *zai* phrase (26) with one containing a bare measure DP (27). The interval of three days denoted by the *zai* phrase in (26) is interpreted as being specific and starting at speech time. On the contrary, the positioning of the beginning of the interval measuring 'three days' in a sentence without a *zai* phrase is less strictly defined, as it can start at speech time or somewhere later, cf. (27). It is not interpreted specifically.

(26) Wo zhunbei zai san tian nei kan-wan yi ben shu.
PRO1SG plan zai three day nei read-finish one CLF book
'I plan to finish reading one book in three days.'
(27) Wo zhunbei hua san tian kan-wan yi ben shu.
PRO1SG plan spend three day read-finish one CLF book
'I plan to spend three days to read one book.'

4.1.2 Specifying the topic time

Having established that *zai* phrases introduce intervals and that the intervals are specific, we now turn to their temporal role.

Given that *zai* phrases do not measure the event time of situations, we propose that they specify the topic time of the utterance or a subinterval of it. In what follows, we endeavour to show that *zai* phrases are different from other temporal adverbials that also refer to the topic time. We assume that this is due to the components that constitute *zai* phrases.

First, look at (28). The *zai* phrase in this sentence is composed of an optional preposition *zai* 'at', a measure DP *liang ge xingqi* 'two weeks' and a post-position *li/nei* 'in'. Due to the post-position *li/nei* 'in', the interval introduced is a completely bounded interval that has a well-defined beginning and end, and the measure DP two weeks specifies the duration of this bounded interval. Moreover, the post-position *li/nei* 'in' requires the eventuality (or at least part of the eventuality) described by the main clause be included in the interval introduced by the *zai*

phrase. In this way, *zai* phrases resemble frame adverbial phrases (Bennett and Partee, 1972). But they differ from temporal frame adverbials that contain other post-positions, such as *zai liang ge xingqi qian* 'before two weeks' in (29) and *zai liang ge xingqi hou* 'after two weeks' in (30).

(28) Lisi (zai) liang ge xingqi li/nei xie-le yi pian xiaoshuo.
Lisi zai two CLF week li/nei write-PFV one CLF novel
'Lisi wrote one novel in two weeks.'
(29) Lisi (zai) liang ge xingqi qian xie-le yi pian xiaoshuo.
Lisi zai two CLF week before write-PFV one CLF novel
'Lisi wrote one novel two weeks ago.'
(30) Lisi (zai) liang ge xingqi hou yao xie yi pian xiaoshuo.
Lisi zai two CLF week after MODE write one CLF novel
'Lisi will start to write one novel in two weeks.'

Due to the post-positions *qian* 'before' in (29), and *hou* 'after' in (30), the intervals denoted by these temporal adverbials are only partially bounded. Specifically, *zai liang ge xingqi qian* 'before two weeks' introduces a half-open interval whose left boundary is unspecified and whose right boundary corresponds to the beginning of the interval of two weeks that terminates at speech time. It is the other way around for *zai liang ge xingqi hou* 'after two weeks'. Although the event of writing one novel is located within the intervals introduced by these temporal adverbials, as with *zai* phrases, the intervals in question are half-open, unlike the bounded interval denoted by a *zai* phrase. Furthermore, notice that the measure DPs in these temporal adverbials (29)-(30) do not specify the duration of the intervals as they do in the case of *zai* phrases, for one obvious reason, which is that the intervals are not completely bounded.

Second, *zai* phrases differ from other temporal adverbials that also function as topic time but do not require that eventualities described by main clauses must be located within the intervals introduced by them. Compare (31) with (32):

(31) Zai Lisi changge de shihou, Zhangsan yijing xie-wan zuoye le.
zai Lisi sing LNK moment Zhangsan already write-finish homework PTCL
'Lisi had already finished his homework when Zhangsan was singing.'
(32) *Zai Lisi changge de shi fenzhong li, Zhangsan yijing xie-wan zuoye le.
zai Lisi sing LNK ten minute li Zhangsan already write-finish homework PTCL
Intended reading: 'During the ten minutes that Lisi sang, Zhangsan had already finished his homework.'

In (31), the when-clause introduces the topic time. In the presence of the temporal adverb *yijing* 'already' that serves to place the event prior to the reference point, i.e. (31), the event of Zhangsan finishing writing his homework is located before the interval specified by the topic time. However, the same event cannot be located in the same manner in the sentence (32) that contains a *zai* phrase, in spite of the presence of *yijing* 'already'. Therefore, we conclude that it is the post-position *li/nei* that imposes the constraint that the eventuality (or part of the eventuality) be located within the interval introduced by the *zai* phrase. This strengthens our claim that *zai* phrases differ from other temporal adverbials that also refer to topic time but do not impose such an 'overlapping' restriction.

Last, we draw the reader's attention to the fact that the measure DPs provide a specific duration for the time span to which *zai* phrases refer. This sets them aside from other temporal expressions denoting topic time. Let us compare (15) with (33):

(33) Zai shang shengwu ke de shihou, Lisi guancha-le na zhi qingwa.
zai follow biology course LNK moment Lisi observe-PFV DEM CLF frog
'Lisi observed that frog when he followed the biology course.'

Both the *zai* phrase in (15) and the temporal subordinate clause in (33) introduce the topic time within which the event of observing that frog is located. Nevertheless, only sentence (33) containing a temporal subordinate clause, is acceptable. In this case, the duration of the topic time is not specified, in contrast to sentence (15), where there is a *zai* phrase.

4.1.3 *Zai* phrase at the syntax-semantics interface

Let us sketch out how our proposal that the *zai* phrase, which restricts topic time can be spelled out at the syntax-semantics interface

First, recall the key semantic notions that we have used. Following much of the prior literature, we assume that topic time is the reference time; it is the time interval under discussion (Reichenbach 1947; Klein 1994). Event time is the duration of the situation. The relation of the topic time and event time is determined by the requirements of the aspect markers. Finally, tense orders the topic time and the utterance time, which is the evaluation time of the matrix clause.

Second, these semantic notions find their way into the syntactic structure in the following way. The *v*P constituent contains the verb and its arguments, that corresponds to the event description. Hence, the argument of the event predicate P, namely the event variable is introduced. Grammatical aspect projects a functional projection AspP. The Aspect head takes as its argument the predicate of events P, contributed by the *v*P which is the complement of AspP. The aspect introduces a lambda operator that binds a temporal variable, whose value will be contributed by the tense node T of the tense function TP. The tense head functions as a temporal anaphora, referring to the topic time of the sentence. Thus, the Aspect head returns a relation holding between an event e and a time t', as proposed by Klein (1994), Thompson (1996, 2005), Kratzer (1998) and subsequent work. Furthermore, the relation imposed by the Aspect head holds if and only if a particular topological relation holds between the event time of e, i.e. the temporal trace of the event, and t'. The perfective aspect requires that the event time $\tau(e)$ is contained in the topic time t'. Similarly, imperfective aspect requires that the event time $\tau(e)$ contains the topic time t'. Finally, tense constrains the reference of the T-head by imposing a relation between topic time and utterance time. For example, past tense requires topic time to precede utterance time.

Third, how can we integrate *zai* phrases in this sentential structure? We see two possibilities. The first is to treat the *zai* phrase as a modifier that takes the aspectual projection as an argument and returns a temporal relation with additional constraints on t', not in terms of ordering but of identification. Because of its function of topic time modifier, it is required to occur high in the tree. Another option could be to assume, following Roberts (1995) and von Fintel (1994), that a

tense is adjoined to a domain restriction variable C_n intended to capture reference time effects. In this case, the *zai* phrase is C_n.[7]

4.2 Satisfying the truth condition of post-position *li/nei* is not sufficient

What we have shown is that *zai* phrases autonomously denote an interval that belongs to somewhere on the time line, and is made referentially accessible in the discourse. This being said, a *zai* phrase does not measure the run time of the event denoted by the main clause, unlike pre-verbal and post-verbal temporal measure DPs. We claim that *zai* phrases as a whole introduce the topic time or a sub-interval of it. Therefore, they do not need to resort to other temporal adverbials to locate events. This is different from real measure phrases that do not specify topic time. Localization of the measured eventuality must be performed by other temporal adverbials such as *zuotian* 'yesterday' in (11), and *qu nian* 'last year' in (12), which cannot be omitted without loosing localization information.[8] A *zai* phrase measures its duration via the measure DP within it. When the measure DPs contained in *zai* phrases are modified by a restrictive relative clause, they directly measure the event described by this relative. This shows that this DP indeed is a measure phrase that specifies the length of topic time, but the whole *zai* phrase is not.

However, we have argued that *zai* phrases behave differently from other temporal adverbials that also specify the topic time. Specifically, the measure DP makes the duration of the topic time specific. Moreover, the presence of the post-position *li/nei* 'in' requires that the eventuality (or part of the eventuality) described by the main clause take place within the time span to which *zai* phrases refer to. This requirement provides truth conditions relevant for the evaluation of the whole construction. In this sense, they resemble frame adverbial phrases. But the construction of *zai* phrases is not limited to the satisfaction of temporal relations. Sentences such as (7) are unacceptable despite the fact that the temporal-aspectual constraints are met.

The temporal relations are satisfied when the eventuality (or part of the eventuality) is asserted to take place within the temporal interval introduced by *zai* phrases. In other terms, if no part of the eventuality denoted by the main clause takes place in the temporal interval, the truth condition imposed by the post-position *li/nei* 'in' cannot be satisfied, cf. (32). Notice that it is also this temporal constraint conveyed by *li/nei* 'in' that matters for evaluating truth in the 'temporal framing' sense.

Table 1 shows that we have acceptable cases on every quadrant. We conclude that the distribution of *zai* phrases cannot be exclusively characterized in temporal terms. Temporal inclusion is neither a sufficient nor a necessary condition for the felicity of sentences containing *zai* phrases. On the contrary, the temporal covering relation constitutes a sufficient condition, but not a necessary one. By enriching the relation with some informational import, we aim at predicting the unacceptability of (7), and the varying acceptability of data such as sentences containing quantificational and focus expressions discussed in Section 4.4.

[7] For the sake of readability, we leave aside intensional concerns.

[8] Recall that Chinese does not express tense information on the verb; for instance, with inflectional morphology.

4.3 A pragmatic component

The *zai*-phrase introduces a temporal interval as an entity that is the informational starting point of the clause and about which one can comment. In this respect, the expression constitutes the theme in the Hallidayan sense.

We observe that *zai* phrases share some prototypical semantic attributes of topic, as proposed by Jacobs (2001). The first property is informational separation. Specifically, the entity introduced by a *zai* phrase is separated from what is said about the entity, namely the main clause. Second, the referent of the address denoted by a *zai* phrase is identifiable. Last, a *zai* phrase sets a temporal frame within which the main clause holds. We thus propose that the construction instantiating a *zai* phrase encodes a specific information structure. The interval is not only a subset of topic time, but is also the topic of the construction, in line with Bittner (2013). The main clause provides event information as the comment for such an interval. The topic-comment structure matters for the relevance of the main clause in characterizing the temporal interval introduced by the *zai* phrase.

As we have mentioned at the end of the preceding section, temporal inclusion (cases with perfective markers) is not sufficient for characterizing the interval despite the fact that it meets the truth conditions of the post-position *li/nei* 'in' in the construction. On the contrary, satisfying the temporal coverage (cases commonly concerning imperfective markers) uniformly provides a relevant characterization for the interval. In the following, we will provide a unified proposal to cover the data that are unaccounted for in terms of the temporal covering.

We propose that sentences with *zai* phrases instantiate constructions associated with the conventional implicature in (34). What is indicated and implicated, but not explicitly said, by the sentence with the particular structure instantiated by a sentence modified by a *zai* phrase, is that there isn't anything to add to the main clause that is relevant for the characterisation of the temporal interval, i.e. that everything that is relevant is said in the main clause.

(34) **Conventional Implicature triggered by the *zai* phrase**
The main clause contributes information that is maximally relevant for the characterization of the interval denoted by the *zai* phrase as a whole.

We expressed the requirement triggered by the *zai* phrase as a conventional implicature because such a requirement is encoded in the construction but its truth or falsity has no effect on the content asserted by the clause. Recall the way Potts (2014) renders proposals by Grice (1975) and Horn (2007):

(35) Meaning *p* is a conventional implicature of phrase S if, and only if:

a) *p* is a conventional (encoded) property of a lexical item or construction in S
b) *p* is entailed by S
c) *p*'s truth or falsity has no effect on the at-issue content of S

In the case at hand, *p* is (34). The conventional properties of the construction with *zai* phrases are characterised by conditions (a) and (c) of (35). As Potts notes, condition b) would enable the implicature to pick out everything that is independent of the at-issue content, but this is not always the case given that the category of conventional implicatures is not homogeneous. The

reason Potts separates (a) and (b), contra Horn, is that words and constructions might have conventional properties that are nonetheless not entailed. Pott's work on connotations offers examples of such meanings.

4.4 Testing the predictions

Consider the construction containing *zai* phrases. The at-issue content of the whole construction is verified in terms of temporal relation. The content asserted by the sentence is true if either temporal inclusion or temporal covering is satisfied. In other words, if no part of the eventuality overlaps the interval, the content asserted by the sentence is false, cf. (32). However, satisfying the truth condition imposed by the at-issue content does not uniformly guarantee the felicity of the whole construction, because the conventional implicature enriches the meaning of the temporal relation. The relation is verified in terms of informational coverage, namely the maximally relevant description for the interval. The implicature can model both temporal relations. We look at differences in the way the main clause can provide information as the comment for the interval.

On the right half of Table 1, that regards the imperfective contexts, the temporal covering is satisfied and so is the truth-condition part of the post-position *li/nei* 'in'. The event description is maximally informative *per se* for the interval because of the temporal coverage. In this way, the informational coverage is satisfied by default.

On the left half of Table 1, that involves perfective contexts, the temporal covering is not met, because the eventuality is included in the interval. One can find both acceptable and unacceptable combinations. Cases are fine if they satisfy the informational coverage requirement, namely that the main clause provides an event description that is maximally informative for characterizing the interval. The informational coverage can be satisfied when the duration of the actual eventuality matches the duration of the interval. If not, the main clause must enable one to build a higher order predicate that is understood to meaningfully characterise the interval in the context. We will discuss different cases in more detail in the following.

Case 1 – telic predicates

As has been pointed out previously, the *zai* phrase can go with an accomplishment predicate that is modified by a perfective marker such as verbal *-le*, e.g. (28). In this perfective context, the event of writing one novel is included in the interval of two weeks. However, temporal inclusion is not sufficient. In principle, the temporal trace of the event could be a lot shorter than the interval. As a matter of fact, the duration of the writing process that leads to the culmination point must correspond more or less to two weeks. Otherwise, the sentence is used infelicitously for describing the situation. Again, this confirms our analysis that maximal description must be satisfied.

The picture is more complicated with respect to achievement predicates, for they represent quasi-instantaneous events, which *per se* cannot provide a maximal description for the interval introduced by the *zai* phrase. All achievement verbs do not behave in a uniform manner regarding whether they can co-occur with *zai* phrases. Their compatibility with *zai* phrases is determined by whether or not they possess a relevant preparatory phase leading to the telos. Examine sentence (36). The event of winning the tennis match is punctual and it is the process of

playing the match that covers maximally the interval of three hours. In the reading available, the telos of winning the match is attained at the end of three hours.

(36) Zuotian zai Zhangsan xuexi de san ge xiaoshi li, Lisi ying-le wangqiu bisai guanjun.
yesterday zai Zhangsan study LNK three CLF hour li Lisi win-PFV tennis match champion
'Yesterday, during the three hours that Zhangsan studied, Lisi won the tennis match.'

However, an achievement predicate like *likai* 'leave' does not co-occur with a *zai* phrase, cf. (7). We assume that the preparatory phase that is associated with the culmination point of *likai* 'leave' is barely standardized, unlike in the case concerning *ying bisai* 'win the match'. It follows that there does not exist a conventionalized process that can be easily evoked as the depiction of the interval introduced by *zai* phrases in a maximal way.

To sum up, when the telic predicates are modified by the perfective marker verbal *-le*, the telos of the telic situations must coincide with the final point of the interval introduced by the *zai* phrase, for the latter to occur in the sentence. Moreover, the existence of the process must be conventionalized, so as to be evoked as providing a maximal characterization for the interval. Since atelic situations lack natural endpoints, they can terminate at any moment on the interval denoted by *zai* phrases. There is thus no guarantee that the temporal interval can be maximally covered. As to some achievement predicates like *likai* 'leave', their lack of conventionalized preparatory processes also makes them unsuitable for providing a maximal coverage to the interval.

Case 2 – plurality of events

When there is a plurality of discrete events, a new more tolerant version of the predicate is built. This 'tolerant' predicate neglects the gaps existing between the events, provided the plurality somewhat spreads over the interval. Relevant cases are (i) when there is an expression defining a rate (37) or the sentence is habitual; or (ii) when a quantifier is present (38). Compare (7) with (38):

(37) Zai shang shengwu ke de liang ge xiaoshi li, Lisi mei ershi fenzhong guancha
zai follow biology course LNK two CLF hour li Lisi every twenty minute observe
na zhi qingwa yi ci.
DEM CLF frog one time
'During the two hours that Lisi followed the biological course, he observed that frog once every twenty minutes.'

(38) Zuotian zai Zhangsan chang ge de san ge xiaoshi li/nei, dabufen ren dou likai-le.
yesterday zai Zhangsan sing song LNK three CLF hour li/nei most person all leave-PFV
'During the three hours that Zhangsan sang yesterday, most people left.'

Note that the extent to which the newly built plural predicate tolerates the gaps depends on pragmatic considerations. If we compare (39), which is modified version of an example from Wu (2005), and (40), we see that these sentences denote plural telic events of winning five championships or smoking ten cigarettes that both take place over a temporal interval of three years. However, while the first sentence is perfectly fine, the second one sounds odd. Given a temporal interval of three years, it is much more reasonable that five occurrences of winning a championship take place in a nicely spaced-out way over this interval, than that ten occurrences

of smoking a cigarette are equally suitably spaced-out. The former type of event is expected not to occur as frequently as the second type of event based on our world knowledge, and a ratio of five events in three years is meaningful. In other words, differently from (39), in (40), there is a pragmatic mismatch between the length of the interval introduced by the zai phrase, i.e. three years, and the quantity of the cigarettes consumed during that period. The pragmatic mismatch disappears once the number of cigarettes consumed is more 'adjusted' to the length of the time span, for instance as in sentence (41).

(39) Ta sa nian nei ying-le wu ge yanjiang bisai de guanjun.
PRO3SG three year nei win-PFV five CLF speech contest LNK championship
'He won five speech contest championships in three years.'

(40) ??Ta san nian nei chou-le shi gen yan.
PRO3SG three year nei smoke-PFV ten CLF cigarette
'Intended meaning: He smoked ten cigarettes in three years.'

(41) Ta san nian nei chou-le shi tiao yan.
PRO3SG three year nei smoke-PFV ten bar cigarette
'He smoked ten bars of cigarettes in three years.'

Case 3 – temporally bounded predicates

This higher-order predicate may be the result from computing forms of restricted complements and judging the relative coverage with respect to that, e.g. taking the complement of the duration of eventualities that are temporally bounded by an overt measure DP.

Compare (15) with (10), repeated as (42) and (43). Both sentences are marked with the perfective marker verbal *-le*. Both events of Lisi observing that frog, and Lisi observing that frog for twenty minutes are included in the interval of two hours. However, only the sentence describing the temporally bounded event can contain the *zai* phrase:

(42) *Lisi zai shang shengwu ke de liang ge xiaoshi li guancha-le na zhi qingwa. (= (15))
Lisi zai follow biology course LNK two CLF hour li observe-PFV DEM CLF frog
'Intended meaning: During the two hours that Lisi followed the biology course, he observed that frog.'

(43) Lisi zai shang shengwu ke de liang ge xiaoshi li, guancha-le na zhi qingwa ershi
Lisi zai follow biology course LNK two CLF hour li observe-PFV DEM CLF frog
twenty fenzhong. (= (10)) minute
'During the two hours that Lisi followed the biology course, he observed that frog for twenty minutes.'

Although the event of observing that frog lasts for only twenty minutes, the information conveyed by the sentence in (43) allows us to calculate the duration of the absence of the situation of observing that frog. It is the sum of these two time spans that matches the length of the interval denoted by the *zai* phrase, and it is the predicate of observing that frog for twenty minutes that can say all that can be said in terms of frog observing for the interval of the *zai* phrase.

Case 4 – experiential *-guo*

Another option is to build a derived stative predication that covers the whole interval by means of experiential *-guo*. As shown in Table 1, all the predicates that are modified by experiential *-guo* are compatible with *zai* phrases, in spite of the differences of aspectual classes that they may show, once they are modified by experiential *-guo*. See (8) and (44):

(44) Zuotian zai Zhangsan chang ge de san ge xiaoshi li/nei, Lisi likai-guo.
yesterday zai Zhangsan sing song LNK three CLF hour li/nei Lisi leave-EXP
'During the three hours that Zhangsan sang yesterday, Lisi had the experience of leaving.'
(He came back afterwards.)

As has been noticed in the literature (Pan and Lee, 2004, Lin, 2007), experiential *-guo* forces a discontinuity effect. It requires the end of the eventuality to occur before the final boundary of the topic time. As for achievements, it is not only the event on its own, but also the resultant state that must be discontinued from the endpoint of the topic time. For instance, sentence (44) means that Lisi came back afterwards before the end of the interval denoted by the *zai* phrase. It is obvious that the duration of the leaving event, even the sum of the duration of leaving and the resultant state of being away, is shorter than the length of the interval introduced by the *zai* phrase. Therefore, it cannot be the event *per se* that provides a maximal description for the interval.

Following Smith (1994)'s work on experiential *-guo* in Mandarin Chinese and Schaden (2007)'s work on super-parfait in French, we propose that the experiential structure containing a *-guo* expresses a sort of perfect/consequent state of a resultant state. 'The experiential ascribes to a subject the property of having experienced the event' (Smith, 1994). It is this property of having experienced a particular type of event that covers the topic time introduced by the *zai* phrase and ensures a form of upward closure. The whole interval is thus covered by the perfect state although the event or the resultant state or the combination of both do not cover the whole interval.

Case 5 – focus particles

Yet another option is to build a derived predication by excluding alternatives via focus particles such as *jiu* 'only', contrast (7) with (45). In (45), *jiu* 'only' scopes over the subject Lisi.

(45) Zuotian zai Zhangsan chang ge de san ge xiaoshi li/nei, jiu Lisi likai-le.
yesterday zai Zhangsan sing song LNK three CLF hour li/nei only Lisi leave-PFV
'During the three hours that Zhangsan sang yesterday, only Lisi left.'

A leaving event is quasi-instantaneous, therefore, it is impossible that the leaving event maximally characterizes the interval of three hours. What is important is the presence of the focus particle *jiu* 'only'. With *jiu*, what is asserted by the sentence is that nobody else left during the relevant interval, and this is predicated of the whole interval.

5 Conclusion

In this paper, we have claimed that *zai* phrases introduce an interval that is independently identified and that can serve as a frame for locating the eventuality described by the main clause. The eventuality can fully overlap the interval or be located within it, dependent on the grammatical aspect markers in the main clause.

Characterising the relation between the interval denoted by the *zai* phrase and the eventuality contributed by the main clause purely in terms of temporal location is not sufficient for explaining the subtle differences in the data discussed in Section 4 in a unified manner. Rather, subtle judgements have more to do with the way the event occupies the interval. This has led us to propose an analysis that extends the overlap relation to all cases by modifying its nature from being purely temporal to being informational.

We have assumed that the main clause must provide a maximally informative description for the interval introduced by the *zai* phrase. It is this conventional implicature that triggers the construction of pragmatically relevant higher-order forms of predication, which are presented as maximally informative for the whole interval.

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