

Event semantics

EGG 2024 in Braşov¹
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<https://deniz.fr/summers/egg2024/>

3. Introducing events

3.4. Champollion (2015)

3.4.3. Champollion's project

Champollion's core observation is that **existential closure over events takes narrowest scope with respect to other scopal elements in a sentence.**

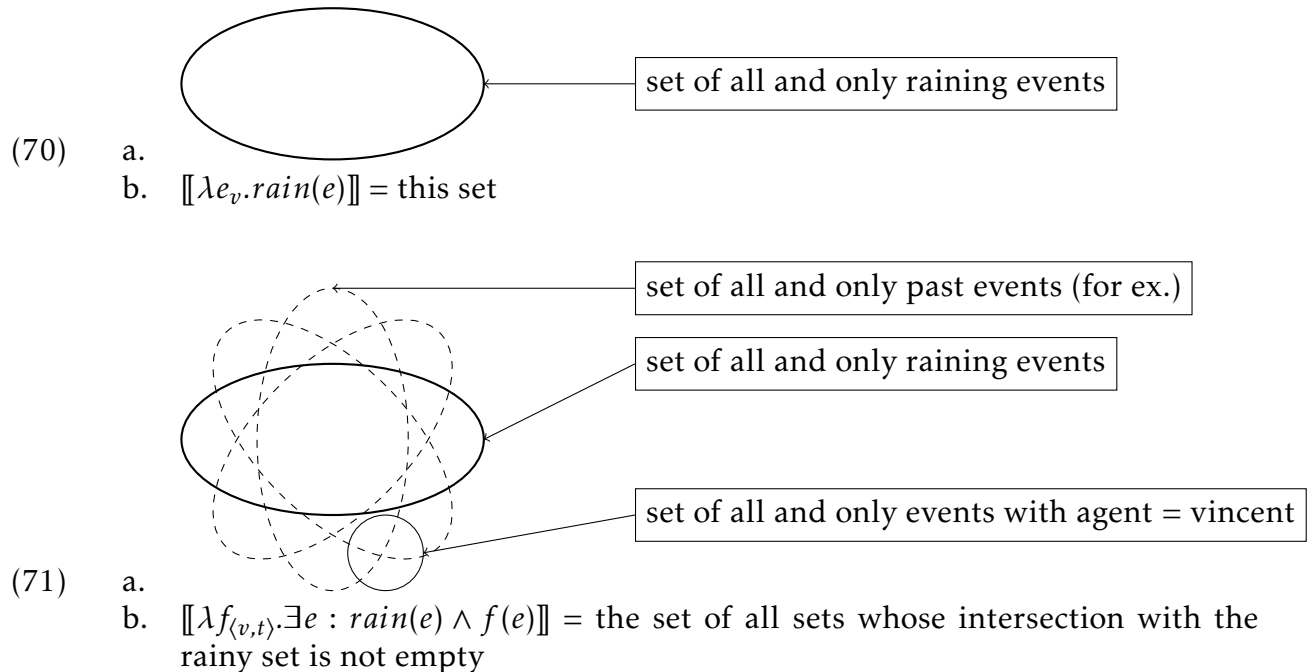
To account for this, Champollion packs existential closure into the lexical entries of verbs (the part after the dot, in (69b)), instead of letting it get introduced 'later.'

One technical problem that this raises is that if e is existentially closed, we can no longer access it and add event participants, modifiers, etc.

The solution lies in the addition of the variable f called the continuation variable. So called because it makes the continuation of the derivation possible.

- (69) a. $\lambda e_v. \text{rain}(e)$ out
b. $\lambda f_{\langle v,t \rangle}. \exists e : \text{rain}(e) \wedge f(e)$ in

An intuition behind the f variable



¹Thanks to Tobias and David for catching typos!

To derive a proposition from a verb phrase denotation, close off the f variable.

Two simple ways of valuing the f variable.

$$\text{rain} \rightsquigarrow \lambda f_{\langle v,t \rangle}. \exists e : \text{rain}(e) \wedge f(e)$$

(72) a. $\text{TRUE} \rightarrow \lambda e_v. e \in D_v$

b. $\text{It rains} \rightsquigarrow [\lambda f_{\langle v,t \rangle}. \exists e : \text{rain}(e) \wedge f(e)](\lambda e_v. e \in D_v)$
 $\exists e : \text{rain}(e) \wedge e \in D_v$
 $\exists e : \text{rain}(e)$

(73) a. $\text{PST} \rightarrow \lambda e_v. \text{past}(e)$

b. $\text{It rained} \rightsquigarrow [\lambda f_{\langle v,t \rangle}. \exists e : \text{rain}(e) \wedge f(e)](\lambda e_v. \text{past}(e))$
 $\exists e : \text{rain}(e) \wedge \text{past}(e)$

The simplest way to do that is just to use the predicate TRUE . But one can get creative.



But the main use of f is to introduce a verb's arguments and modifiers. Let's start with:

(74) a. $\text{rain} \rightsquigarrow \lambda f_{\langle v,t \rangle}. \exists e : \text{rain}(e) \wedge f(e)$

b. $\text{heavily} \rightsquigarrow \lambda V_{\langle \langle v,t \rangle, t \rangle} \lambda f_{\langle v,t \rangle}. V(\lambda e'. \text{heavily}(e') \wedge f(e'))$

Note: The V variable is going to get saturated by VP denotations.

(75) $\text{It's raining heavily} \rightsquigarrow$

$$[\lambda V_{\langle \langle v,t \rangle, t \rangle} \lambda f_{\langle v,t \rangle}. V(\lambda e'. \text{heavily}(e') \wedge f(e'))](\lambda g_{\langle v,t \rangle}. \exists e : \text{rain}(e) \wedge g(e))$$

$$\lambda f_{\langle v,t \rangle}. [\lambda g_{\langle v,t \rangle}. \exists e : \text{rain}(e) \wedge g(e)](\lambda e'. \text{heavily}(e') \wedge f(e'))$$

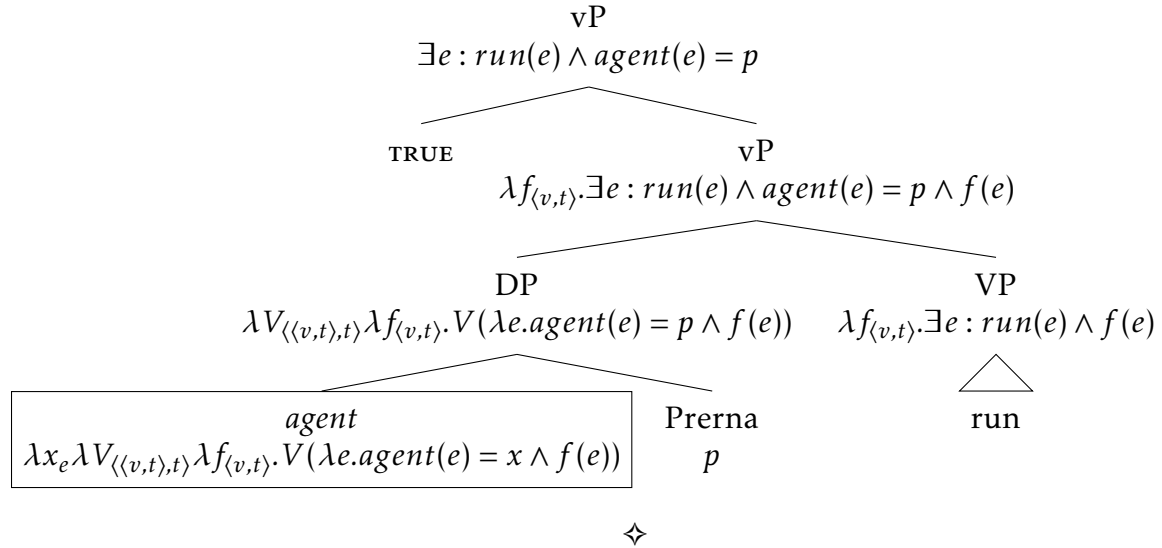
$$\lambda f_{\langle v,t \rangle}. [\lambda g_{\langle v,t \rangle}. \exists e : \text{rain}(e) \wedge g(e)](\lambda e'. \text{heavily}(e') \wedge f(e'))$$

$$\lambda f_{\langle v,t \rangle}. \exists e : \text{rain}(e) \wedge [\lambda e'. \text{heavily}(e') \wedge f(e')](e)$$

$$\lambda f_{\langle v,t \rangle}. \exists e : \text{rain}(e) \wedge \text{heavily}(e) \wedge f(e)$$

Introducing arguments

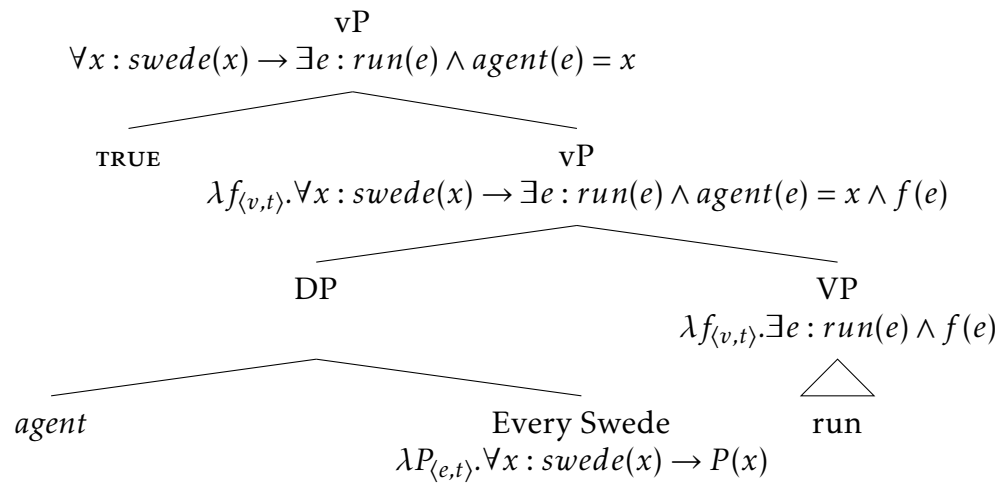
(76) Prerna ran.



(77) vP \rightsquigarrow

$$\begin{aligned}
 & [\lambda V \lambda f. V(\lambda e. \text{agent}(e) = p \wedge f(e))] (\lambda g. \exists e' : \text{run}(e') \wedge g(e')) \\
 & \lambda f. [\lambda g. \exists e' : \text{run}(e') \wedge g(e')] (\lambda e. \text{agent}(e) = p \wedge f(e)) \\
 & \lambda f. [\lambda g. \exists e' : \text{run}(e') \wedge g(e')] (\lambda e. \text{agent}(e) = p \wedge f(e)) \\
 & \lambda f. \exists e' : \text{run}(e') \wedge [\lambda e. \text{agent}(e) = p \wedge f(e)](e') \\
 & \lambda f. \exists e' : \text{run}(e') \wedge [\lambda e. \text{agent}(e) = p \wedge f(e)](e') \\
 & \lambda f. \exists e' : \text{run}(e') \wedge [\text{agent}(e') = p \wedge f(e')]
 \end{aligned}$$

Quantified arguments This gets pretty involved derivationwise. I'll provide the final truth conditions and leave the derivation to you. You'll need to modify the translation of *agent* so that its first argument is of type $\langle\langle e, t \rangle, t\rangle$. (Answer in Champollion's paper.)



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Is there a way of rigging up the denotation of *agent* so that it gets $\forall x$ to scope under $\exists e$ by using the f variable?

4. Tense and aspect

There are two interrelated notions that go by the name of ‘aspect,’ *lexical aspect* (aka *Aktionsart*) and *grammatical aspect*, and neither of these can be studied without talking about *tense*.

4.1. Tense

Sentences locate eventualities in time.

Paul’s swim, in (78), is located in the past, the present, or the future relative to the time of utterance. Here, what creates these differences is the form of the verb.

- (78)
- a. Paul nagea.
Paul swam.
 - b. Paul nage.
Paul is swimming.
 - c. Paul nagera.
Paul will swim.

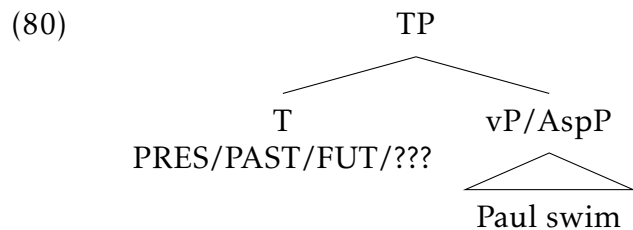
In some contexts, like, for conjugation purposes, the word ‘tense’ refers to the form of a verb, e.g., the *passé simple* or *simple past* for (78a). This use of the term collapses tense (in the technical sense) and grammatical aspect—which we will get to shortly.

The sentences in (79) belong to different conjugation classes, but they are in the same tense (in the technical sense): the past. What meaning differences exist between the pair is the effect of aspect.

- (79)
- a. Paul nagea.
Paul swam.
 - b. Paul nageait.
Paul was swimming.

I’m not going to attempt to define tense (in the technical sense) just yet, as what it is depends on how we formalize the contrasts in (78) and (79), but the notion will become clear as we go along.

To the extent that it helps, tense (in the technical sense) is whatever sits in the T position in a tree like (80), and what it is depends on what we think its sister is.



4.1.1. A brief look at tense logic

Whether a sentence is true or not often depends on the time at which it’s uttered.

- (81) Greece is a kingdom. Kamp (1968)
 a. On May 10th, 1968: True
 b. On July 23rd, 2024: False

We can account for this by relativizing the interpretation function $\llbracket \cdot \rrbracket$ to times. Omitting other parameters, we write (82), where t can be replaced by particular times, e.g., in our history:

- (82) $\llbracket \text{Greece is a kingdom} \rrbracket^t = \llbracket \text{Greece be a kingdom} \rrbracket^t = 1$ iff Greece is a kingdom at t .
 a. $\llbracket \text{Greece is a kingdom} \rrbracket^{10/05/1968} = 1$
 b. $\llbracket \text{Greece is a kingdom} \rrbracket^{23/07/2024} = 0$

Note that we don't do anything special (here) about the present tense: The evaluation parameter is the moment of utterance, and the present. This is good enough for present purposes, but course not right—see the discussion between Arthur Prior and Hans Kamp about “now” (Prior 1968, Kamp 1971).

With this, we can define tenses as sentential operators that manipulate the time index on the interpretation function.²

- (83) a. $\llbracket \text{PAST}(\phi) \rrbracket^t = 1$ iff there is a time t' earlier than t s.t. $\llbracket \phi \rrbracket^{t'} = 1$
 b. $\llbracket \text{FUT}(\phi) \rrbracket^t = 1$ iff there is a time t' later than t s.t. $\llbracket \phi \rrbracket^{t'} = 1$

So to capture the truth conditions of (84a), we identify that this sentence breaks down into “PAST(Greece be a republic)” and apply the interpretation rule in (83b).

- (84) a. Greece was a kingdom.
 b. $\llbracket \text{PAST}(\text{Greece be a kingdom}) \rrbracket^t = 1$
 iff there is a time t' earlier than t s.t. $\llbracket \text{Greece be a kingdom} \rrbracket^{t'} = 1$
 iff there is a time t' earlier than t s.t. Greece is a kingdom at t'

When the sentence is uttered now, there is such a time. Hence the sentence is predicted to be true, this matches our intuitions, and this is Good.



The future case is parallel to the past case, and I encourage you to try your hand at (85).

- (85) $\llbracket \text{FUT}(\text{Greece be a kingdom}) \rrbracket^t = 1$
 iff ...

What issues does the future raise?



²Tense logic is due to (the aptly named) Arthur Prior. See Gamut (1991: vol. 2, ch. 2) and the relevant Stanford Encyclopedia of Philosophy entries for more serious introductions.

A noteworthy feature of treating tense as a propositional operator is that these can stack, allowing us to write, e.g., (86).

(86) [[PAST(PAST(Greece was a kingdom))]]^t

Show that the truth conditions derived for (86) match our intuitions about the truth conditions of the sentence

(87) *Greece had been a kingdom.*

This is to suggest that even with very little, we can get quite far.

How many pasts, how many futures? Some languages make fewer or greater distinctions than past vs. present vs. future.

St'át'imcets (a severely endangered language spoken in southern British Columbia, Canada) doesn't have (overt) past or present tense morphology.

A verb like (88a) may describe a past or a present event, but not a future one. The morpheme *kelh* is required for and forces a future interpretation. (All St'át'imcets data are from Matthewson 2005.)

- (88) a. *sáy'sez'-lhkan*
 play-1SG.SUBJ
 'I played / I am playing.' Matthewson (2005: ex. 4c)
- b. *sáy'sez'-lhkán kelh*
 play-1SG.SUBJ kelh
 '* I played / * I am playing / I will play.' Matthewson (2005: ex. 7c)

Adverbs, other expressions and predicates' lexical aspectual class help constrain temporal reference.



Gikūyū (a Bantu language spoken in Kenya) distinguishes between two degrees of past and future-ness. The data in (89) are borrowed from Cable (2013). This phenomenon is usually referred to as 'graded tense.'

- (89) **The Graded Tenses of Gikūyū (Mugane 1997) ³**
- | | | |
|---------------------|--------------------|--|
| a. 'Current Past' | Mwangi nīekūinaga. | <i>Mwangi was dancing (within the day)</i> |
| b. 'Near Past' | Mwangi nīarainaga. | <i>Mwangi was dancing (within last few days)</i> |
| c. 'Remote Past' | Mwangi nīāinaga. | <i>Mwangi was dancing (prior to 'Near Past')</i> |
| d. 'Current Future' | Mwangi nīekūina. | <i>Mwangi will dance (within the day).</i> |
| e. 'Remote Future' | Mwangi nīakaina. | <i>Mwangi will dance (tomorrow or later).</i> |

4.1.2. Insufficiencies of the simple propositional operator approach

The goal now is to transition to a different conceptualization of tense and related phenomena that

1. captures tense-related contrasts that natural languages display better than the possible refinements of the simple “tense as propositional operators” system sketched out above,
2. and (b) connects better with *event* semantics as practiced standardly since Davidson.

This move is *not* a ‘falsification,’ nor is it a message to forget about tense logic. In fact, the devices that we’ve seen above (propositional operators, parameter manipulation) and the problems that we will see just now will be recurrent themes in your career as formal semanticists (modal logic, indexicals, etc.).

Losing track of now Classical tense logic is able to capture the truth conditions of (90a), but not of (90b).

- (90) a. A child was born that would become ruler of the world.
 b. A child was born that will become ruler of the world. (Kamp 1971)

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- (91) $\llbracket \text{PST}(\exists x : \text{child}(x) \wedge \text{born}(x) \wedge \text{FUT}(\text{ruler}(x))) \rrbracket^t = 1$ iff
 $\exists t' < t : \text{a child at } t' \text{ is born at } t' \text{ and } \exists t'' > t' \text{ that child rules the world at } t''$

Let’s say that this child is born in 1990. It suffices for them to rule the world at any later time (e.g., 1991, 1992, ...) for (91) to be satisfied. And this corresponds to the intuitive truth conditions of (90a).

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In a context where that child becomes ruler of the world in, e.g., 2000, example (90b) is false. It requires the child to become a ruler *later than utterance time*, e.g., in 2026.

But because operators like PST and FUT “overwrite” evaluation time, there is no way of referring back to it once it’s been overwritten.

Can you imagine a fix?

Tense on subsentential constituents Tense is frequently thought of as a verbal category, but it has manifestations in the nominal domain as well.

The way that we naturally understand sentence (92) is non-contradictory: Every past fugitive is now in jail.

- (92) Every fugitive is in jail. (Enç 1986: ex. 13)

If we try to account for the pastness of being a fugitive, we fail to capture that the past fugitives are in jail *now*.

- (93) $\llbracket \text{PST}(\forall x : \text{fugitive}(x) \rightarrow \text{jail}(x)) \rrbracket^t = 1$ iff
 $\exists t' < t : \text{every } x \text{ who's a fugitive at } t' \text{ is in jail at } t'$

If we try to account for the nowness of being in jail, we fail to capture the pastness of being a fugitive.

- (94) $\llbracket \forall x : fugitive(x) \rightarrow jail(x) \rrbracket^t = 1$ iff
every x who's a fugitive at t is in jail at t

Note that both of these truth conditions are contradictory.



What we need is to be able to insert tense operator in subsentential constituents:

- (95) $\llbracket \forall x : PST(fugitive(x)) \rightarrow jail(x) \rrbracket^t = 1$ iff
 $\forall x : \exists t' < t : \text{if } x \text{ is a fugitive at } t' \text{ then } x \text{ is in jail at } t.$

(Skipping compositional details, and the two possible relative scopes of $\forall x$ and $\exists t'$.)

Here, the quick fix is to be able to insert tense operators at the NP level, and this is OK because the NP is of type t , and tense operators are of type $\langle t, t \rangle$.

Morphological expression of (graded) nominal tense In some languages, temporal information on nouns can be marked overtly.³

- (96) a. Juan ha'e pai'-kue
Juan 3PRO priest-KUE
Juan is a former priest / an ex-priest.
b. Juan ha'e pai'-rã
Juan 3PRO priest-RA
Juan is a future priest. Paraguayan Guaraní, Tonhauser (2007)

And, some languages have *graded* nominal tense.

- (97) a. làakwàa-nì-kâan
girl-PROX-PAST1
'this girl from earlier today'
b. làakwàa-nì-kóonyè
girl-PROX-PAST2
'this girl from yesterday'
c. làakwàa-nì-kíinyè
girl-PROX-PAST3
'this girl from long ago' Kipsigis (Kenya), Kouneli (2019: exx. 96a–98a)

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 (98a) and (98b).

- (98) I didn't turn off the stove.

³See also Nordlinger & Sadler (2004), Thomas (2014), a.o. For exactness, Tonhauser argues that Paraguayan Guaraní *-kue* and *-rã* aren't tenses in that they display different properties from verbal tenses—but that's a level of detail that we won't go into together.

- 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.

- (99) "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.