A Simple Annotation Schema for Temporal Expressions

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Roadmap

- Tense and Aspect
- Theories of Tense
- Significance
- Past Approaches
- Current State and Examples
- Future Direction
- Goals

Tense and Aspect

- English
  - Past, Present, Future Tense, Perfect Aspect

- Japanese and Korean
  - Past/non-past
  - present and future determined by adverbials or context

- Mandarin
  - No tense markers
  - Relies on aspectual markers and adverbials

- Mayan
  - Relies on aspect, mood, and contextual information

Reichenbach (1947)

- Speaker Time, Event Time, Reference Time

I see Mary
   E,R,S

I saw Mary
   E,R_S

I will see Mary
   S_E,R

I have seen Mary.
   E_R,S

I had seen Mary.
   E_R_S

I will have seen Mary.
   S_E_R

Comrie (1985)

- Addition of before, simul, after
- Reference time only plays a role in relative tenses

I see Mary.
    E simul S

I have seen Mary.
    E before R simul S

I saw Mary.
    E before S

I had seen Mary.
    E before R before S

I will see Mary.
    E after S

I will have seen Mary.
    E before R after S

Corpus Annotation

- Qualitative
  - How is tense formed?
- Quantitative
  - Which constructions are most frequent?
  - How has usage shifted overtime?

- South Slavic Aorist
- Japanese Marked Past

(1) Morgen lese   ich ein Buch
     Tomorrow read.PRS 1.SG DET book

     'Tomorrow I read a book'

(2) Morgen   werde ich   ein Buch lesen
     Tomorrow FUT   1.SG DET book read.INF

     'Tomorrow I will read a book'

(3) Co   jutro   robisz?
     What tomorrow do.PRES.2.SG

     'What you do tomorrow?'

(4) Jutro   czytam   książkę
     Tomorrow read.1.SG book.ACC

     'Tomorrow I read a book'

Computational Incentive

- Automatically recognize events and sequence them

- Medical
- Defense
- Legalese
- Geolocation

Past Approaches

- TimeML
  - Standard markup language for temporal events
  - Event Annotation
  - TIMEX Tags (MedTime)

- Highly complex
  - Lead to Errors
  - Must Train Professional Annotators
  - Annotation Effort

(12) John taught twice on Monday but only once on Tuesday.

```
John <EVENT eid="e1" class="OCCURRENCE"> taught </EVENT>
<SIGNAL sid="s1"> twice </SIGNAL>
<SIGNAL sid="s2"> on </SIGNAL>
<TIMEX3 tid="t1" type="DATE" value="xxxx-wxx-1"> Monday
</TIMEX3>
but only
<SIGNAL sid="s3"> once </SIGNAL>
<SIGNAL sid="s4"> on </SIGNAL>
<TIMEX3 tid="t2" type="DATE" value="xxxx-wxx-2"> Tuesday
</TIMEX3>
<MAKEINSTANCE eiid="ei1" eventID="e1" tense="PAST"
aspect="NONE" signalID="s1" polarity="POS" cardinality="2"/>
<MAKEINSTANCE eiid="ei2" eventID="e1" tense="PAST"
aspect="NONE" signalID="s3" polarity="POS" cardinality="1"/>
<TLINK eventInstanceID="ei1" signalID="s2" relatedToTime="t1"
relType="IS_INCLUDED"/>
<TLINK eventInstanceID="ei2" signalID="s4" relatedToTime="t2"
relType="IS_INCLUDED"/>
```

Current State

- **Speaker Time**:
  - Relative to publication time of document in question

- **Reference Time**:
  - If reference time is overtly stated, it is marked R
  - Temporal adverbials (yesterday, tomorrow)
  - Temporal adjuncts (after, before) POS, NEG, SIMUL

- **Event Time**:
  - Events marked at the clause level in a simple numeral sequence (E=1, E=2, etc.)

- Tense and Aspect marked at the clause level

John met Mary after he met his mom on Tuesday.

Event$_1$: John met Mary
Tense: Simple Past
Reference Point: some time after he met his mom on Tuesday
Sequence: 2

Event$_2$: he met his mom
Tense: Simple Past
Reference point: Tuesday
Preposition: after - Negative (event sequenced before previous clause)
Sequence: 1

John meets his mom   John meets Mary
-------Tuesday ---Utterance Time--------------------------------

John met Mary after he met his mom on Tuesday.

$[[E_1 = 2 [SP_1$ John met Mary$]] [R_1 [$NEG after$] [E_2 = 1 [SP_2$ he met his mom $[R_2$ on Tuesday$]]]]]$

$[[E_1 = 2 [SP_1$ John met Mary$]] [R_1 [$NEG after$] [E_2 = 1 [SP_2$ he met his mom $[R_2$ on Tuesday$]]]]]$

$[[E_1 = 2 [SP_1$ John met Mary$]] [R_1 [$NEG after$] [E_2 = 1 [SP_2$ he met his mom $]] [R_2$ on Tuesday$]]]]$

$[[E_1 = 2 [SP_1$ John met Mary$]] [R_1 [$NEG after$] [E_2 = 1 [SP_2$ he met his mom $]] [R_2$ on Tuesday$]]]$

$[[E_1 = 2 [SP_1$ John met Mary$]] [R_1 [$NEG after$] [E_2 = 1 [SP_2$ he met his mom $]] [R_2$ on Tuesday$]]]$

Future Direction

- Deeper properties of durations and events
  - He read a book **in** four hours
  - He read a book **for** four hours
- Modality
  - How confident are we that an event has happened, or will happen?
- Crosschecking events across multiple documents
  - Older document vs newer document mentioning similar events
  - Discrepancies between sources

- Temporal Logic
  - # I will eat the food yesterday.
  - # I ate the food tomorrow.

Goals

- Annotate time and events

- Interpret tense over embedded clauses
  - Can we develop an algorithm?

- Universal Theory of Tense

Thank you!

References

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