

# Concepts

Following <https://plato.stanford.edu/entries/tense-aspect/>

- ▶ Event

The engine broke down

- ▶ State

The engine is still not working

- ▶ Process

They are rebuilding the engine

- ▶ Sometimes just combined into events
- ▶ Sometimes just combined into events and states
- ▶ In modern theories, events compose into bigger events
  - ▶ Rebuilding = Dismantling ⊙ Repairing ⊙ Assembling

# Tense

- ▶ Tense: when
  - ▶ An event occurs
  - ▶ A state holds
  - ▶ A process proceeds
- ▶ Absolute (really, relative to the present)
  - The engine broke down
  - I regret to inform you the engine broke down
  - We will make the engine great again
- ▶ Relative (to some time)
  - The engine will have been fixed next week

# Reichenbach's Model

## Interplay of three components

- ▶ Event time
- ▶ Reference time
- ▶ Speech time

E, R, S	Sam is working
S – E, R	Sam will work
E, R – S	Sam worked
E – R – S	Sam had worked
S – E – R	Sam will have worked
R – E – S	Sam would (go on to) work

- ▶ Enhancements needed for more complex sentences

Sam would have worked

# Aspectual Classes or Aktionsarten

The internal structure of an event (Vendler, building on Aristotle's)

▶ State

She's happy today

▶ Achievement: transition into a state

She received an award

She is completing her project

▶ Activity: indefinite ending

She is studying Haskell

She is writing code

▶ Accomplishment: definite result state

She is implementing a new parser

▶ Semelfactive (Comrie, Carlota Smith), e.g., *sneeze*, *knock*

Her product exploded the whole market

## Grammatical Tests to Distinguish the Aspects

- ▶ Statives don't work with progressives

\*She's being happy today

She's receiving an award today

She is completing her project

- ▶ Achievements can work with *in* but not with *for* adverbials

She won an award in two days

\*She won an award for two days (invites a different reading)

She reached the peak of her profession in two years

\*She reached the peak of her profession for two years

- ▶ Accomplishments work with *in* and sometimes *for* adverbials

She implemented a parser in two days

She implemented a parser for two days

- ▶ Activities work with *for* but not with *in* adverbials

\*She wrote code in two days

She wrote code for two days

# Event Nucleus

Moens and Steedman

- ▶ An event notionally has three components
  - ▶ Preparatory phase
  - ▶ Culminating event
  - ▶ Consequent phase
- ▶ Event types reference components of the nucleus differently

	Preparatory phase	Culminating event	Consequent phase
State	no	no	yes
Achievement	no	yes	no
Activity	yes	no	no
Accomplishment	yes	yes	yes

How about semelfactives?

## Lexical or Grammatical?

- ▶ Vendler claimed it's lexical

- ▶ A verb has a fixed *aktionsart*

She completed her project

\*She completed her project all night

- ▶ Can coerce an achievement into an activity

Students completed their projects all night

- ▶ Can coerce a state into an activity

She is resembling her mother more and more every day

- ▶ Iteration

Miranda played *Hamilton* for two years

# Relation to Noun Phrases: Graduality and Telicity

Manfred Krifka

- ▶ Part-whole relation (recall mereology)
  - ▶ Referents of NPs: objects
  - ▶ Referents of VPs: events (broadly)
- ▶ Cumulative reference
  - ▶ Predicate for parts holds for whole

beer  
code

drink beer  
write code

- ▶ Quantized reference
  - ▶ Predicate for whole doesn't hold for parts

bottle of beer  
method (as in code)

drink a bottle of beer  
write a method



# Entailments

Dowty, 1979: imperfective “paradox”

▶ Some entailments hold

She was writing code

⇒

She wrote code

▶ Some entailments fail

She was implementing a parser

⊄

She implemented a parser

# Temporal and Aspectual Entailment

Koher, de Vroe, Steedman, 2019

Jane has arrived in London

⇒

Jane is in London now

Jane will arrive in London

⊄

Jane is in London now

Jane has gone to London

⇒

Jane is in London now

Jane had gone to London

⊄

Jane is in London now

(but we get)

Jane was in London

# Temporal and Aspectual Entailment

Jane went to London

≠

Jane is in London now

(but we get)

Jane was in London

Jane was walking in the woods

⇒ Jane walked in the woods

Jane was implementing a parser

≠ Jane implemented a parser

George has acquired the house

⇒ George owns the house

George is acquiring the house

≠ George owns the house

# Temporal Entailment Assessment Dataset

- ▶ Dataset of  $\sim 11,000$  sentence pairs sampled from VerbOcean (before-after category) and WordNet verb entailment
- ▶ Filtered to remove verb pairs not temporally related
  - ▶ 22% labeled entailment
  - ▶ 78% labeled nonentailment
- ▶ Methods
  - ▶ Variants of ELMo, BERT, ...
  - ▶ Baselines: majority and majority with respect to tense pair

<b>Model</b>	<b>Average Precision</b>	<b>Accuracy</b>	<b>F<sub>1</sub> Score</b>
Majority class	0.22	0.78	0.44
Majority class per tense pair	0.35	0.80	0.66
Every other method	$\leq 0.31$	$\leq 0.58$	$\leq 0.49$

Challenge for you