

Event semantics

EGG 2024 in Braşov

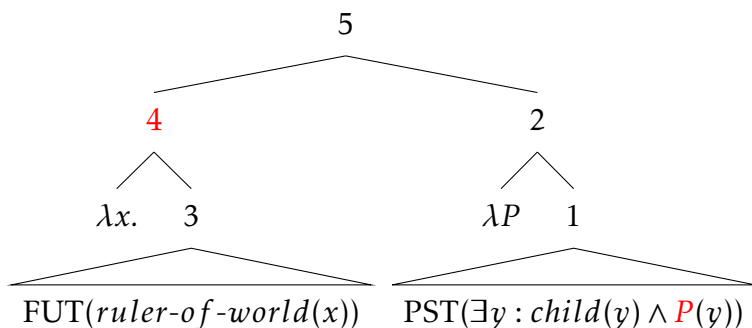
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Trying to tie up some loose ends

One of Ede’s complaints “The examples you give against the Priorean treatment of tense can be handled within it if we move certain constituents out of the scope of tense operators.”¹

- (i) A child was born who will become ruler of the world.



- (ii) a. $\llbracket 1 \rrbracket^t = \exists t' < t : \exists x : x \text{ is a child at } t' \text{ and } P(x)$
 b. $\llbracket 2 \rrbracket^t = \lambda P_{\langle e,t \rangle} . \exists t' < t : \exists y : y \text{ is a child at } t' \text{ and } P(y)$
- (iii) a. $\llbracket 3 \rrbracket^t = \exists t'' > t : x \text{ is ruler of the world at } t''$
 b. $\llbracket 4 \rrbracket^t = \lambda x . \exists t'' > t : x \text{ is ruler of the world at } t''$
- (iv) $\llbracket 5 \rrbracket^t = \llbracket 2 \rrbracket^t (\llbracket 1 \rrbracket^t)$
 $\llbracket 5 \rrbracket^t = \exists t' < t : \exists y : y \text{ is a child at } t' \text{ and } \exists t'' > t : y \text{ is ruler of the world at } t''$

This solution to Kamp’s challenge rests on the possibility of abstracting over predicates (λP , cf. over individuals), and that of being able to move predicates up.



More challenging examples come from placing the relative clause that is interpreted at a *later than matrix* time in a position it can’t move out of. In (69), *any NP* has to remain below negation for *any* to be licensed—so it can’t outscope matrix tense. But *hmm...*

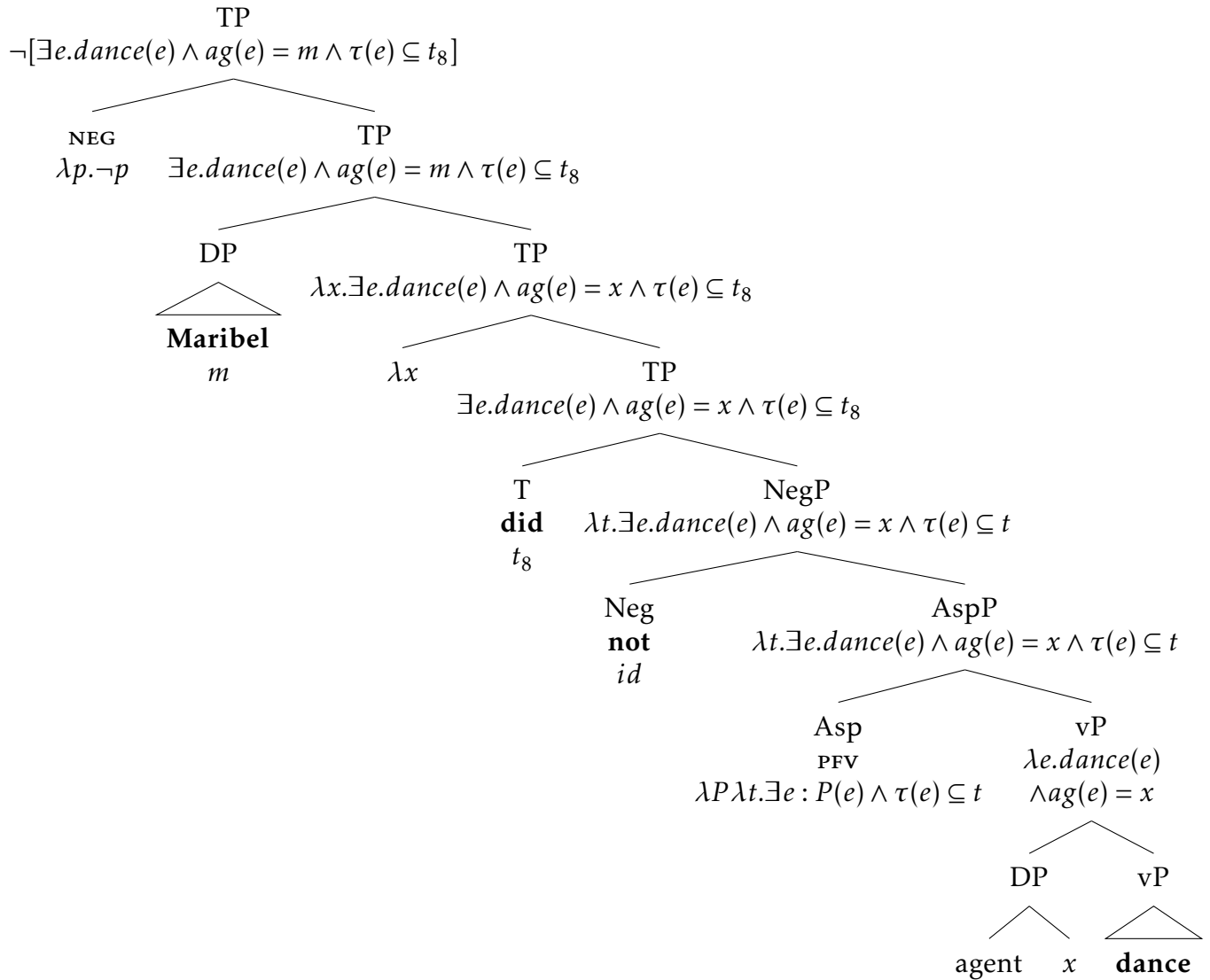
- (v) a. I tried not to hire anybody who put on a terrible performance.
 b. She failed to talk to any prospective student who (later) decided to come to UMass. (Kusumoto 2005)

¹Thanks, of course, to Katia for help with the points below.

One of Arild's complaints "You give (69b) as the structure of (69a) and interpret that. This isn't faithful to the English morphemes and surface word order."

- (vi) a. Maribel didn't dance.
 b. [not [Maribel dance]]

To do things more properly, we can assume (a) non-interpreted movement, e.g., subject movement to Spec, TP, and (b) things that are interpreted in places different from where they're pronounced, e.g., "not." (Alternative assumptions will do similar tricks. E.g., with Bernard & Champollion's *event negation*, one can interpret "not" in situ.)



4. Tense and aspect

4.1. Tense

4.1.2. Insufficiencies of the simple propositional operator approach

Referential tense The following sentence comes from Partee (1973).

Given the past operator defined above, a regular semantics for negation, and the option of scoping tense below or above it, we get the truth conditions in (69a) and (69b).

- (69) I didn't turn off the stove.
- a. There is a time t' that precedes t at which I didn't turn off the stove.
(Past over negation)
 - b. There is no time t' that precedes t such that I turned off the stove.
(Negation over past)

These two translations (the only two available ones given our assumptions) fail to capture the intuitive truth conditions of the sentence.



Based on similar facts, Partee proposes that tenses are (at least sometimes) more like referential pronouns.

- (70) "I didn't turn off the stove" is true at t (= now) with respect to an assignment function g iff I didn't turn off the stove at time $g(8)$
where $g(8)$ = the time at which I pulled out of the driveway just now.

4.1.3. Reichenbach/Klein

In the system above, we can capture the difference between (71a) and (71b) by assuming that the former sentence has one past operator, and that the second one has two.

- (71) a. Peter left.
b. Peter had left.

Reichenbach (1947) and, later, Klein (1996) offer a different perspective on this contrast. They argue that tense and aspect information in a sentence involves a relationship between *three* times:

- *Utterance time*, also called *Speech time*, and labeled S by Reichenbach
This is the time at which a sentence is uttered, and corresponds to the time parameter in tense logic before any manipulation by tense operators.
- *Reference time*, also called *Topic time*, and labeled R by Reichenbach
 - Sentences are about this time, which is distinct from utterance time and event time. This will become clearer with examples, but it roughly corresponds to the time parameter above *after* it has been manipulated by tense operators.

- Importantly, whether a sentence is past, present or future tense depends on whether reference time precedes, coincides or follows utterance time.
- In the composition, reference time is usually what sits at the T node.

- *Event time*, also called *Situation time*, and labeled E by Reichenbach

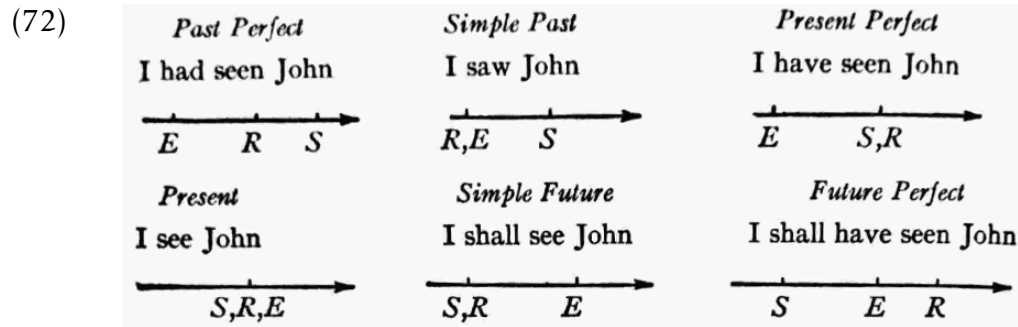
This is the runtime of the eventuality described by a sentence.

It is usually determined by a function τ , and we can refer to left and right boundaries of that runtime as well.

The relationship between event time and reference time is established by grammatical aspect.

Now, to account for the difference in (71), Reichenbach says: The sentences both involve a past reference time. They differ in that event time coincides with reference time in the past simple, but that event time precedes reference time in the past perfect.

Here is a fuller picture:



(73)

<i>Structure</i>	<i>New Name</i>	<i>Traditional Name</i>
$E - R - S$	Anterior past	Past perfect
$E, R - S$	Simple past	Simple past
$R - E - S$	Posterior past	—
$R - S, E$		
$R - S - E$		
$E - S, R$	Anterior present	Present perfect
S, R, E	Simple present	Present
$S, R - E$	Posterior present	Simple future
$S - E - R$	Anterior future	Future perfect
$S, E - R$		
$E - S - R$		
$S - R, E$	Simple future	Simple future
$S - R - E$	Posterior future	—

The main virtue of distinguishing between three times is that it allows us to capture contrasts that would have been difficult (maybe?) in tense logic. Namely:

- (74) a. Peter left.
b. Peter has left.
- (75) a. Peter ran.
b. Peter was running.

And this... gets us into grammatical aspect territory.

4.2. Grammatical aspect

In Reichenbachian terms, tense is the relationship between utterance time and reference time.

But this is not the only feature of sentences that locates eventualities in time. There's also *grammatical aspect* (also called *outer aspect*).

Grammatical aspect refers to the relationship between event time and reference time. For example, all the examples in (76) are in the past tense and involve a past reference time. But the relationship between the runtime of Prerna's run and that reference time is different:

- (76) Yesterday morning... (= reference time)
- a. Prerna was running a 5k.
-
- b. Prerna had run a 5k.²
-
- c. Prerna ran a 5k.
-

If we assume that reference time is kept constant across the examples in (76), we need something else to place event time differently relative to reference time.



First, we need to be able to refer to event time. We'll use the function τ from events to times, specifically, to their runtimes. This is Krifka's (1989) *temporal trace* function.

- (77) $\tau : D_v \rightarrow D_i$ with D_i a domain of times or intervals
 $\forall e : \tau(e) = \text{the runtime of } e$

With this function in our toolbox, we can relate $\tau(e)$ for any particular e to the time provided by tense via relations like $<$ (precedes) or \circ (overlaps), etc.

²I currently don't know how to distinguish *Prerna had run* from *Prerna had been running* in Reichenbach.

You may also define other functions that relate events to times. E.g., $LB(e)$ could be defined to pick out the starting point of an event, etc.



The grammatical aspectual difference that you will encounter most frequently is one between *perfective* and *imperfective* aspect.

The imperfective puts reference time within event time.

$$(78) \quad \llbracket \text{IPFV} \rrbracket = \lambda P_{\langle v, t \rangle} \lambda t_i. \exists e : P(e) \wedge t \subseteq \tau(e)$$

The perfective puts event time within reference time.

$$(79) \quad \llbracket \text{PFV} \rrbracket = \lambda P_{\langle v, t \rangle} \lambda t_i. \exists e : P(e) \wedge \tau(e) \subseteq t$$

The perfect would make event time precede reference time, and so on.

4.3. Lexical aspect

Berit covered this :)



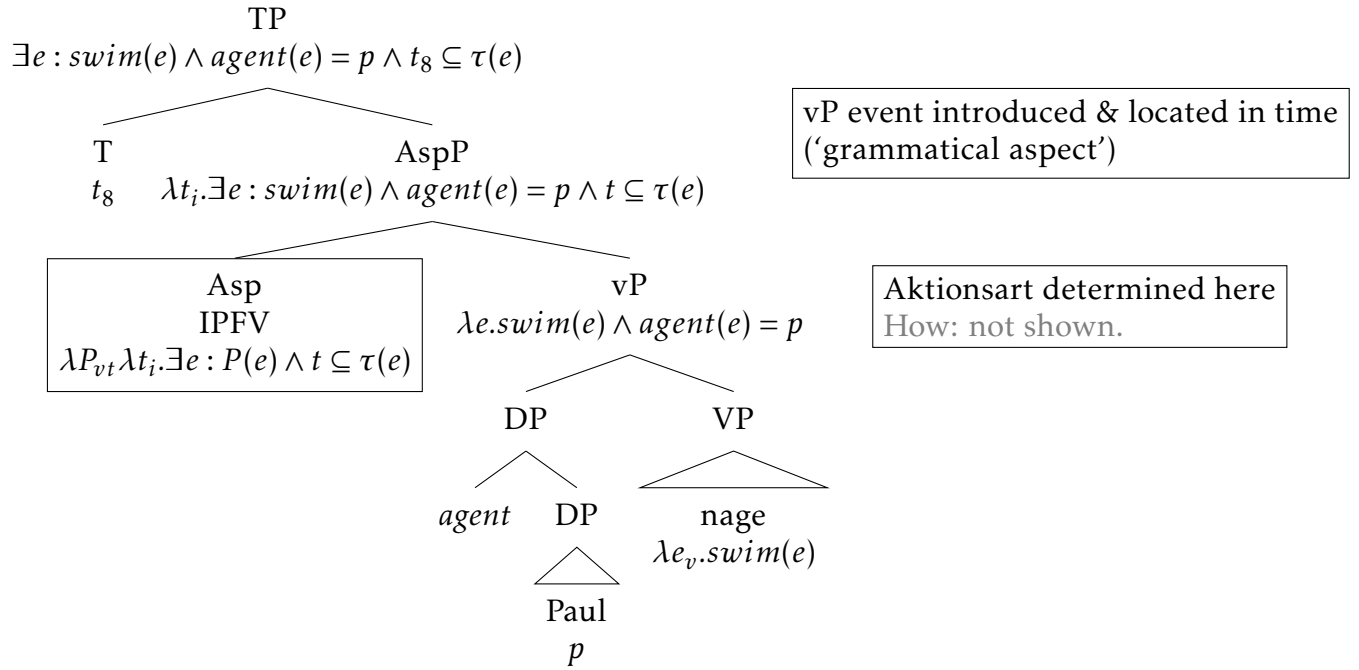
One starting point is Dowty (1979: ch. 2).

4.4. Composition

I'll revert to a pre-Champollion (2015) way of doing things, but how would you translate, e.g., IPFV into the Champollion way of doing things?



- (80) a. Il faisait quoi Paul ce matin à 8 heures?
What was Paul doing this morning at 8 o'clock? (\rightarrow sets topic time/T)
- b. Il nageait.
He was swimming. (\rightarrow runtime of swimming 'surrounds' topic time)



5. Negation

The material for this section comes from Bernard and Champollion (2024) + references therein and Przepiórkowski (1999). These authors prominently cite work by Higginbotham, which I did not consult directly.

5.1. Evidence for negative events

Recall that we took sentences like (81) to suggest that non-*that*-clause complements of perception verbs denote events.

(81) Leah saw Maribel shuffle her feet.

In particular, these sentences could not be reduced to “Leah saw Maribel and Maribel shuffled her feet.”³



Perception verbs’ complements can also contain negation:

(82) Leah saw Maribel not leave.

And this suggests there are events characterized by negative sentences. Let’s call such things *negative events*.

Technical evidence for negative events One initial reason for surprise goes as follows. Consider:

(83) a. Leah saw Maribel not leave.
b. Leah saw David not jump.

Let the following translate the complements of “saw.”

(84) a. $\neg\exists e : \textit{leave}(e, m)$
b. $\neg\exists e' : \textit{jump}(e', d)$

This implies that the sets $\lambda e. \neg\textit{leave}(e, m)$ and $\lambda e'. \neg\textit{jump}(e', d)$ are both empty, and crucially then, the same set.

Yet, the truth conditions of (83a) and (83b) are different, which suggests that the extensions of the embedded negated clauses are different.

B&C: These extensions are populated, by distinct sets of *nonactual events*.



Let us also try to translate (85) by using only classical negation where $e \in \llbracket \text{David saw} \rrbracket$ reads “David saw e .”

(85) Leah saw Maribel not leave.

³Leah could have seen the shuffling, but not Maribel (\Rightarrow direction false), or Leah could have seen Maribel, but not the shuffling (\Leftarrow direction false). Both in a context where Maribel did indeed shuffle her feet.

- a. $\neg[\exists e : \textit{leave}(e) \wedge \textit{agent}(e) = m \wedge e \wedge e \in \llbracket \textit{David saw} \rrbracket]$
compatible with David not seeing anything, and with Maribel leaving
- b. $\exists e : \neg[\textit{leave}(e) \wedge \textit{agent}(e) = m \wedge e \wedge e \in \llbracket \textit{David saw} \rrbracket]$
too weak
- c. $\exists e : \neg[\textit{leave}(e) \wedge \textit{agent}(e) = m] \wedge e \in \llbracket \textit{David saw} \rrbracket]$
too weak

Other empirical evidence for negative events (Higginbotham, via Przepiórkowski 1999) Some of these examples are only convincing with an actual analysis, or by ruling out possible alternative accounts that don't reference negative events.

We can refer to negative events:

- (86) a. John didn't know the answer to the problem. *This* lasted until the teacher did the solution on the board.
- b. John didn't ask Mary to dance at the party, which made her angry.

Negative events can stand in causal relationships:

- (87) I kept the child awake by not turning out the light.

Negative events can be counted, said to happen, last a certain amount of time...

- (88) In all his life, [John didn't come to a party he was invited to] twice. It was actually on the same evening.
- (89) What happened next was that the consulate didn't give us our visa.
- (90) His not fulfilling the duties of his position took place over a six-month period in 1983.

or be otherwise described:

- (91) The non-rising of the sun made us feel anxious.

5.2. (Non)actuality and event negation

Actual and nonactual events B&C assume that some events are actual and some are non-actual:

For example, the construction of the Eiffel Tower occurred and we say that it is an *actual* event; Ponce de León's discovery of the fountain of youth did not occur and we say that it is a *nonactual* event. B&C: p. 6

Their proposal is fully extensional and they leave these *actual* and *nonactual* as unanalyzed predicates of predicates of events.

But they suggest that actual events occur in the actual world, and nonactual events occur in nonactual worlds.

Event negation Verbal negation is *event negation*.⁴

(92) For any (regular) event predicate or set of events P , $Neg(P)$ denotes anti- P events.

P and $Neg(P)$ are related by means of the Principle of Negation:

(93) **Principle of Negation**

$$\forall P : [[\exists e \in P : actual(e)] \leftrightarrow \neg[\exists e \in Neg(P) : actual(e)]]$$

If there is an actual P event, then there is no actual anti- P event and vice-versa.

They translate

(94) It's raining.

a. $\exists e \in \{e : rain(e)\} : actual(e)$

b. $\neg \exists e \in Neg(\{e : rain(e)\}) : actual(e)$

(95) It's not raining.

a. $\exists e : actual(e) \wedge e \in Neg(\lambda e' : rain(e'))$

b. $\neg \exists e : actual(e) \wedge rain(e)$

via Principle of Negation

✧

(96) Leah saw Maribel not leave. \rightsquigarrow

$$\exists e : actual(e) \wedge exp(e) = l \wedge see(e) \wedge$$

$$\exists e' : theme(e) = e' \wedge e' \in Neg(\lambda e'' . agent(e'') = m \wedge leave(e''))$$

⁴B&C remain agnostic as to whether event negation coexists with classical negation, or whether the former suffices. They show that a sentence and its event negated variant can't be true together, that double event negation cancels, that it's downward monotonic, etc., just like classical negation. Note though that \neg in the meta-language denotes classical negation.

6. Conclusion

- We have motivated the addition of eventualities into our semantic framework by showing that this
 - accounts for otherwise unaccounted properties of natural language sentences (*it happened late last night*),
 - and so in a way that is possibly more explanatory and economical than certain alternatives (adjectival \approx adverbial modification, the diamond pattern of entailment).
- We have seen different ‘flavors’ of event semantics, and possibly gone through too many options for achieving the same result.

We haven’t really tried to decide on what the right way of doing things is, or whether it even makes sense to ask that question.

One benefit of this was that it gave us lots of opportunity to practice semantic composition, and that it may help in navigating the literature.
- We have seen how existentially closing the eventuality argument interacts with other scope taking elements like quantifiers, negation and conjunction.

And we talked a little bit about tense.

There are things that we haven’t seen:

- Do stative sentences introduce a state argument? Or are ‘action verbs’ special in being the only ones to introduce an event argument?
- How are eventualities structured internally?
- Stay tuned for next time...