

Computational Perspectives on Aspect

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Ling 315: Aspect

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1 More Analyses of Aspect

- Reichenbachian System
- Discourse-Representation Theory (DRT; Kamp and Reyle 1993)

2 Background on Computational Implementations

Reason to want treatments of Tense/Aspect:

1. Machine Translation
2. Question-Answering Systems

Famous Aspect papers within CL (see Bibliography in Butt 1995 for exact references):

- Moens and Steedman (1988) — *Aspectual Coercion*
- Hinrichs (1986) — *Temporal Anaphora*

(1) Fred arrived at 10. He had got up at 5; he had taken a long shower, . . .

2.1 Machine Translation — Some Examples

- Eurotra (Allegranza et al. 1991)
- Verbmobil (Butt 1995)
- linguattec (Eberle 2002)

Main Questions: Transfer Architecture vs. Deep Semantic Analysis?

2.2 Question Answering

- Just beginning — nothing major published yet.
- Deep Semantic Analysis necessary.

For deep semantic analysis of tense/aspect, CL approaches have generally worked with versions of DRT, which integrates a version of Reichenbach's system.

3 The Reichenbachian System

3.1 The Basics

Reichenbach (1947) proposed to view and logically encode tense/aspect by means of three core times:

- Speech Time (S) — when the utterance takes place (usually “now”)
- Event Time (E) — when the Event takes place
- Reference Time (R) — Reference with respect to which an event is situated.

3.2 Example with respect to German

Ehrich (1992) works out a very detailed analysis of German using these Reichenbachian notions.

(2)

		Contextually Determined	
		S, R	R < S
Intrinsic	E, R	Present	Past
Relations	E < R	Perfect	Past Perfect
	E > R	—	—

The “,” stands for \circ (overlap).

(3)

Present Tense Verbs	E \circ R,	R > S or S \subseteq R
Past Tense Verbs	E \circ R	R < S
Infinitives/Participles	E,R	R,S
Future Auxiliary		R > S
Present Perfect Auxiliary	E < R	R \circ S
Past Perfect Auxiliary	E < R	R < S

Example Drawings Using a Timeline

4 German to English Translation

4.1 Present Tense

Temporal Adverbials disambiguate the German present tense.

- (4) Wir machen übermorgen einen Termin aus.
We'll arrange an appointment day after tomorrow.

Event in combination with a Temporal Adverb

- (5) DRF:28: genau, wir **treffen** uns **dann** in der Eingangshalle des Czerczinsky mit den Unterlagen
ERF:29: we **will meet** in the lobby of the Czerczinsky with the papers.

Unmodified Event

- (6) wir **treffen** uns in der eingangshalle.
we **are meeting** in the lobby

Statives, on the other hand, are always realized in the present tense in English: whether or not a temporal adverb is present is irrelevant.

Statives

- (7) a. D7:08 Dienstag **ist** etwas ungünstig.
E7:08 Tuesday **is** a bit inconvenient.
b. D7:14 **Meinen** Sie das **reicht** uns?
E7:14 Do you **think** that **is** enough for us?
c. D7:07 Da **habe** ich noch Zeit.
E7:07 I still **have** time then.
d. BonnD1:89 und **am siebenundzwangisten**, da **ist** leider der Kongress in Berlin wieder
BonnE1:89 and **on the twenty-seventh** there **is** the conference in Berlin again

4.2 The German Past Tense

Occurrences of the German past tense within the Verbmobil dialogs are rare and fairly uninteresting. They always correspond to the English past or past progressive, depending on whether or not the predicate in question is a state or an event. Typical examples are shown in (8) and (9).

- (8) D1:19 nein halt das **war** jetzt Mai
E1:19 no wait, that **was** May now
(9) D1:07 oh, ich **dachte** eigentlich an den fünfzehnten April
E1:07 oh, I **was** actually **thinking** of the fifteenth of April, a week later

5 German Perfect

- (10) D3:01 der Termin den wir neulich **abgesprochen haben** ...
 E3:01 the appointment that we **decided on** the other day ...
- (11) BonnD1:02 das **hatten** wir ja **vorgesehen**
 BonneE1:02 we **had planned** on that

Effect of *since*:

- (12) Ich **bin** schon seit Montag in London.
 I **have been**/***am** in London since Monday.

6 The Verbmobil Implementation

```
tense_condition  ::      e_rel_r           : tense_rel,
                      r_rel_s           : tense_rel,
                      tense_inst        : marker,
                      e_time            : marker,
                      r_time            : marker,
                      s_time            : marker,
                      tloc               : tloc_type,
                      sur_tense         : etense_val.
```

Temporal Adverbs

(13)

Type		Examples
st_dist	(not coincident with S)	<i>morgen, im April, montags</i>
st_equ	(coincident with S)	<i>heute, jetzt</i>
st_prec	(precedes S)	<i>gestern, vorhin</i>
st_perf	(perfectivizing)	<i>seitdem, bisher</i>

The German Present Tense

e_rel_r:	assoc	(underspecified)
r_rel_s:	follow_eq	(ambiguous)
r_time :	sort: temporal_c	(underspecified)
s_time :		(specified as “now” in anchors)
e_time :		(coindexed with the verb)
tense_inst:		(same as the e_time)

The statement *saturate_tense* effects the translation.

1. Present Disambiguated to Future by Temporal Adverbial →Future

```
saturate_tense1(~precede,follow_eq,temporal_c,dynamisch_c,st_dist) =>
  e_rel_r: overlap_rel &
  r_rel_s: follow &
  sur_tense: fut.
```

2. Present of Dynamic Verbs →Present Progressive

```
saturate_tense1(~precede,follow_eq,temporal_c,dynamisch_c,~st_dist &
  ~st_perf&~st_prec) =>
  e_rel_r: overlap_rel &
  r_rel_s: equal &
  sur_tense: presprog.
```

3. Present of Stative Verbs →Present

```
saturate_tense1(~precede,follow_eq,temporal_c,statisch_c,
  ~st_dist & ~st_perf & ~st_prec) =>
  e_rel_r: overlap_rel &
  r_rel_s: equal &
  sur_tense: present.
```

4. Present of Stative Verbs with Temporal Adverb →Present

```
saturate_tense1(~precede,follow_eq,temporal_c,statisch_c,st_dist) =>
  e_rel_r: overlap_rel &
  r_rel_s: follow &
  sur_tense: present.
```

Past Tense

e_rel_r:	assoc	(underspecified)
r_rel_s:	precede	(unambiguously past)
r_time :	sort: temporal_c	(underspecified)
s_time :		(specified as “now” in anchors)
e_time :		(coindexed with the verb)
tense_inst:		(same as the e_time)

5. German Past of Dynamic Verbs →Past Progressive

```
saturate_tense1(~precede,precede,##,dynamisch_c,##) =>
  e_rel_r: overlap_rel &
  sur_tense: pastprog.
```

6. German Past of Stative Verbs → Simple Past.

```
saturate_tense1(~precede,precede,##,statisch_c,##) =>
    e_rel_r: overlap_rel &
    sur_tense:spast.
```

The Perfect

e_rel_r:	precede	(introduced by auxiliary)
r_rel_s:	equal	(present tense morphology)
r_time :	sort: temporal_c	(underspecified)
s_time :		(specified as “now” in anchors)
e_time :		(coindexed with the verb)
tense_inst:		(same as the e_time)

The Past Perfect

e_rel_r:	precede	(introduced by auxiliary)
r_rel_s:	precede	(past tense morphology)
r_time :	sort: temporal_c	(underspecified)
s_time :		(specified as “now” in anchors)
e_time :		(coindexed with the verb)
tense_inst:		(same as the e_time)

8. German Present Perfect → English Simple Past

```
saturate_tense1(precede,equal,##,##,##) =>
    sur_tense:spast.
```

9. German past perfect → English past perfect

```
saturate_tense1(precede,precede,##,##,##) =>
    sur_tense:pastperf.
```

10. Perfect Reading Introduced by *seitdem* and Similar Adverbials → Perfect

```
saturate_tense1(assoc, follow_eq, temporal_c, ##, st_perf) =>
    e_rel_r: precede &
    r_rel_s: equal &
    sur_tense:presperf.
```

7 Homework

1. How would the system handle the translation of the following pair?

Event in combination with a Temporal Adverb

- (14) DRF:28: genau, wir **treffen** uns **dann** in der Eingangshalle des Czerczinsky mit den Unterlagen
ERF:29: we **will meet** in the lobby of the Czerczinsky with the papers.

Unmodified Event

- (15) wir **treffen** uns in der eingangshalle.
we **are meeting** in the lobby
2. Write a transfer rule in conjunction with a representation of the future auxiliary that would take care of translation pairs like the following:
- (16) Karls5:16 auf jeden Fall **werde** ich am Donnerstag **kommen**
Karls5:16 in any case, I'll **come** on Thursday