The Pragmatics and Semantics of Temporal Meaning

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In all languages, sentences convey information that allows people to locate situations in time. Languages vary: some have tense and tense-like forms, others do not. I will suggest general pragmatic principles to account for how temporal location works in language. The principles have different realizations according to the forms that are syntactically obligatory in a given language.

I will begin by introducing the general principles, in Section 1; Section 2 gives some necessary preliminaries to the analysis; Sections 3-5 discuss Mandarin Chinese, Navajo, and English; Section 6 concludes. In an appendix, I show how to formalize the analysis of Mandarin within the framework of Discourse Representation Theory.

1. Principles for temporal interpretation

Time is a single unbounded dimension. To locate situations in time we need an orientation point, an anchor. The speaker is the center of linguistic communication, so that the canonical orientation points in language are the speaker, the speaker's place (*here*) and the speaker's time (*now*). The speaker's time is the Present, the here and now. The time of speaking, or Speech Time, is the default orientation point: this deictic principle is basic to language (Lyons 1977). 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. Here I will discuss single sentences that are temporally interpreted according to the deictic principle (in more complex cases, other orientation points are possible). I use capital letters to refer to time, lower case for tense

There is an aspectual constraint on the deictic pattern, also apparently universal, that involves the aspectual notion of boundedness. Situations in the Present must be open and unbounded, without endpoints: they include ongoing events (*John is talking*, *Mary is drawing a circle*); particular states (*Agnes is excited*); or general states (*Louis often feeds the cat*). This constraint on the deictic principle gives rise to the pattern stated in (1).

(1) The deictic pattern of temporal interpretation
    a. Unbounded situations are located in the Present
    b. Bounded situations are located in the Past

The pattern has often been observed in language. The constraints given here explain why this pattern obtains. Note that (1) is a default: explicit temporal information may locate bounded events in the Future, unbounded situations in Past or Future; but not bounded events in the Present. I motivate and state the constraints in this section. They will be illustrated in the discussion of particular languages.

Why are bounded events non-Present? The answer is both pragmatic and semantic. In taking the temporal perspective of the Present, speakers are limited by a tacit convention that communication is instantaneous. The perspective of the present time is incompatible with a bounded event, because the bounds would go beyond that perspective (Lyons 1977, Kamp & Reyle 1993, Giorgi & Pianesi 1997). I state this well-known constraint in (2):

(2) Bounded Event Constraint
    Bounded situations may not be located in the Present.

There are some well-known exceptions, e.g., sports reports, stage directions, literary commentary, procedural discourse. I think that sports reports and procedural discourse follow the principle of narrative,

 Proceedings of the 2004 Texas Linguistics Society Conference, ed. Pascal Denis et al., 92-106. Somerville, MA: Cascadilla Proceedings Project.

set in the present: situations are related to each other. Stage directions and literary commentary, however, are more like generalizing statements: they hold whenever a play is staged, a literary work is read. Performatives are sometimes said to be exceptions to the constraint, but this ignores their peculiar nature. Performatives are not exceptions to the constraint: a performative is not a report, but an actual event that is located at the moment of speaking.

Why are bounded events located in the Past by default, rather than the present? The answer to this question has two steps. The first step is to state a very general simplicity principle that applies to the interpretation of incomplete information. What is said often underdetermines meaning. Yet people usually agree on interpretations; this is partly because in filling out, they limit inferences as much as possible.

(3) Simplicity Principle of Interpretation
Choose the interpretation that requires the least information added or inferred.

The simplicity principle is used generally in computation of all kinds; see Kanisza 1976 for an interesting discussion of how it applies in visual perception – people choose the simplest interpretation that is compatible with the visual array that they perceive.

We can now move to the second step. Assuming the Bounded Event Constraint, bounded events might be set in either the Past or the Future, yet the default interpretation sets them consistently in the Past. I argue that the Past is simpler than the Future. Temporally the Past and Future have an entirely symmetrical relation to Speech Time. But the Future has an element of modality that the past does not: it involves uncertainty (modeled perhaps with branching futures (Dowty 1979)), perhaps planning. Thus the Future is more complex than Past, in the sense that it involves both modality and temporality. Therefore, when there is a choice between a Past and a Future interpretation, the former conforms to the Simplicity Principle. Later I will propose a subsidiary principle based on this one for the interpretation of zero-marked sentences, that is, sentences without an overt aspectual viewpoint.

2. Preliminaries to the analysis

I think it useful to distinguish between languages with and without tense.

Comrie 1986 defines tense as "grammaticized location in time": it is a formal category of grammar, by morphological and semantic criteria. In another approach, Dahl proposes a general category of tense, aspect, mood that has distinct variations across languages (1985, 2000). I will take a version of the narrow view. I suggest that tense proper is a formal category that is obligatory in independent clauses.

This will enable me to recognize languages in which all sentences have direct temporal information - that is, tensed languages; and languages in which direct temporal information need not appear - tenseless languages. These are the two extremes of a continuum. There are also in-between cases, of which Navajo is one; see below.

I will assume a Discourse Representation Theory (DRT) approach. The information conveyed by a sentence is interpreted by construction rules from surface structure and entered into a dynamic Discourse Representation Structure (DRS). The information concerns entities and their relations. The entities relevant here are times, and situation entities. When licensed directly by information in a clause, or indirectly by rule, entities are entered into the DRS. The defining properties and relations appear as conditions on the entities (Smith 1991/7, Kamp & Reyle 1993).

2.1 Direct temporal information: Tense and temporal adverbs

I take tense to be obligatory grammaticized location in time, essentially following Comrie. As an inflectional morpheme - the traditional notion of tense - tense is part of the grammatical spine of the sentence. All independent sentences of a language have tense, so that direct temporal information always appears. Semantically, I shall say that tense codes relations between three times, following Reichenbach (1947); see below. I also note another feature of tense, brought out in recent work by Iatridou (2000): although the primary meaning of tense is temporal, non-present tenses may have atemporal meanings in certain contexts. These features characterize certain tense in most languages. In list form:

(4) Features of tense
Morpho-syntactic
i. Inflectional: verbal morpheme or auxiliary
ii. Obligatory
Semantic
iii. Temporal meaning basic: tense codes relations between 3 times; see below
iv. May have atemporal meanings in certain contexts

For the first three features, the more of them that apply to a given morpheme, the more tense-like it is. Morphemes that have all three features are full-fledged tenses.

I will say a little more about feature (iv). Scholars have long noticed that certain past tense have meanings such as conditional, hypothetical, contrary-to-fact, in the context of an *if*-clause and other conditionals. This holds across languages of several different families. (Steele 1975, Fleischman 1989; Iatridou 2000). I give some simple examples for English and French. I assume that both languages have tense; and that *would* is a past form of the modal *will*. The past tense has atemporal meaning in the context of an *if*-clause:

(5) a. If John passed the exam, he would succeed.
b. If John had passed the exam, he would have succeeded

a'. Si Jean passait l'examen, il y réussirait.
b'. Si Jean avait passé l'examen, il y aurait reussi.

The atemporal meaning is semantic, triggered by context; counter-factual interpretation is pragmatic; see (14) below. Participation in atemporal interpretation can be a telling semantic criterion for tense. But it is not required: some past tenses of French don't have the atemporal meanings (*passé simple, passé composé*); some languages have forms that code these meanings directly (arguably, the shifted past *would* of English).

The meaning of a tense, I assume, involves three times: Speech Time, Situation Time, and Reference Time. Tense codes two relations between these times: the relation between Speech Time (SpT) and Reference Time (RT), and the relation between RT and Situation Time (SitT). This is essentially the view of Hans Reichenbach 1947, modified and extended in recent work (Hinrichs 1986, Kamp & Reyle 1993). The basic tense meanings are given in (6).

(6) Simple tense meaning

Present:	RT=SpT;	RT=SitT
Past:	RT < SpT;	RT=SitT
Future:	RT > SpT;	RT=SitT; modal force

The so-called relative tenses differ in that RT≠SitT, e.g. perfect *have*.

Temporal adverbs are optional; as far as I know they appear in all languages. They may relate a situation to SpT (*yesterday*); or to RT (*then, 3 days earlier*); or to another situation (*when, before*). When they appear with tense, adverbs narrow down the temporal location in the basic cases (there are others). When they appear without tense, they provide direct temporal information. I do not deal with adverbs here; see Smith 1991/7, Kamp & Rohrer 1993.

2.2 Aspectual information

I show in this paper that aspectual meaning provides indirect information about temporal location. This adds another dimension to the well-known close relation between the two domains.

I will assume that aspectual systems have two components, situation type and viewpoint (Smith 1991/7). Situation type indirectly classifies the situation expressed in a clause as state or event; the information is conveyed by the verb constellation (the verb and its arguments) and other information. The main semantic features that distinguish the situation types are static vs dynamic, telic vs atelic, durative vs

non-durative. I shall refer to non-durative events as 'single-stage events'. There are linguistic correlates for the major situation types, so that they constitute covert linguistic categories in language (Whorf 1956, Vendler 1957). I list the basic situation types in (7):

(7) States: static, unbounded in principle; simple (a) or generic, generalizing (b)
  a. know the answer, be happy, own the farm, etc. — Simple
  b. Lions eat meat; John feeds the cat every day. — Generalizing
  Events: dynamic; telic/atelic, durative/non-durative
  c. sleep, run, — Durative, Atelic
  d. draw a picture, walk to school, — Durative, Telic
  e. flap a wing, reach the top — Single-stage telic and atelic

The defining properties of each situation type are associated with a clause of a given situation type - and with the situation entity for that clause. The distinction most important for this paper is that between events that are 'intrinsically bounded' and those that are not. Telic events and single-stage events are intrinsically bounded.

Aspectual viewpoint makes visible for semantic interpretation all or part of a situation. The viewpoints are usually expressed morphologically. Neutral viewpoints appear in zero-marked clauses, which have no overt viewpoint morpheme. There are differences in viewpoints across languages, but their main contributions can be given summarily; as in (8):

(8) Aspectual viewpoints
  Perfectives: events semantically visible as bounded
  Imperfectives: part of a situation visible, unbounded
  Neutral viewpoints: partial information allowing inference

Perfective viewpoints make visible bounded situations, usually bounded events. Neutral viewpoints make visible partial information, so that inferences of boundedness or unboundedness can be made under appropriate conditions. Neutral viewpoints are discussed in Smith 1991/7; and in sections 3 and 4 below.

There is a well-known interaction between aspectual and temporal information: it involves the relation between a Situation Time interval and the boundedness of a situation. Bounded events are included in the SitT interval (SitT $\subseteq$e), e.g. (9a); unbounded events and states overlap or surround the SitT interval (SitT O e), e.g. (9b):

(9) a. Leigh built a sandcastle. John left. — SitT $\subseteq$ e
  b. John was working. Leigh was at school. — SitT O e

In some approaches, this relation is represented by aspect, and tense is said to code only the relation between SpT and RT, e.g. Klein 1994.

3. Tenseless language: Mandarin Chinese

Mandarin is a tenseless language: it has no tense morphemes. However, the notion of Reference Time is needed to account for a number of forms in the language. These forms code the relation between Reference Time and Situation Time. What differentiates a language like Mandarin from a tensed language is that the relation between Reference Time and Speech Time is not coded grammatically. When no direct temporal information appears in a sentence, aspectual information allows the inference of temporal location according to the general pragmatic principles given above.

3.1 Temporal location

Temporal information is conveyed by adverbs, temporal connectives; and future-oriented lexical verbs and modals (*zhunbei* 'plan', *yao* 'want', etc).

Despite the lack of tense, we need the notion of Reference Time for Mandarin. One reason is that the difference between perfectives *-le* and *-guo* involves Reference Time, as in (13) below. Another reason is that certain adverbs code the relation between RT and SitT (e.g. *yijing* 'already', *cai* 'have just'). A third reason is that Reference Time is needed to account for the temporal relations between situations; this point is developed in Hinrichs 1986. The example illustrates:

(10) Ta chile fan cai zou de.
She eat LE rice only then go DE.
Only after eating did she go.

The structurally determined RT for 'going' is the time of 'eating' (Mangione & Li 1993).

Finally, we need the notion of Reference Time to allow for shifted deictic forms. Shifted deictics convey the speaker's perspective at RT. I give as an example a fragment from a 1997 novel. The speaker contrasts her current good fortune with her earlier, rough life in Shanghai (see Smith & Erbaugh 2005 for further discussion).

(11) a...xiang dao gei nage sha qian dao keren da bachang de shi,
... think to give that kill 1,000 knife guest big slap DE incident...

b. he xianzai shenghuo yi bijiao zhen shi bu shen huishou
with now life one compare really be boundless comparison

c. Wo xianzai suoxing nenggou jia gei Bi Xiansheng....
I now simply able marry to Bi Mr. ....

...thinking back to the time when I slapped that violent killer guest,
comparing it to my current life, it was really a boundless difference.
Now I could simply marry Mr Bi..

I conclude that the notion of Reference Time is relevant to Mandarin. But grammatical forms relevant to temporal location do not relate RT to SpT; that relation is pragmatically determined.

3.2 Aspectual information

Situation type in Mandarin is realized by the verb constellations, as in languages generally. Mandarin has the basic set of situation types noted above; I will not discuss them here (Smith 1991/7.)

Overt viewpoint morphemes are available only for event sentences, and are syntactically optional. There are several perfective viewpoints; two of them differ in the relation that they code between Reference Time and Situation Time. The main perfective viewpoints are these:

(12) Perfective viewpoints of Mandarin
-le: bounded event: RT = SitT.
-guo: bounded prior situation; Sit < RT.
Resultative Verb Complements (*wan*, *dao*, etc);RT=SitT

Le conveys that an event is bounded, within SitT, SitT simultaneous with RT.: *-guo* conveys at least one time included in SitT, the event takes place at that time; SitT precedes RT. The examples below illustrate the difference between *-le* and *-guo*, both very commonly used.

(13) a. Ta da-le majiang
S/he play-LE mahjiang
S/he played majiang

b. Ta da-guo majiang
S/he play-GUO mahjiang
S/he has played mahjong at least once, at a time prior to RT

c. Ta jie-le hun
S/he marry-LE
Sh/e got married (and probably still is married

d. Ta jie-guo hun
S/he marry-GUO
She has been married at least once, at a time prior to RT

As the translations indicate, the interpretation of *-guo* is very close to that of a perfect - although it is not a tense. I do not discuss RVCs and other cases here; see Smith 1995, Smith & Erbaugh 2005.

There are two imperfectives: *zai* makes visible an unbounded event in progress; SitT = RT; *-zhe* makes visible an unbounded situation; surrounding SitT; SitT=RT.

Sentences with overt aspectual morphemes but no temporal information are consistently interpreted as follows: imperfectives are taken as located in the the Present, perfectives are taken as located in the Past. This follows the pragmatic principles given in I. By the Deictic Principle, imperfectives are located at Speech Time, the Present. By the Bounded Event Constraint, perfectives cannot be located at Speech Time; by the Simplicity Principle of Interpretation, they are located in the Past (rather than the Future).

Zero-marked sentences are common in Mandarin in the spoken and written language. States are always zero-marked; events are often so. Zero-marked sentences have the neutral viewpoint, which allows both bounded and unbounded interpretations (Smith 1991/7). However, there is a consistent default interpretation. Zero-marked sentences are interpreted according to the temporal features of the situation they express: intrinsically bounded events are taken as bounded (telic and single-stage events); states and other events are taken as unbounded. I state this principle of interpretation as (14):

(14) Temporal Schema Principle
Interpret zero-marked sentences according to the temporal schema of the situation expressed in the sentence, unless there is explicit or contextual information to the contrary.

This is a special case of the Simplicity Principle of Interpretation: no new information required. It is reminiscent of Grice's Maxim of Quantity, which bids us to Say no more than is needed; as well as the Informativeness Principle of Levinson (1983), and the R-principle of Horn (1984).

The inference of boundedness - whether a situation is bounded or not - allows the inference of temporal location, following the pattern stated above for sentences with overt aspectual viewpoints: intrinsically bounded events are taken as Past, others are taken as Present.

The examples illustrate: the texts are taken from Smith & Erbaugh 2005.

(15) Default: States unbounded, Present
a. Buguo, Xianggang mei you biguan zishou de tiaojian,
However, Hong Kong not have close self-self DE situation

Xianggang shi shijie shang ziyou du zui gao de jingji tixi.
Hong Kong is world on freedom degree most high DE economic system.

However, Hong Kong does not have the option of closing its doors;
Hong Kong has the freest economic system in the world

b. ...cun zhong zhuyao jiedao ji shiji kanlai hen pingjing
village within main street and market appear very peaceful

yixie nyuzi xietong xiao tong zai lu pang zouguo huo zuo zai gongyuan liaotian
some woman in-company child at roadside walk past or sit-at park chat,

...the village main streets and market look very peaceful, some women
with their children walk past along the roadside or sit in the park chatting,

(16) Default: Telic events bounded, Past
. . zai huihuang niandai, Wang Jizhi faming de zhongwen da ziji
... at glorious era, Wang Jizhi invent DE Chinese word processor

..in (that) glorious era, Wang Jizhir invented the Chinese word processor,

(17) Default: Atelic event unbounded, Present
Xiong de you tui zhizhu diban, zuo tui xiangqian kuachu yi bu.
Bear DE right leg set floor, left leg toward front stride one step.

Xiong kuangfang di qianhou **yaobai**, xiong chenjin zai ziji chuangzao de wudao zhong.
Bear wild style DI front back sway, beard eeply immerse in own create DE dance in

Bear's right leg is set on the floor, his left leg striding one step forward. Bear
sways wildly back and forth, deeply immersed in a dance of his own creation.

These interpretations are consistent with the features of the situation types.

I can now state the realization of the deictic pattern in Mandarin

(18) a. Present: Unbounded situations are located at Speech Time:
i. Event clauses with imperfective morphemes *zai* or *-zhe*;
ii. Atelic event clauses, zero-marked;
iii. State clauses with stative verb constellations, zero-marked;
iv. Stative generalizing/habitual clauses, zero-marked.

b. Past Bounded events are located before Speech Time:
i. Clauses with perfective morphemes *-le* or *-guo* and/or RVC;
ii. Clauses with telic event verb constellations, zero-marked.

c. Non-default. Future; Unbounded situation in Past
i. Clauses with future modals , future-oriented verbs and expressions: Future
ii. Clauses with time adverbials and temporal connectives: Past, Future

The a-b cases follows the pragmatic constraints stated above. The Bounded Event Constraint locates bounded events as non-present. By the Simplicity Constraint on Interpretation, non-present situations are located in the Past. By the Temporal Schema Principle zero-marked states are Present, zero-marked bounded events are non-present. In the c cases, information overrides the default. For examples, and discussion of narrative and other non-deictic interpretation, see Smith & Erbaugh 2005.

Aspectual information cues the inference of temporal interpretation, if there is no explicit temporal information. With overt viewpoints, aspectual information is semantically conveyed. The temporal meaning is inferred. With zero-marked clauses, the aspectual interpretation is inferred, providing the basis for the inference of temporal meaning. The inference patterns that I have stated are defaults; adverbials and pragmatic knowledge can override them. In actual texts, explicit adverbials are quite frequent.

4. Mixed tense and tenseless language: Navajo

Navajo has a mixed system. There are several tense-like forms; they are optional, so that a well-formed sentence may lack direct temporal information. For such sentences, aspectual information allows

inferences about temporal location along the same lines as I have laid out for Mandarin (see Smith, Fernald & Perkins 2003, in press for a detailed account).

Navajo is an Athabaskan language with a complex verb word. Nominals are optional, so that a verb word can constitute a complete sentence in itself. There is no overt form that corresponds to a verb; the 'verb base' is closest to lexical verb. I set out in (19) the basic parts of the verb word.

(19) na'ashkǫ́ǫ́' (I swimming around)
a. na - 'a - ø - sh - ł - kǫ́ǫ́'
b. 1 2 3 4 - 5 - 6
c. pref+pref + cjg+subj+ cl + stem
d. around(1+2), impf (3), 1p (4), swim (5+6)
e. verb base: [na'a...łkǫ́ǫ́'] (swim around)

Navajo has a set of 'conjugational' prefixes, or modes, e.g. prefix 3 above. One Mode is relevant to temporal location, and others are relevant to aspect. I list them according to their traditional names, which give a fairly good idea of their function. The actual prefixes vary in shape according to a number of factors (Young & Morgan 1987, 1991).

(20) Conjugational prefixes: Modes
Future, Perfective, Imperfective, Progressive, Customary, Iterative, Optative

4.1 Direct temporal forms in Navajo

There are types of direct temporal forms in Navajo. The Future Mode, which is the most tense-like, appears with event verb words only; the others are possible for all verb words.

(21) Direct temporal forms,
a. Future Mode: optional for event verb words
b. Temporal particles: optional for all verb words
Future *dooleeł*; Past *ńt'ęę'*, *dąą́*
c. Adverbs: optional for all verb words
yiskąągo 'tomorrow', *adąądąą́* 'yesterday', etc.)

The Future Mode is inflectional but not obligatory: it contrasts with other modes, none of which are temporal in nature. The temporal particles are neither inflectional nor obligatory. Semantically, however, both have tense-like properties. The examples are due to Ellavina Perkins, Mary Willie, Irene Silentman, and Young & Morgan 1987 (cited as YM).

(22) Future mode
n'deeshkǫ́ǫ́ł (I will swim around)
a. na - 'a - dee - sh - ł - kǫ́ǫ́ł
b. na'a + dee -> n'dee

(23) Temporal particles
a. 'Ashą́ą
1p-impf-eat (I eating)
b. 'Ashą́ą dooleeł
1p-impf-eat FPrt (I will eat, be eating)
c. 'Ashą́ą́ ńt'ęę'...
1p-impf-eat PPrt (I was eating ...)

The Future Mode and the temporal particles have non-actual meanings in certain contexts; this is like certain tense morphemes, as noted above.

(24) Single clause conditional
Tł'ízí náhiideesh'naał ńt'ęę'
goat I-again-revive-Fut PPrt
I should have revived the goat

(25) Present Counter-factual
Ánísts'óózídąą'go k'ad ashyéé́h doo ńt'ęę'
I-thin-PPrt+GO now I-be-married FPrt PPrt
If I were thin I would be married now

(26) Past Counter-factual
Siláo 'idlį́į́jí hazhó'ó bíhooł'ąągo shį́į́ t'ahdii siláo nishłíí dooleeł ńt'ęę'
policeman to-be-one carefully I-learn-it-perf+GO, probably still policeman I-am FPrt PPrt
If I had taken police training more carefully, I'd probably still be a policeman (YM p 678)

The atemporal past may be hypothetical rather than counter-factual. To see this, imagine the following scenario: You are a doctor, and you have a patient in the hospital. You don't know whether she has been given medicine, but you want to find out and the nurse is not available. You say:

(27) azee' neikáhí neinii'go naaltsoos yikáá' áyiilaa doo ńt'ęę'
medicine giver give-it-to-him-impf-GO paper on-it she-make-it-perf FPrt PPrt
If the nurse gave it (the medicine), she would have made a note.
(So, let's look at the notebook...)

In the light of these examples, I shall say that the future Mode and the temporal particles are tense-like, meeting two or more tense criteria.

The Future mode has three tense features: it is an inflectional morpheme; it codes temporal meaning; it has non-actual meanings in certain contexts. The past and future particles are syntactically unlike tenses: they are optional and independent of the verb. Semantically, however, they are like tenses. they have basic temporal meanings and they have non-actual meanings in certain contexts. As the examples above show, past and future forms together (mode or particle) convey hypothetical or contrary-to-fact meaning.

Thus, tense-like morphemes are available for all verb words in Navajo; though there are more choices for events - recall that the Future mode is available only for event verb words.

For Navajo, as for Mandarin Chinese, temporal meanings must include the notion of Reference Time. There are adverbs that involve reference time, e.g. *t'aa íídą́ą* (already); the shifted use of *k'ad* (now) and other deictics; clauses with temporally related situations. The language also allows a perfect interpretation, as in this sentence set in the Future.

(28) Yiskąągo nihaa yíníyágo t'áá 'íídąá kintahgoo niséyá dooleeł
tomorrow us-to you-see-us-perf+GO already town-to I-make-trip-perf FPrt
Tomorrow when you come to see us, I will already have made a trip to town (YM p 203)

I now turn to a discussion of sentences without direct temporal forms. For such sentences, temporal location is inferred pragmatically with aspectual information, just as in Mandarin Chinese.

4.2 Aspectual information in Navajo

In Navajo, as in languages generally, situation type is expressed by at the level of the clause. Since the verb word constitutes a minimal clause in Navajo, we analyze verb words as expressing events or states. (Smith 1991, 1995).

Navajo has three overt viewpoint morphemes: perfective, imperfective, and progressive. They are available for event verb words. State verb words always zero-marked, and event verb words with non-viewpoint modes are zero-marked.

The deictic pattern of temporal interpretation holds for Navajo, with the same pattern of inference from the same constraints. Event verb words with the perfective viewpoint are bounded, and taken as located in the Past. Event verb words with the imperfective or progressive viewpoint are unbounded, and taken as located in the Present. Zero-marked verb words are interpreted according to the Temporal Schema Constraint discussed above for Mandarin. If the situation type they express is intrinsically bounded, the situation is taken as bounded (telic and single-stage events). If the situation type does not have intrinsic bounds - states and atelic events - the situation is taken as unbounded. States are unbounded; they are taken as Present.

In Navajo, zero-marked event verb words are relatively unusual, unlike Mandarin Chinese. Zero-marked events arise with when the verb word has a non-viewpoint mode morpheme. Two such morphemes - the Future and Optative modes - are future-oriented, so that the question of temporal location does not arise. There are two other mode morphemes, the Customary, which forms derived statives; and the Iterative, which forms derived statives or Activities. The latter two are not exemplified here; see Smith et al 2003.

I state the general pattern of temporal interpretation in summary, and then illustrate the key cases with examples. This is a default system. Explicit temporal information can override the default.

(29) Indirect temporal interpretation in Navajo - the default
- A. Present: Unbounded situations are located at Speech Time:
  - i. Event verb word, imperfective or progressive viewpoint
  - ii. Zero-marked state verb word
  - iii. Generalizing/habitual verb word, zero-marked
- B. Past: Bounded events are located before Speech Time
  - i. Event verb word, perfective viewpoint
- C. Non-default cases: Future; Unbounded situations in the Past
  - i. Event verb word, Future mode
  - ii. Event or state, Future Particle, adverb,
  - iii. Unbounded event or state, Past particle or adverb

A. Unbounded situations in the Present.

(30) a. John Kinłaánídi naalnish
John Flagstaff-at 3p-impf-work
John is in Flagstaff working
b. Nléí dziłbąąhgóó hoołtįįł
that-one-over-there mountainside-along 3p-prog-rain
It's raining there along the mountainside (YM p 461)
c. Díí tsé doo ndaaz da
this stone neg 3p-heavy (neut) neg
This stone is not heavy (YM p 654)

The examples (a-b) express unbounded events, with the imperfective and progressive viewpoints. They are taken as Present by the Deictic Principle. (c) is a zero-marked State, taken as unbounded by the Temporal Schema Constraint and thus as Present, by the Deictic Principle.

B. Bounded events in the Past

(31) Shimá sání chizh ła' bá nánijaa' dóó bá dídíłtjéé'
my-grandmother firewood some for-her 1p-perf-bring and for-her 1p-perf-build fire
I brought back some firewood for my grandmother and built a fire for her (YM p 564)

This example has events with the perfective viewpoint. They are explicitly bounded, and taken as Past, by the Bounded Event Constraint and the Simplicity Principle of Interpretation.

The next set of examples is given to indicate that, given the use of the future mode, particles, and adverbs, Navajo has the full range of temporal possibilities.

C. Additional information overrides the default.

(32) Future. Non-default, explicit Future information
a. Shimá kindęę́ ch'iyáán ła' bá nahideeshnih
my-mother groceries some for-her pref-1p-Fut-buy
I'll buy some groceries for my mother - future Mode
b. Yiskąago Mary ałtso 'íílta' doo
tomorrow Mary complete 3p-perf-read FPrt
Tomorrow Mary graduates from school
c. Yiskąago azee' yił shaa 'anáá'átsééh
tomorrow medicine with-it to-me out-of-sight-again-3p-impf-jabsmth
He is giving me another injection tomorrow (YM p 363)

(33) Past: Unbounded situations, Past particles or adverbs
a. Kingóó 'aneeshkał ńt'ęę́' shee nikihoníłtą́
store toward 1p-prog-move along PPrt on-me 3p-begin-perf-rain
As I was going to the store it began to rain
b. Adą́ą́dą́ą́' Jáan Kinłaánídi naaghá
yesterday John Flagstaff around-3p-impf-go
John was in Flagstaff yesterday (hanging out)
c. Awéé yichahgo ńt'ęę́' bimá bich'į' nídiilwo'
baby cry-Cust PPrt mother her-to run-Cust
When the baby cried mother always came running.

The examples in (32) show that bounded events can be located in the Future; those in (33) show that unbounded events, and states, can be located in the Past.

This discussion has shown that Navajo has a mixed temporal system. Temporal information may be coded linguistically by the Future mode, temporal particles, and/or time adverbs, but it is always optional. There are thus many sentences that do not have direct temporal information. In such cases aspectual information cues temporal interpretation, according to the pragmatic principles given at the beginning of this article.

5. Tensed language: English

In this section I give a brief account of temporal location in English. The purpose is to show that it conforms to the principles given above, although the system for temporal location is quite different. In English, unlike the two languages discussed above, tense is obligatory. Therefore, all independent sentences have direct temporal information, which is given by past or present tense, or Future *will*. Temporal adverbs are optional.

Situation types are conveyed by the verb constellation. The situation types discussed above occur in English, with the characteristics given. Telic and single-stage events have intrinsic bounds; atelic events and states do not.

Aspectual viewpoint information is also obligatory: all clauses have either the simple (perfective) or progressive (imperfective) verb form. There are no zero-marked clauses in English.

(34) Viewpoints in English:
Perfective, situations in their entirety: events as bounded; states as unbounded.
Imperfective (progressive), events only, unbounded

This brief summary of familiar material ignores complex cases; they are not relevant here.

I now give an account of temporal location in English. The possibilities follow the deictic pattern.

(35) The deictic pattern in English
Present tense: Present tense, unbounded situations: ongoing events, states
Past tense: Bounded events, unbounded states - perfective viewpoint
Unbounded events - progressive viewpoint
Future *will*: Bounded & unbounded situations - future *will*
Bounded & unbounded situations - present tense, future adverb

The pragmatic principles are relevant only to the Present: by the Bounded Event Constraint, bounded events are not located at SpT. English has event clauses with the simple perfective verb form: strikingly, they are taken as derived statives: generic or generalizing.

Since states are unbounded: they surround Situation Time. When they are located at Speech Time they can extend indefinitely into the past or future.

(36) Situations in the Present
i. Event clauses with progressive *be+ing*:
Mary is talking
ii. State clauses with stative verb constellations, perfective (simple verb form)
John believes in ghosts.
Leigh is in the garden.
iii. Derived statives: generic, habitual clauses, perfective (simple verb form)
Kim walks to work.
John feeds the cat
Leigh plays tennis

This approach accounts for 'timeless' or 'temporally indefinite' interpretations traditionally ascribed to lawlike statements, generics, etc. Even in a thoroughly tensed language like English, aspectual factors limit temporal interpretation.

6. Conclusion

Three very general pragmatic principles go a long way toward explaining how situations are temporally located in language. The principles are the Deictic Principle, the Bounded Event Constraint, and the Simplicity Principle of Interpretation, of which the Temporal Schema Principle is a special case. They may be realized differently in different languages. Lexical and adverbial information can determine a temporal interpretation that departs from the default.

In some languages temporal information is obligatory, expressed by linguistic forms. Then pragmatic principles play a relatively minor role at the level of the sentence (though not in discourse). This is the case with a tensed language since full-fledged tense is obligatory, part of the grammatical spine of a sentence. Languages may have tense-like morphemes as well as full tense morphemes.

When temporal information is not expressed - obligatorily by tense, or with adverbs - aspectual viewpoint and situation type provide keys to the interpretation of temporal location through the feature of boundedness. Aspectual viewpoints explicitly code whether a situation is bounded or unbounded. Zero-marked clauses are interpreted by the Temporal Schema Principle together with the other principles.

Three times - Situation Time, Reference Time, and Speech Time - are needed to account for temporal interpretation in tenseless as well as tensed languages. Without tense, relation to Speech Time need not be coded linguistically, but is conveyed by linguistic or situational context. Information in the context may override the default interpretation that the pragmatic principles deliver.

7. Appendix: Sketch of Implementation in Discourse Representation Structures

Temporal location should be part of the semantic representation for all discourse. It is essential to understanding: the coordinates for truth conditions include time. As we have seen, in languages without tense the determination of temporal location is pragmatic, depending on inference from aspectual

information. I sketch an account for Mandarin, in the framework of Discourse Representation Theory. I indicate how the relevant information is conveyed or inferred in a Discourse Representation Structure (DRS). A similar account could be given for Navajo: the compositional rules and characterizations of viewpoint and situation type would differ only according to the details of the language.

The DRS is developed from construction rules. The input to the rules is a relatively rich syntactic surface structure, with information associated with particular linguistic forms. The output for temporal location are temporal and situation entities and characterizing features in the entered in the DRS. I ignore cases where information in sentence or context overrides the default, including adverbs.

The basic idea for Mandarin is to see that aspectual information is stated in such a way as to be accessible to inference rules for temporal location. Overt aspectual viewpoints give the key information as to boundedness. For the case of the neutral viewpoint in a zero-marked clause, the key information is in the defining features of the situation type expressed. Recall that intrinsically bounded situation types are taken as bounded, in the default case of zero-marking.

7.1 Aspectual information

Situation entities are introduced at the level of the clause. Compositional rules interpret the situation type of a clause and introduce a situation entity of the appropriate type into the DRS. The rules consider the verb and nature of arguments (quantized or not). For instance, Rule A sketches a rule for Mandarin that recognizes Activities and introduces an entity with the appropriate characterizing features. 'Activity' and other terms for situation type are shorthand for the cluster of semantic features - in the case of Activities, these are : Dynamic, Atelic, Durative. Situation type rules ignore viewpoint morphemes.

(i) $_{\text{Clause}}$ [NP (Adv) V_{atel} ([NP]) -> entity: Activity: atelic

Rule A would apply to the sentence in (ii) and interpret it as an 'Activity':

(ii) Zhangsan zai gongzuo wan
Zhangsan at park play

Activities are atelic. This feature can be formalized in terms of part structure: for an atelic event, part of an event falling under a predicate P also falls under that predicate, as in (iii):

(iii) The atelic property
AtelicE predicate P_{At}: $\forall e, e' [P_{At}(e) \& P_{At}(e') \rightarrow \exists e' < e]$

This is sometimes known as the 'divisive' property:

Now consider Rule B, a sketch of a rule that recognizes Accomplishment events and introduces an entity with the relevant characterizing features.

(iv) Rule B:
$_{\text{Clause}}$[NP V_{tel} $_{\text{NP}}$[Quant]] -> entity: Accomplishment:telic

Rule B interprets a clause as an Accomplishment event if it has a verb of a potentially telic class and a quantity noun with a classifier. Unspecified NPs in Mandarin are indeterminate.

Rule B applies to (v): *mai* is a telic verb, *yige shu* is a quantized NP.

(v) Wo mai-le yiben shu
I buy -LE one-CL book

The term 'Accomplishment' is shorthand for semantic features informally called Dynamic, Telic, and Durative. The feature of telicity is relevant to temporal location: telic events are intrinsically bounded. We can represent telicity with a semantic feature requiring that a telic event that falls under a predicate P_t has no proper part that falls under the same predicate, as in (vi). I will call this 'Property B':

(vi) The telic property: Property B
TelicE, predicate P_t: $\forall e, e' [P_t (e) \& P_t (e') \rightarrow \neg \exists e' < e]$

This property holds for other telic events - that is, Achievements - and for single-stage events as well. We will require that compositional rules for telic events and single-stage events state that the situation entities have Property B.

7.2 Viewpoint

Viewpoint makes semantically visible all or part of a situation. Overt viewpoints determine boundedness. In tenseless languages such as Mandarin, all viewpoints will introduce SitT (t_1) and RT (t_2) and their relation. Recall that the relation to SpT is pragmatically determined. The perfective *-le* provides that $t_1 = t_2$, and that the event entity is located at t_1 and included in the t_1 interval, as in (vii).

(vii) e-le: Introduce t_1, t_2; $t_1 = t_2$; $\& \exists e \exists e' [e' \in E \& e \preceq e' \& e \subseteq t_1]$

This allows for bounded but incomplete telic situations, which occur in Mandarin with *-le*.
For other Mandarin viewpoints see Smith & Erbaugh 2005.

7.3 Zero-marked clauses

The zero morpheme (ϕ) conveys a neutral aspectual viewpoint that gives partial information, indeterminate as to boundedness (Smith 1991, 1994). It also introduces Situation Time and Reference Time into the DRS: $t_1 = t_2$; ø neutral; e = the event or state entity introduced by a clause. This requirement is very weak: it says only that some of e must be visible at SitT; but it allows that all of e be visible.

(viii) e-ϕ: Introduce t_1, t_2; $t_1 = t_2$ & $\exists$ e [e $\in$ E & $t_1 \subseteq$ e]

However, the default viewpoint interpretation of a zero-marked clause is more specific. The clause is semantically visible as bounded or unbounded according to its situation type: the temporal schema of the entity expressed determines boundedness.

Recall that situation entities with intrinsic bounds have Property B. We can relate this property to temporal interpretation, via the relation of a situation entity to Situation Time. Recall that bounded events are included in SitT, and unbounded events overlap or surround the SitT interval. We will provide that if the situation entity of a clause has property B, the default viewpoint interpretation is that of a bounded event and the event in its entirety is included in SitT, noted as (t_2):

(ix) e-ϕ: If e has property B, then $t_2 \subseteq$ e ; otherwise, e O t_2).

Once this relation is stated in the DRS, inference rules of temporal interpretation can apply. When $t_2 \subseteq$ e, the default is that the situation is located in the Past; when e O t_2 , the default is that the situation is located in the Present.

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Proceedings of the 2004 Texas Linguistics Society Conference: Issues at the Semantics–Pragmatics Interface

edited by Pascal Denis, Eric McCready, Alexis Palmer, and Brian Reese

Cascadilla Proceedings Project Somerville, MA 2006

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ISBN 1-57473-417-2 library binding

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This paper can be cited as:

Smith, Carlota S. 2006. The Pragmatics and Semantics of Temporal Meaning. In *Proceedings of the 2004 Texas Linguistics Society Conference*, ed. Pascal Denis et al., 92-106. Somerville, MA: Cascadilla Proceedings Project.

or:

Smith, Carlota S. 2006. The Pragmatics and Semantics of Temporal Meaning. In *Proceedings of the 2004 Texas Linguistics Society Conference*, ed. Pascal Denis et al., 92-106. Somerville, MA: Cascadilla Proceedings Project. www.lingref.com, document #1509.