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## **Time with and without tense**

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How is temporal information conveyed in language? In languages with tense it is direct; without tense, inference allows the receiver to arrive at an indirect temporal interpretation. I will discuss tensed and tenseless languages, proposing a unified approach that applies to both. I show that a few very general pragmatic principles account for temporal interpretation, direct and indirect.<sup>1</sup>

I assume that understanding a sentence requires that the receiver locate an event or state, spatially and temporally: time is one of the basic coordinates for truth conditional assessment. Sentences in all languages convey information that allows us to determine the temporal location of the situation expressed. One would like to understand how this happens.

The pragmatic principles that I suggest constrain direct temporal interpretation and guide indirect. In languages with tense, tense gives direct temporal information; however certain apparent possibilities do not arise, due to the pragmatic constraints. In languages without tense, inference allows temporal interpretation. The key point in such languages

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<sup>1</sup> I would like to thank the audience at the Colloque for interesting questions and discussion. In this article I take the position that a language is tenseless if it does not have overt tense morphemes.

is that aspectual information guides temporal interpretation. Temporal adverbs are always optional; I am mainly concerned with temporal inference that occurs without them.

There are striking commonalities in the semantics of tensed and tenseless languages. I'll show that both tensed and tenseless languages require the notion of Reference Time, roughly as proposed by Reichenbach (1947), in addition to Speech Time and Event Time.

In section §1 of this article I introduce the background assumptions on which I rely, and the general ideas which inform the analysis. I propose three pragmatic principles and a classification of languages according to the way they express temporal information. In sections §2-4 I discuss temporal interpretation in English, a tensed language, and in several other languages including Mandarin Chinese and Navajo; §5 gives a formal sketch of the account in the framework of Discourse Representation Theory; §6 concludes.

## **§1. Background and principles**

§1.1 Background: I sketch very briefly the approach to temporal location and aspect that I will assume.

Temporal location: I take an approach based on Reichenbach 1947. Locating a situation in time linguistically involves three times and two relations. The times are Speech Time, the moment of speech; Situation Time, the time at which an event or state occurs or holds;<sup>2</sup> and Reference Time, the temporal standpoint or perspective from which

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<sup>2</sup> Reichenbach's term was 'Event Time'.

a situation is presented. Speech Time is related to Reference Time, and Reference Time to Situation Time, by the relations of simultaneity and sequence.

Aspect: Aspectual systems have two components, I assume, situation type and viewpoint (Smith 1991/7). The two components interact in the sentences of a language. This discussion focuses on aspectual information about boundedness, which as we will see allows temporal inference.

The notion of situation type is based on the categories proposed in Vendler (1967). Situation type indirectly classifies a clause as expressing a situation with certain internal temporal properties. There are three temporal features: Static-Dynamic, Telic-Atelic, Durative-Punctual. These features cluster in the situation type categories State, Activity, Accomplishment, Achievement, Semelfactive.<sup>3</sup> The labels are shorthand for clusters of features. The verb and its arguments convey situation type, together with adverbs. A clause is associated by rule with a temporal schema that gives its defining properties. Aspectual information is conveyed in all languages, so far as I know. The term 'situation' includes states and events; other terms are 'event structure' and 'eventuality' (Bach 19xx)

Telic events and punctual events are intrinsically bounded. The very notion of these events involves a set terminal point: telic events have a change of state or final natural endpoint and the single stage constitutes a bound for punctual events. The property of intrinsic bounding cuts across the situation type categories.

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<sup>3</sup> I have added the Semelfactive situation type to those originally proposed by Vendler (Smith 1991/7). The Semelfactive is implicit in his discussion of certain Achievements, single-stage, punctual events that do not involve a change of state.

The cluster of temporal properties that characterize the situation types are as follows: States are Static and Durative; Events are dynamic. Activities are Atelic, Durative; Semelfactives are Atelic, Punctual; Accomplishments are Telic, Durative; Achievements are Telic, Punctual.

Aspectual viewpoints make visible for semantic interpretation all or part of a situation. In the two-component theory all clauses have an aspectual viewpoint. Viewpoint is usually expressed by a morpheme associated with the verb. Perfective viewpoints make events visible as bounded, including endpoints. Bounds may also be stated independently with adverbial or other information (Depraetere 1995). Imperfective viewpoints make situations visible without information as to endpoints, unbounded. Neutral viewpoints are flexible, giving enough information to allow a bounded or an unbounded interpretation (Smith 1991/7). The neutral viewpoint appears in clauses without an overt viewpoint morpheme; I will call such clauses ‘zero-marked’, following Klein et al 2000.

Boundedness information may thus be conveyed by viewpoint and/or situation type. The boundedness of a situation determines the nature of its location at Situation Time. Bounded situations occur within the Situation Time interval: for instance, in *Mary walked to school* the event of walking occurs within the past interval talked about. Unbounded situations – ongoing events and states - overlap or surround the Situation Time interval, for instance, in *Mary was walking to school* the event extends beyond the interval talked about in the sentence.

(1) Bounded events (E) are included in the SitT interval:

SitT  $\subseteq$  E

(1a) Leigh built a sandcastle. John left.

Unbounded events and states (S) overlap the SitT interval:

E/S O SitT

(1b) John was working. Leigh was at school.

## §1.2 Pragmatic principles for temporal interpretation

I now turn to the pragmatic principles that underlie this account of temporal interpretation. They are familiar, though are not always invoked for this purpose. The first two, the Deictic Principle and the Bounded Event Constraint, are linguistic in nature; the third, the Simplicity Principle of Interpretation is quite general, applying to many different kinds of information.

Time is a single unbounded dimension that stretches indefinitely into the past and future. To locate events and states in time we need an orientation point. Prototypical linguistic communication provides it: the speaker is the center of linguistic communication, and Speech Time is the default orientation point. This is the Deictic Principle, basic to linguistic communication. Following the deictic principle we take Speech Time to be the Present, and locate other times with reference to Speech Time. The Past precedes, the Future follows. The pattern discussed here appears in discourse of many types. There are two other patterns: situations may be related to each other or to a previous time, as in narrative and description (Smith 2003).

The Deictic Principle locates situations with respect to Speech Time. The principle allows any type of situation to be located in the Past, Present, or Future (I use initial capitals for times, lower case for tenses). We do not locate all situations freely, however. There is a well-known constraint that involves the aspectual notion of boundedness. Bounded situations are discrete entities: they are closed, with an initial and final endpoint, or they are punctual. They cannot be neutrally located at Speech Time.<sup>4</sup> Situations in the Present must be open and unbounded, without endpoints: they include ongoing events

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<sup>4</sup> There are exceptions, e.g. performative utterances; and apparent exceptions, such as stage directions. For discussion see Smith 2003.

*(John is talking, Mary is drawing a circle)*; particular states (*Agnes is excited*); and general states (*Louis often feeds the cat*).

The explanation for the constraint is at once pragmatic and semantic. In taking the temporal perspective of the Present, speakers obey the tacit convention that communication is instantaneous, occurring at an idealized moment of speech. A bounded event in its entirety is incompatible with a report of a bounded event, because the bounds would go beyond the present moment (Kamp & Reyle 1993: 536-7). Similar ideas are expressed in Lyons 1977, Giorgi & Pianesi 1997. (This convention concerns communication and does not disturb the general notion of the Present as an interval). Thus the second principle excludes the possibility that a bounded situation can be located at Speech Time. I call it the Bounded Event Constraint. Boundedness plays an important role in guiding inference about temporal location, a point developed below.

The Bounded Event Constraint holds for languages generally, so far as we know; it is realized differently according to the resources of a given language. The Deictic Principle and the Bounded Event Constraint are both peculiar to linguistic communication.

The third principle that I will draw on is a general simplicity principle of interpretation. It concerns the need for enriching limited information that is provided to a receiver – of language, and other types of information as well. People often utter sentences that underdetermine an interpretation, saying the minimum that is necessary. The receiver enriches the interpretation, filling it out with additional information (cf Grice's second Maxim of Quantity 1975; the Informativeness Principle of Levinson 1983, the R-principle of Horn 1984). But such enrichment proceeds sparingly. By a very general principle of information-processing, when people encounter incomplete information they prefer to

make the simplest possible completion. A clause with no explicit temporal information is incomplete as to temporal location.

The effect isn't limited to language. For instance, Kanisza 1976 discusses visual perception and shows that people interpret visual information along these same lines. He gives examples of how complex figures are perceived as simple gestalts, making the point that perceivers add as little as possible. Similar principles are used to constrain computational reasoning procedures. The three principles:

(2) The Deictic Principle

Speech Time is the central orientation point for language. The Present time is located at Speech Time; the Past precedes it, the Future follows.

(3) The Bounded Event Constraint

Bounded situations may not be located in the Present.

(4) The Simplicity Principle of Interpretation

Choose the interpretation that requires least information added or inferred.

For English and other tensed languages, these three principles affect the interpretation of the present tense. For tenseless languages, they underlie the default pattern of temporal interpretation, which is, very simply this: unbounded situations are located in the Present, bounded situations in the Past. The Future requires explicit information. See below for discussion and examples.

### §1.3 Temporal information in language: a classification

Languages can be classified according to how they convey temporal information. I propose a three-way classification that allows for the variation that we find among languages.

I suggest that we recognize fully tensed languages, mixed-temporal languages, and tenseless languages. The differences between them are important for the semantic-pragmatic account that I develop here.

The notion of tense can be taken broadly or narrowly. In recent cross-linguistic work, Dahl, Bybee and others have proposed a broad Tense-Aspect-Mood category that can be expressed linguistically in a variety of ways (Bybee et al 1994, Dahl & Velupillai in press). I will explore a narrower view, essentially following Comrie 1976. I shall say that tense is a morpheme that expresses temporal information, a verbal inflection or auxiliary. The tense morpheme is obligatory, part of the grammatical ‘spine’ of a sentence. As such, tense has grammatical ramifications: it is involved in agreement, case, anaphora, and the finite/non-finite distinction. All main clauses have an obligatory tense morpheme, so that all main clauses convey temporal information. I take this to be the hallmark of a fully tensed language. English, French, German, Hindi, are tensed languages. (They differ as to how aspect is realized.)

Mixed-temporal languages have some of the characteristics of tensed languages. They have inflectional morphemes and/or temporal particles and clitics that give direct temporal information, but they are syntactically optional. Thus a given sentence may or may not convey temporal information; Navajo and other Athabaskan languages are of this type.<sup>5</sup>

Finally, there are languages without temporal inflections or particles, such as Mandarin Chinese and Thai, some Mayan languages, and probably others.<sup>6</sup> I will refer to them as tenseless languages. Temporal adverbs are not included in these categories; so far as I know they are optionally available in all languages.

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<sup>5</sup> I cannot offer a complete cross-linguistic account here; there are undoubtedly differences among mixed-temporal languages that are worth exploring.

<sup>6</sup> For information about tenseless languages see the World Atlas of Language Structures, 2005.

I assume that the syntax of a fully-tensed language includes the TensePhrase functional category. The other types of language have a syntactic AspectPhrase category but no TensePhrase. These languages introduce some temporal information, but the information must be supplemented by pragmatic inference, as developed in detail below. I do not posit syntactic structure that corresponds to the pragmatics of temporal inference. Thus although all languages convey information that allows temporal location, they do so with different syntactic structures and semantics.

In the discussion I consider tensed languages first and then focus on sentences without direct temporal information in mixed-temporal and tenseless languages.

## § 2. Tensed languages

Tense codes temporal information directly. In the neo-Reichenbach account that I assume, tense gives information about three times and their ordering relations of sequence or simultaneity. Present tense conveys that all three times are simultaneous; past tense conveys that Reference Time precedes Speech Time. The future conveys that Reference Time follows Speech Time, always with the element of uncertainty that inheres in the future

Reference Time and Situation Time are simultaneous with simple tenses, in sequence with other tenses and certain syntactic structures.<sup>7</sup> Tense alone locates only relationally. Adverbs usually specify RT except in distinguishable cases (e.g. with perfect tenses, future-in-past, etc.) . I will focus on tense and the aspectual information that allows

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<sup>7</sup> The perfect conveys that Situation Time precedes Reference Time. A complement clause can convey that Situation Time precedes or follows, e.g. *Max said that Nora (had) left*, *Max said that Nora was leaving soon*.

temporal interpretation, with some reference to temporal adverbs. Neo-Reichenbach accounts of tense are given by Hinrichs 1986, Smith 1991/7, Kamp & Reyle 1993, Klein 1994.<sup>8</sup>

The pragmatic principles constrain temporal interpretation in English and other tensed languages. There are two cases in English: the default interpretation of present tense sentences as located in the Present; and aspectual coercion in present tense simple (non-progressive) event sentences.

Present tense sentences are flexible in interpretation with temporal adverbials. Present sentences are temporally located in the Present or Future, depending on the adverb with which they appear e.g., *Mary is working now/ tomorrow*.<sup>9</sup> Now consider present tense sentences without adverbials, as in (5).

- (5) a Mary is working.  
b Carl owns the farm.

Given the facts about adverbials, we might expect sentences like this to be indeterminate between a Present and Future reading, but they are not: the default is Present. The interpretation is predicted by the Deictic and Simplicity Principles. By the Deictic Principle, the Present is the preferred temporal location. By the Simplicity Principle, the Present is simpler than the Future in terms of the information conveyed: the Future always has an element of uncertainty.

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<sup>8</sup> Klein's account of tense differs in several ways from Reichenbach's; his notion of Topic Time, however, is close to Reference Time. Differences arise in accounting for the perfect, which involves both temporal ordering (anteriority), and embedded futures. Bohnemeyer 2003 argues convincingly that Klein's approach cannot deal with relative tenses except as special cases.

<sup>9</sup> Present tense also appears in the historical present - present tense and past adverb -, which locates a situation in the past. The historical present needs an appropriate context, beyond the scope of this discussion.

Temporally the Future follows Speech Time, but it is unlike other times in having this additional element. As Lyons puts it “Futurity is never a purely temporal concept; it necessarily includes an element of prediction or some related notion” (1977: 677). The future is ‘open’: we cannot know what will happen but can only predict, with various degrees of certainty (Yavaş 1982). This uncertainty is explicit in the branching-time schema proposed by Dowty 1977, Landman 1992: one cannot be sure which of the branches possible in the future will be the one that actually occurs. The element of uncertainty makes the Future more complex than the Past or the Present in the information it conveys.<sup>10</sup>

Now consider the aspectual interpretation of event sentences with present tense. Present tense event sentences with the progressive, and statives, are not problematic:

- (6) Mary is talking.
- Leigh believes in ghosts.
- Sam is in the garden.

The sentences of (6) express ongoing situations located in the Present.

But there is an apparent problem with perfective event sentences: sentences with the simple, non-progressive verb form, which codes the perfective aspectual viewpoint. The problem is simply that such sentences should not be possible with present tense. Recall that, according to the Bounded Event Constraint, bounded events are not located in the Present. Bounded events cannot be located at Speech Time, yet the perfective viewpoint focuses events with initial and final boundaries.

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<sup>10</sup> The uncertainty of prediction makes it a kind of modality, as Yavaş 1982, Enç 1996 point out. An account of the meaning of the future must allow for different possibilities. In current formal semantic theories of modality, such differences are modeled as possible worlds (Kratzer 1981, von Stechow 2006).

Aspectual coercion resolves the problem: simple present tense event clauses are semantically stative in English. They express a generalization, a pattern of events rather than a particular event (Krifka et al 1995). The basic event verb and its arguments are coerced from eventive to stative: such sentences are derived statives:

(7) English derived statives

Kim walks to work.

Leigh (usually) sleeps late.

Lions eat meat.

Since states surround Situation Time, at Speech Time they can extend indefinitely into the past or future, as in ‘timeless’ or ‘temporally indefinite’ interpretations of generalizations.

Tensed languages may honor the Bounded Event Constraint in more than one way. In French, for instance, the *présent* is imperfective: events are unbounded. In Russian and Polish, the present perfective locates events in the Future (Comrie 1976, Vetters & Skibinska 1997).

I now turn to an account of temporal interpretation in tenseless and mixed-temporal languages. I will show that the notions of Speech Time, Reference Time, and Event Time are relevant for these languages as well as for tensed languages. In languages that have sentences without direct temporal information, aspectual viewpoint codes the relation between Reference Time and Situation Time. The relation between Speech Time and Reference Time, which is necessary for temporal location, is pragmatically inferred. I begin with Mandarin Chinese.

### §3 Tenseless languages and mixed-temporal languages

#### §3.1 Mandarin Chinese

In tenseless languages a sentence need not have direct temporal information – although temporal adverbs that give such information are always possible. I will show that aspect enables inference about temporal location. Before the discussion I state the basic pattern of default temporal location; it holds for Mandarin and, so far as I know, generally for sentences without direct temporal information.

(8) Temporal location pattern – a default  
Unbounded situations, Present  
Bounded events, Past

This pattern is explained by the three pragmatic principles stated above. Unbounded situations are located in the Present, by the Deictic Principle and the Simplicity Principle: the simplest deictic interpretation is Present.

Bounded events are located in the Past, as has often been observed. The explanation uses all three principles. By the Deictic Principle and the Bounded Event Constraint, bounded events are oriented to Speech Time but cannot be located in the Present. They might then be located in the Past or the Future. By the Simplicity Principle, they are located in the Past. Recall that the Past is simpler in terms of information conveyed than the Future: the Past doesn't have the element of uncertainty that is always part of the Future.

To locate situations in the Future, and to override the defaults given in (8), explicit temporal information is needed. One source of such information is the temporal adverb. Other sources include future-oriented verbs such as *plan*, *expect*; adverbs or other information in the sentence or context.

### § 3.2 Inferred temporal location

In this section I show how aspectual information allows the inference of temporal location. We have seen that temporal location in tensed languages requires three times: Speech Time, Reference Time, and Situation Time. The same three are needed to account for temporal location in languages without tense. Aspect conveys the relation between Reference Time and Situation Time; the relation between Speech Time and Reference Time is inferred. I demonstrate below for Mandarin Chinese,

Mandarin is tenseless, I take it (cf Y. R. Chao 1948, Hu et al 2001, Lin 2003); the language has with a rich aspectual system. There are several overt aspectual viewpoints: two perfective morphemes (*-le* and *-guo*) and a group of Resultative Verb Complements (RVCs) which are also perfective.<sup>11</sup> The language has two imperfective viewpoints (*zai* and *-zhe*). In Mandarin overt viewpoints are optional; the neutral viewpoint occurs in zero-marked clauses. See Smith 1991/7, Smith & Erbaugh 2001, 2005 for detailed discussion of Mandarin.

The grammar of Mandarin requires the notions of Reference Time. I present several kinds of evidence for this claim. The first comes from a comparison of the perfective viewpoint suffixes of Mandarin. The *-le* perfective conveys that the event talked about occurred at some time, unstated directly; the *-guo* perfective conveys that the event occurred prior to a given time. The examples illustrate, from Chao 1968: grammatical morphemes are given in capital letters in the glosses.

- (9) a Wǒ shuāiduàn-le tuǐ  
I break-LE leg  
I broke my leg (it's still in a cast).

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<sup>11</sup> Resultative Verb Complements are verbal suffixes that convey perfective viewpoint, and in addition have content in their own right; see Smith 1991/7 for discussion.

b Wǒ shuāiduàn-guo tuǐ  
I break-GUO leg  
I broke my leg (it has healed since).

Reference Time explains the contrast of 9a and 9b: the viewpoints code different relations between SitT and RT. The *-le* perfective conveys that SitT is the same as RT. In contrast, the *-guo* perfective conveys that SitT is prior to RT; *-guo* is essentially a perfect.<sup>12</sup>

Adverbials also provide evidence for Reference Time in Mandarin. There are two temporal adverbs, *yǐjīng* and *caí*, that code a sequential relation between RT and SitT. Both convey that the event expressed is prior to a given time, the temporal standpoint: SitT precedes RT. The examples illustrate; 10a has the sentential particle *le*, arguably a different morpheme from the *-le* perfective suffix (Li & Thompson 1981):

(10) a Zuótiān wǎnshàng tā yǐjīng zǒu le  
yesterday evening s/he already leave LE.  
Yesterday evening s/he had already left.

b Wǒ caí dào.  
I only-just arrive.  
I have just arrived.

These adverbs are similar to *already* in English.

Reference Time is needed to model the relations between situations expressed in complex sentences and in texts. In complex sentences, for instance, the situation in one clause may be located relative to the situation in the other clause. The locating clause provides RT, as in (11), from Mangione and Li (1993). In this sentence DE is a

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<sup>12</sup> The other differences between the Mandarin perfective morphemes are not relevant here (see Smith 1991/7, Lin 1993).

nominalizing morpheme: the understood subject of the second verb (*zǒu*) is the same as the overt subject of the first verb (*chī*).<sup>13</sup>

- (11) Tā chī-le fàn cái zǒu de.  
S/he eat-LE rice only-then go DE.  
Only after eating did s/he go.

The structurally determined RT for 'going' is the time of 'eating' (1993:67). The wider context may also provide information locating situations as overlapping or in sequence. Overlapping situations share Reference Time; those in sequence do not. Thus RT provides a locus for relating situations in a principled manner, explicated for English in Hinrichs (1986).

Finally, shifted deictic forms give a different type of evidence for Reference Time. Deictics such as *here*, *now* orient to Speech Time; but in English and in Mandarin they can shift to another orientation time. Just as deictics in their basic uses suggest the temporal standpoint of the Present, shifted deictics suggest a different temporal standpoint. The example is a fragment from a 1997 novel. The speaker compares a past time with her rough life at an earlier time; the shifted deictic is *xiànzài* (now).<sup>14</sup>

- (12) xiǎng dào gěi nàge shā qiān dāo kèrén dà bāchang  
..think give that kill 1,000 knife guest big slap  
  
yǐ bǐjiào zhēn shǐ bù shēn huǐshou. Wǒ xiànzài sǔoxǐng  
one compare really be boundless comparison. I now  
  
nénggòu jià gēi Bǐ Xiānshēng....  
simply able marry with Bi Mr.

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<sup>13</sup> The morpheme DE is a hallmark of this construction, known as 'shi..de' construction; the verb *shi* may be omitted, as it is here. The second event - going - is grammatically nominalized. DE also appears in complex nominals as essentially a relative clause marker, and has other functions as well. This section includes examples of DE as a full and reduced relative clause marker.

<sup>14</sup> This and subsequent examples are given more fully, with their provenance, in Smith & Erbaugh 2005.

...thinking back to the time when I slapped that violent killer guest, really a boundless difference. Simply, now I was able to marry Mr Bi..

Here the temporal standpoint is the Past.

To account for these facts, I shall say that the aspectual viewpoint morphemes of Mandarin code the Reference Time –Situation Time relation: it is part of the semantic meaning conveyed by the forms. No grammatical forms relate Reference Time to Speech Time, however. This is the relation that locates a situation temporally. In tenseless languages it is determined indirectly, by inference, as I will show directly.

Recall that the key factor in inferred temporal location is the boundedness or unboundedness of the situation expressed. The default pattern is repeated here:

(8) Temporal inference pattern

Unbounded situations, Present

Bounded events, Past

Overt aspectual viewpoint is optional in Mandarin. Thus there are two cases, sentences with overt aspectual viewpoints and zero-marked sentences; the latter have the neutral viewpoint. I first give examples of sentences with overt viewpoints, which follow the pattern above and can be understood with the notions already introduced., and then consider sentences with the neutral viewpoint.

### §3.3 Sentences with overt aspectual viewpoints

Imperfective viewpoints focus situations as unbounded, with no information as to endpoints. They are taken as temporally located in the Present by default; DE in these examples is similar to a relative clause morpheme.

(13) zai (progressive)

a shìshíshàng zhèzhǒng móshǐshì zài chāoxí kēxué

fact-on, this-kind model ZAI copy natural science

In fact, this model is already copying the natural sciences.

b. yīqiè dōu zài zhàobān hé lǐ huà de móshì.

everything all ZAI indiscriminately-imitate 'rationalization' DE model.

Education in Hong Kong is already too systematized, everything is all about indiscriminately imitating some model of 'rationalization'.

(14) -zhe (stative imperfective)

Yánzhe biān fàng-zhe jǐ kuài xǐyī bǎn,  
edging side set ZHE several CL wash board,

bú dà píngzhèng de luǎn shí dì miàn shǎn yào zhe

not very level DE cobblestone floor surface shine ZHE

yī dài yòu yī dài zhùmín suǒ tà chū de guāngzé.

one generation another one generation resident which tread DE glow.

(describing a courtyard) Several washboards are set down along its sides, where the rough cobblestone surface shines with a gloss trodden smooth by generation after generation of residents

The Deictic and Simplicity Principles predict this interpretation.

Perfective viewpoints focus events with bounds, and are located in the Past by default; (15) is an example; it has an RVC suffix, which conveys the perfective.

(15) Bounded event in the Past

... zhè shǐ wǒ hé duō wèi niánqīng xuézhě jiāotán hòu  
this be I and many CL young scholar exchange-talk after

suǒ dé-dào de jiélùn.

SUO reach-RVC DE conclusion

This is the conclusion which many young scholars and I reached after exchanging views.

As noted in section §2.1, perfectives cannot be located in the Present, by the Deictic

Principle and the Bounded Event Constraint. They are located in the Past rather than the Future by the Simplicity Principle. The examples of (9) above illustrate the same point.

The default interpretations can be overridden when there is information to the contrary. Two cases are illustrated in (16):

(16) a Unbounded event in the Past

Wǒ yī tóu gōng zuò, yī tóu wén zhe yī zhèn yī zhèn guō  
I one head work, one head smell-ZHE one burst one burst pan

lǐ de yú xiāng, huáng yú zài wǒmen ānhuī shì méi yǒu de.  
in DE fish fragrance, yellow fish in our Anhui be not exist DE.

One part of me was working, one part was smelling wave after wave of the fragrant smell of the fish in the pan. Yellow croaker fish was something we didn't have back home in Anhui....

b Bounded event in the Future

Nèi dì jiāng yú běn zhōu liú quán miàn jìn yòng  
mainland about to this Saturday completely forbid use

jí yòng jí qì de fābào cān jù  
disposable DE polystyrene food-containers

This coming Saturday the mainland [from Hong Kong] will completely ban the use of disposable polystyrene food containers.

In (16a) the larger context, an autobiographical text, sets the narration in the Past; in (16b) the future *jiāng* (will) and the temporal adverb indicates Future. The default can also be overridden by information that locates unbounded events in the Future, and states in the Past and Future.

### §3.4 Other tenseless languages

Tenseless languages other than Mandarin have the same pattern of temporal

interpretation based on inference from overt aspectual viewpoints. I give examples from Thai and Yucatek Mayan. As we now expect, sentences with an imperfective viewpoint are taken as Present; sentences with a perfective viewpoint (marked in (18) as CM for ‘Completive’) are taken as Past.<sup>15</sup>

(17) Thai

a nit kamləŋ tææŋ klɔŋge  
Nid IMPF compose poem  
Nid is composing a poem

b lûuk nøy kamləŋ ûan nâa-rák yûu  
child Noy ADV fat cute IMPF  
Noy’s baby is fat and cute

c nit sâaŋ bâan yaŋ mây slt  
Nid build house PERF  
Nid built a house

(18) Yucatec Mayan

a táan in pak’ -ik-ø  
DUR 1A plan.IMPF.TR-3b  
I am planting it

b t-in pak’ -aj-ø  
CM-plant-CM-TR-3b  
I planted it

c T-a ch’a-(a) le in chóoy-o’  
CM-2A take-PERF-TR DEM my bucket-DEM  
You took my bucket

These examples from three languages show that the pattern given of interpretation is quite general in tenseless languages. The same pattern is found in mixed-temporal languages.

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<sup>15</sup> The Thai examples are due to Sudmuk 2001, Iwasaki & Ingkaphirom 2005; the Yucatek Mayan examples are from Brody 1998. Mayan languages vary considerably in the temporal domain; this is an interesting topic for future research.

### §3.5 Mixed-temporal languages

The category of ‘mixed-temporal language suggested above distinguishes languages which have characteristics of both tensed and tenseless languages. They may have temporal verbal inflections, particles, or other temporal forms (in addition to adverbs). These forms are optional, so not all sentences have direct temporal information.

Navajo is such a language. Some clauses have direct temporal information: there is a future verb prefix, and past and future temporal particles. The future prefix is a member of a set of prefixes known as ‘modes’; one mode prefix appears in all event clauses but they are not available for stative clauses. The future is the only mode prefix that is temporal: the others convey aspectual and modal information.<sup>16</sup> Semantically the future prefix is privative: its absence conveys no information about futurity. The past and future particles are optional. Thus Navajo permits sentences with no direct temporal information.

In Navajo sentences that lack direct temporal information, temporal inference follows the default pattern identified above. Aspectual viewpoints allow temporal interpretation, as (19) illustrates: the examples are from Smith, Perkins & Fernald 2003, which discusses the Navajo system in some detail.

(19) Navajo  
a Biih yish’nééh  
into-3 1psubj-IMPF-crawl  
I’m crawling into it

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<sup>16</sup> There are 7 mode morphemes of Navajo. 3 convey aspectual viewpoints: Perfective, Imperfective, and Progressive. 2 convey aspectual situation type information; the Customary and Iterative modes; the remaining modes are the Future and the Optative.

b Nléí dziłbąąhgóó hoołtíł  
that-one-over-there mountainside-along 3-3psubj-PROG-rain  
It's raining there along the mountainside

c Hooghan binishishnish  
hogan on-3-1psubj-perf-work  
I did some work on a hogan

Other mixed-temporal language include Hua, a Papuan language. In Hua the main distinction is also Future-Nonfuture (Haiman 1980). Hopi, a Uto-Aztecan language, also has a Future-Nonfuture system (Malotki 1983).

#### §4. Zero-marked sentences: the neutral viewpoint:

In Mandarin and a number of other languages, a sentence may appear without an overt aspectual viewpoint. Such clauses are zero-marked. In the two-component approach to aspect, all sentences have an aspectual viewpoint: viewpoint makes all or part of a situation visible for semantic interpretation. Zero-marked clauses have the neutral viewpoint. This viewpoint is flexible, allowing open and closed interpretations. It requires only that part of a situation be visible; this accounts for the indeterminacy of zero-marked clauses, since the event or state may or may not extend beyond the Situation Time interval.

There is a default pragmatic interpretation for zero-marked clauses, which is based on situation type, or event structure. This default supplements the weak semantic information of neutral viewpoint. The default inference depends on whether boundedness is expressed by temporal features of the situation of the clause. Telic and single-stage events (Achievements and Semelfactives) are intrinsically bounded; States and atelic events

(Activities) are unbounded. This information is part of semantic representation. The temporal features are associated with the event or state entity introduced in a clause.

(20) Temporal Schema Principle

In a zero-marked clause, interpret boundedness according to the temporal features of the event or state entity.

This default pattern supplements the weak semantic information of neutral viewpoint. It is a special case of the Simplicity Principle. The default provides the input to temporal interpretation, which follows the pragmatic principles in inferring that bounded events are taken as Past, unbounded situations are taken as Present.

In Mandarin, zero-marked clauses are optional for event clauses and required for statives of all kinds. The overt viewpoint morphemes are not available for statives. The boundedness interpretation of these clauses depend on the event or state entity, as in (20). In clauses with intrinsically bounded situations, the situations are taken as bounded; otherwise the situation are taken as unbounded. With this inferred boundedness information, temporal location inference proceeds as it does for clauses with overt aspectual viewpoints. The examples illustrate:

(21) Unbounded: states and atelic events

a State

xiāngǎng méiyǒu bìguān zìshǒu de tiáojiàn  
Hong Kong not-have close self-self DE situation.  
Hong Kong does not have the option of closing its doors.

b Generalizing stative

Fapao jiāo cān jù fāngbiàn, chéng běn dī dàn wēihài jí dà,  
Polystyrene food container convenient, price low, but harm extremely great,  
Polystyrene containers are convenient and cheap, but extremely harmful.

c Activity

zài dí sīkē jiézòu zhōng, Xióng kuáng fàng de qián hòu yáobǎi,  
at disco rhythm inside, Bear wild style DE front back sway,

Xióng chén jīn zài zìjǐ chuàngzào de wǔ dǎo zhōng.  
Bear deeply immerse in own create DE dance in.

Inside the disco rhythms, Bear sways wildly back and forth, deeply immersed in a dance of his own creation

(22) Bounded events

a Wáng Jizhǐ fā míng zhōngwén dǎ zìjǐ  
Wang Jizhi invent Chinese word processor  
Wang Jizhi invented the Chinese word processor

b zài qǔ dé zuǐ chù de chénggōng zhǐhòu,  
at take receive most early DE success after,

ní guāngnán yòu tí chū xīn de yánjiū kējí  
Ni Guangnan also bring up new DE research project,  
After his early successes, Ni Guangnan proposed new research projects

These examples involve two steps of default inference: the Temporal Schema Principle provides the inference of boundedness or unboundedness, and the Temporal Inference Pattern provides the inference of temporal location.

Zero-marked clauses appear in other tenseless languages; some have the same pattern in Mandarin, others do not. Thai has a slightly different pattern in its written and spoken forms. In written Thai temporal interpretation is based on the property of intrinsic boundedness, as in Mandarin. In conversational Thai the property of duration determines whether a situation is located in the Present or the Past. States and durative events – telic and atelic - are taken as Present, while single-stage, punctual events are taken as Past, as in these examples:

(23) Thai  
a State

nít mii khaamsuk  
Nid have happiness  
Nid is happy

b Durative events  
nít hua rór  
Nid laugh  
Nid is laughing

c nít sâa bâan  
Nid build house  
Nid is building a house

c Punctual event  
nít phop naalilkaa  
Nid find watch  
Nid found a watch

For this information about Thai I am indebted to Sudmuk 2001.

Mixed-temporal languages also allow zero-marked clauses. In Navajo, for instance, such clauses appear when the mode morpheme does not convey an aspectual viewpoint. Temporal interpretation of such clauses in Navajo are also based on event structure: durative clauses are taken as simultaneous, punctual clauses taken as sequential (Smith & Perkins 2005). Although the interpretation of zero-marked clauses is similar across languages, we cannot assume that it is identical.

## §5. Formalizing the analysis

The account of temporal inference proposed above has semantic and pragmatic components. It deals with sentences that do not convey direct temporal information. The account is semantic in using information conveyed by the aspectual forms of a sentence: viewpoint morphemes, and the composite of verb and argument that realizes situation type, or event structure. It is pragmatic as well: the default inferences about temporal

location are pragmatic in nature.

In this section I briefly sketch a formal account for Mandarin Chinese in the framework of Discourse Representation Theory (Kamp & Reyle 1993). The framework includes syntactic, semantic and pragmatic information, and information from context.

Construction rules introduce into the Discourse Representation Structure (DRS) the semantic information conveyed by linguistic forms. The construction rules apply to a fully-annotated syntactic structure.

Syntax: For Mandarin Chinese, I assume that aspectual viewpoints are in the AspP node of the syntactic surface-structure tree. I assume an Aspect Phrase node rather than a TensePhrase in the syntactic structure of tenseless languages like Mandarin, following Cole & Wang 1996. This is the first step of formal implementation for the account given above: the viewpoints introduce Reference Time and Situation Time and their relation, while pragmatic inference relates Reference Time to Speech Time.

The construction rules are semantic: they enter into the DRS the information associated with linguistic forms. For the temporal interpretation of tenseless sentences, we need rules that introduce the information conveyed by aspectual forms; tensed sentences, of course, require rules for interpreting tense.<sup>17</sup> Aspectual information involves situation type and viewpoint. It introduces situation entities, times, and conditions that characterize and relate them.

Situation type: situation entities are composed by rule for each clause according to the verb and its arguments. The rules introduce a situation entity E into the DRS with conditions that associate with E the identifying cluster of temporal properties. For instance,

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<sup>17</sup> For a sketch of such rules see Smith, in press.

(24a) gives an Achievement sentence in Mandarin and (24b) a construction rule for interpreting the aspectual information:

- (24) a wǒ zhǎodào wǒde lǎyīnjī  
 I find+arrive(RVC) my tape recorder  
 I found my tape recorder
- b Construction rule  
 $CL[X NP_{def} Y V_{Ach} RVC (-LE) (NP_{def}) Z]$   
 $\Rightarrow E; +Dyn, +Punct, +Telic$

The left-hand side of the rule specifies that it apply to a clause with a definite subject NP, a verb of the Achievement class with an RVC and an optional perfective morpheme *-le*, and an optional definite object. The right-hand introduce a situation entity E into the DRS; with the conditions that it is dynamic, punctual, and telic. These are the characteristics of an Achievement event. Similar rules are required for the other situation types, and for aspectual coercion, shifts from one situation type to another.

Viewpoint information: On the analysis proposed above, aspectual viewpoints in Mandarin introduce two times, Reference Time and Situation Time, and their relation. The times are annotated as RT ( $t_2$ ) and SitT ( $t_3$ ). The viewpoints also introduce boundedness information, which is represented by conditions relating the SitT interval and the situation entity E. Perfective viewpoints make visible a bounded event, introducing a condition that the SitT interval  $t_3$  includes E:  $E \subseteq t_3$ . Imperfective viewpoints make visible a situation without bounds, introducing a condition that E overlaps SitT:  $E \cap t_3$ . The neutral viewpoint introduces a condition providing that a portion of the situation is semantically visible.

I assume that the event or state entity E has been introduced into the DRS by the verb and its arguments. (25) gives construction rules for the viewpoint morphemes of

Mandarin; for each morpheme, the rule introduces the information associated with that morpheme into the DRS.

Boundedness information is stated in terms of the relation between the situation entity and the Situation Time interval  $t_3$ . Bounded events are included in  $t_3$ , other situations overlap  $t_3$ . The rather cumbersome statement for the neutral viewpoint provides for the indeterminate information conveyed, merely that some part of the event or state is semantically visible.

(25) Construction rule for the viewpoint morphemes of Mandarin

- a.  $_{Cl}[ X_{AspP}[-le] Y ] \rightarrow t_2, t_3; t_3 = t_2; E \text{ at } t_3; t_3 \subseteq E$
- b.  $_{Cl}[ X_{AspP}[-guo] Y ] \rightarrow t_2, t_3; t_3 < t_2; E \text{ at } t_3; t_3 \subseteq E$
- c.  $_{Cl}[ X_{AspP}[zai] Y ] \rightarrow t_2, t_3; t_3 = t_2; E \text{ at } t_3; E \text{ O } t_3$
- d.  $_{Cl}[ X_{AspP}[-zhe] Y ] \rightarrow t_2, t_3; t_3 = t_2; E \text{ at } t_3; E \text{ O } t_3$
- e.  $_{Cl}[ X_{AspP}[\emptyset] Y ] \rightarrow t_2, t_3; t_2 = t_3; E \text{ at } t_3; t_3 \subseteq e];$

$$\exists e \exists e' [e' \in E \ \& \ I(e') < e \ \& \ t_1 \subseteq e]$$

These rules provide that two times,  $t_2$  and  $t_3$  are introduced in the DRS with each aspectual viewpoint.

The third time involved in temporal meaning,  $t_1$  for Speech Time (SpT), is entered automatically into the DRS for each clause, as posited by Kamp & Reyle 1993. The pragmatic inference rule for temporal location – (27) below - relates  $t_1$  and  $t_2$ , Speech Time and Reference Time.

The neutral viewpoint does not give boundedness information, so that an additional inference rule is needed for zero-marked cases. Recall the Temporal Schema Principle, which says that boundedness is inferred from the intrinsic boundedness property of a situation entity. Telic and punctual events are intrinsically bounded, other

situations are not. The rule looks at the temporal properties associated with the situation entity E in the DRS; if they include the properties [+telic] or [+ punctual], boundedness is inferred. If other properties temporal are associated with E, unboundedness is inferred.

<sup>18</sup> The inferences about boundedness take the form of statements about the relation between E and the Situation Time interval  $t_3$ .

(26) Default boundedness inference rule: Temporal Schema Principle

- a.  $E; [+telic] \vee [+ punctual] \rightarrow t_3 \subseteq E$
- b.  $E; [\pm dynamic]; [- punctual] \vee [-telic] \rightarrow E \cap t_3 \neq \emptyset$

As before, we represent boundedness by including E in the SitT interval, and unboundedness by providing that E overlap the SitT interval. This new condition is more informative than the condition given in (25e) above. It is only a default and can be overridden by additional information. The information provided by this rule serves as the input to the temporal inference rule below.

I can now state a simple rule of default temporal inference. The rule infers temporal location from the boundedness of the situation entity. Bounded events are included in the  $t_3$  interval and trigger the inference of Past; unbounded situations overlap the  $t_3$  interval and trigger an inference of Present. The boundedness information conveyed by viewpoint is represented by the relation between E, the situation entity, and  $t_3$ , SitT; from this the rule infers the relation between  $t_1$  and  $t_2$  (SpT and RT).

The inference rule looks at the boundedness property of the situation entity E and introduces a new condition into the DRS that relates  $t_1$  to  $t_2$ .

(27) Default temporal inference rule

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<sup>18</sup> Recall that 3 two-valued temporal features characterize situation entities: [ $\pm$ dynamic] or dynamic-static; [ $\pm$  telic] or telic-atelic; [ $\pm$  punctual] or punctual-durative.

- a) If  $E \circ t_3 \rightarrow t_1 = t_2$
- b) If  $t_3 \subseteq E; \rightarrow t_1 < t_2$

The relation between Speech Time ( $t_1$ ) and Reference Time ( $t_2$ ) is the inference of temporal location. Sentences with overt aspectual viewpoints convey boundedness information semantically as provided in Rule 25; zero-marked sentences have the additional step of inference given in Rule 26.

## §6. Conclusion

Temporal interpretation, I have shown, is guided by a very few pragmatic principles. The principles constrain temporal location in tensed languages and guide temporal inference in other cases. I propose three classes of language according to how temporal information is conveyed: tensed, tenseless, and mixed-temporal. In tensed languages every sentence has direct information about temporal location; the other two types allow sentences without such information. For such sentences temporal location is inferred from aspectual information.

The notions of Speech Time, Reference Time, and their relations are needed to explain temporal meaning across languages. Tense conveys this information directly. Decoupling the two relations involving Reference Time is the key to temporal interpretation in tenseless and mixed-temporal languages.<sup>19</sup> The relation between Reference Time and Situation Time is conveyed semantically by aspectual viewpoint. The relation between Reference Time and Speech Time is pragmatically inferred. There are two simple default principles, which can be overridden by adverbs and other temporal information in the sentence or context.

Boundedness is the main factor in temporal inference, It is expressed directly by

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<sup>19</sup> More precisely, in sentences that do not have temporal adverbs or other forms that convey direct temporal information.

overt aspectual viewpoints. In zero-marked clauses, both boundedness and temporal location are inferred from the event structure associated with a sentence.

Further research is needed to test and develop the general claims I make about types of temporal information in languages of the world.. There may be a another type of language, one that has neither tense nor overt aspectual viewpoints. Apparently Maybrat, a language of Indonesia, is such a language (Dol 1999). Maybrat is tenseless, with optional temporal and aspectual adverbs. I would hypothesize that the pragmatic principles hold for this language as well, and that event structure information allows temporal inference. If so, we would expect that intrinsically bounded events are taken as Past by default, others are taken as Present; and that overt information is need for Future temporal location.

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