

Temporal Logic and Tense/Aspect

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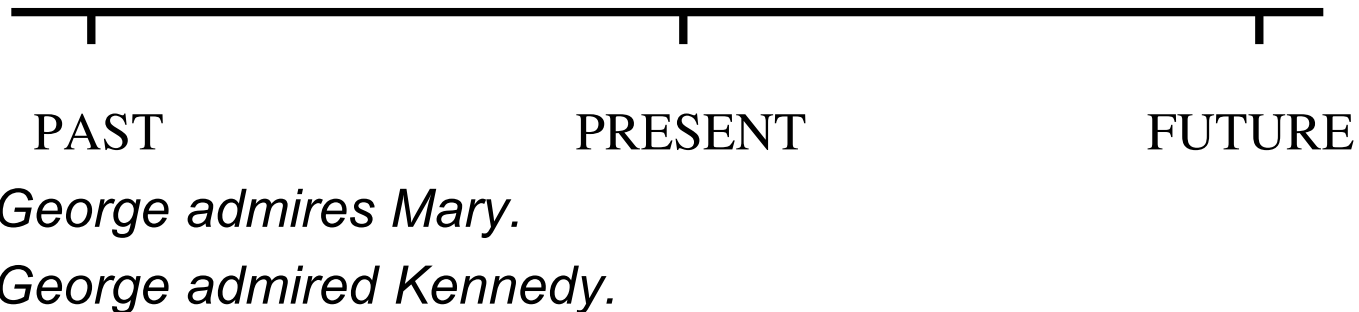


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CS 112

Tense

- Grammatical expression of the time of the situation described, relative to some other time (e.g., moment of speech)

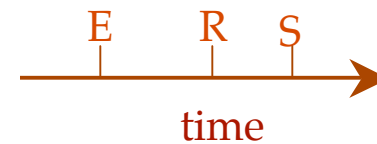


Reichenbach

- Tensed utterances introduce references to 3 'time points'
 - Speech Time: S
 - Event Time: E
 - Reference Time: R

_SI had [mailed the letter]_E [when John came & told me the news]_R

$E < R < S$



- The concept of 'time point' is an abstraction — it can map to an interval
- Three temporal relations are defined on these time points
 - at, before, after
- 13 different relations are possible

Reichenbachian Tense Analysis

| Relation | Reichenbach's Tense Name | English Tense Name | Example |
|-------------------------|---|--|--|
| E<R<S E=R<S | Anterior past Simple past | Past perfect Simple past | I had slept I slept |
| R<E<S R<S=E | Posterior past E>R<S | | I would sleep |
| R<S<E | | | |
| E<S=R S=R=E S=R<E | Anterior present Simple present Posterior present | Present perfect Simple present Simple future | I have slept I sleep I will sleep <i>Je vais dormir</i> |
| S<E<R S=E<R | Anterior future E<R>S | Future perfect | I will have slept |
| E<S<R | | | |
| S<R=E | Simple future | Simple future | I will sleep <i>Je dormirai</i> |
| S<R<E | Posterior future | | I shall be going to sleep |

- Tense is determined by relation between R and S
 - R=S, R<S, R>S
- Aspect is determined by relation between E and R
 - E=R, E < R, E > R
- Relation of E relative to S not crucial
 - Represent R<S=E as **E>R<S**
- Only 7 out of 13 relations are realized in English
 - 6 different forms, simple future being ambiguous
 - Progressive no different from simple tenses
 - *But I was eating a peach*
≠> *I ate a peach*

Tense as Operator: Prior

| Relation | Reichenbach's Tense Name | PRIOR | English Tense Name | Example |
|----------|---|-------|--------------------|---------------------------|
| E<R<S | Anterior past | PPp | Past perfect | I had slept |
| E=R<S | Simple past | Pp | Simple past | I slept |
| R<E<S | Posterior past | PFp | | I would sleep |
| R<S=E | | | | |
| R<S<E | Anterior present Simple present Posterior present | Pp | Present perfect | I have slept |
| E<S= R | | p | Simple present | I sleep |
| S= R= E | | Fp | Simple future | I will sleep |
| S= R<E | | | | <i>Je vais dormir</i> |
| S<E<R | Anterior future | FPp | Future perfect | I will have slept |
| S=E<R | | | | |
| E<S<R | Simple future | Fp | Simple future | I will sleep |
| S<R=E | | | | |
| S<R<E | Posterior future | FFp | | I shall be going to sleep |

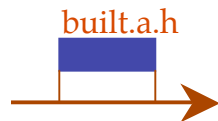
- Free iteration captures many more tenses,
 - *I would have slept*
PFpφ
- But also expresses many non-NL tenses
 - *PPPPφ [It was the case]⁴ John had slept*

Aspect

- Two Varieties
 - Grammatical Aspect
 - Distinguishes viewpoint on event
 - Lexical Aspect
 - Distinguishes types of events (situations)(eventualities)
 - Also called Aktionsarten

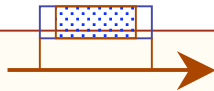
Grammatical Aspect

- Perfective – focus on situation as a whole
 - John built a house



- Imperfective – focus on internal phases of situation
 - John was building a house

was building.a.h



Aktionsarten

- **STATIVES** *know, sit, be clever, be happy, killing, accident*
 - can refer to state itself (ingressive) *John knows* , or to entry into a state (inceptive) *John realizes*
 - **John is knowing Bill, *Know the answer, *What John did was know the answer*
- **ACTIVITIES** *walk, run, talk, march, paint*
 - if it occurs in period t, a part of it (also an activity) must occur for every/most sub-periods of t
 - X is Ving entails that X has Ved
 - *John ran for an hour, *John ran in an hour*
- **ACCOMPLISHMENTS** *build, cook, destroy*
 - culminate (telic)
 - x Vs for an hour does not entail x Vs for all times in that hour
 - X is Ving does not entail that X has Ved.
 - *John booked a flight in an hour, John stopped building a house*
- **ACHIEVEMENTS** *notice, win, blink, find, reach*
 - instantaneous accomplishments
 - **John dies for an hour, *John wins for an hour, *John stopped reaching New York*

| | Telic | Dynamic | Durative | E.g. |
|----------------|-------|---------|----------|-------------------|
| Stative | - | - | + | know, have |
| Activity | - | + | + | walk, paint |
| Accomplishment | + | + | + | destroy, build |
| Achievement | + | + | - | notice, win |

Different types of tense systems across languages

- Using verbal inflection:
 - Languages with a two-way contrast:
 - English: Past (before the moment of speaking) vs. Nonpast
past *-ed*: *She worked hard.*
nonpast (unmarked): *We admire her. I will leave tomorrow.*
 - Dyirbal (Australian language): Future vs. nonfuture:
future *-ñ*: *bani-ñ* 'will come'
nofuture *-ñu*: *bani-ñu* 'came, is coming'
 - Languages with a three-way distinction:
 - Catalan, Lithuanian: Past vs. Present vs. Future
(Cat.) past: *treball-à.* (Lit.) *Dirb-au.* 'I worked'
present: *treball-a.* *Dirb-u.* 'I work'
future: *treball-arà.* *Dirb-siu.* 'I will work'

Different types of tense systems across languages

- A much richer distinction:

- ChiBemba (Bantu language):

- For past:

- Remote past (before yesterday) *Ba-àlí-bomb-ele* ‘they worked’
 - Removed past (yesterday) *Ba-àlí-bomba* ‘they worked’
 - Near past (earlier today) *Ba-àcí-bomba* ‘they worked’
 - Immediate past (just happened) *Ba-á-bomba* ‘they worked’

- For future:

- Immediate future (very soon) *Ba-áláá-bomba* ‘they’ll work’
 - Near future (later today) *Ba-léé-bomba* ‘they’ll work’
 - Removed future (tomorrow) *Ba-kà-bomba* ‘they’ll work’
 - Remote future (after tomorrow) *Ba-ká-bomba* ‘they’ll work’

Aspect

- Internal temporal organization of the situation described by an event.
- Most common:
 - **Perfective:** Situation viewed as a bounded whole.
 - **Imperfective:** Looking inside the temporal boundaries of the situation.
 - **Habitual**
 - **Progressive**
- Other related aspectual distinctions:
 - **Iterative:** The action is repeated.
 - **Inceptive:** The action is began.
 - **Inchoative:** Entering into a state.

Different types of aspect systems across languages

- Some languages use auxiliaries and particles associated with the verb:

English:

- **Perfective:** *have* + Past Participle *I have eaten.*
- **Progressive:** *be* + Present Participle *I am eating.*
- **Habitual:** *use to* + Base form *I used to sing.*

Catalan:

- **Habitual:** *soler* + Infinitive
Sol parlar. ‘She generally talks.’
Solia cantar. ‘She used to talk’
- **Iterative:** *anar*_(past) (‘to go’)+ Present Part
Va tornant ‘She keeps coming back’
go_{past} coming_back

Different types of aspect systems across languages

- Other languages use a derivational component:

Russian: by means of a system of verbal prefixes

- **Imperfective**: simple verbs *Ja čítal* ‘I was reading’
- **Perfective**: prefixed verbs *Ja pročítal* ‘I (did) read’

Finnish: by means of the case of the object

- **Perfective**: *Hän luki kirjan*_(acc.) ‘He read the book’
- **Imperfective**: *Hän luki kirjaa*_(part.) ‘He was reading the book’.

Basic meaning: only part of the object being referred to is affected by the situation.

Tense and Aspect

- Aspect and Tense generally cross-classify:

- Russian:

- Present:

- Only imperfective: *čítáju* ‘I read’

- Past:

- Imperfective: *Ja čítál* ‘I was reading’

- Perfective: *Ja pročítál* ‘I (did) read’

- Future:

- Imperfective: ??

- Perfective: *Ja pročítáju* ‘I shall read’

Tense and Aspect

– Basque:

- Present:

- Imperfect (Gerund + Present tense auxiliary) *ekartzen du* ‘he is bringing it’
- Perfect (Past Participle + Present tense aux.) *ekarri du* ‘he has brought it’

- Past:

- Imperfect (Gerund + Past tense aux.) *ekartzen zuen* ‘he brought, used to bring’
- Perfect (Past Participle + Past tense aux.) *ekarri zuen* ‘he brought, had brought’

- Future:

- Simple (Future Participle + Pres. tense aux.) *ekarriko du* ‘he will bring it’
- Past Future (Future Participle + Past tense aux.) *ekarriko zuen* ‘he would bring’

An interesting case

- Tense and Aspect in 2 different creoles, evolved independently from each other:

| | Hawaiian Creole | Haitian Creole |
|---|----------------------------|--|
| Base Form (he walks, he walked) | <i>He walk</i> | <i>Li maché</i> |
| Progressive he is walking, he was walking | <i>He stay walk</i> | <i>L'ap maché</i> (<i>Li ap maché</i>) |
| Perfective he has walked, he had walked | <i>He bin walk</i> | <i>Li té maché</i> |
| Perfective Progressive (he has/had been walking) | <i>He bin stay walk</i> | <i>Li t'ap maché</i> (<i>Li té ap maché</i>) |
| Irreal (he would walk, he will walk) | <i>He go walk</i> | <i>L'av maché</i> |
| Irreal Progressive (he would/will be walking) | <i>He go stay walk</i> | <i>L'av ap maché</i> (<i>Li av ap maché</i>) |
| Irreal Perfective (he would/will have walked) | <i>He bin go walk</i> | <i>Li t'av maché</i> (<i>Li té av maché</i>) |
| Irreal perfective Progressive he would/will have been walking | <i>He bin go stay walk</i> | <i>Li t'av ap maché</i> (<i>Li té av maché</i>) |