Event semantics

EGG 2024 in Braşov
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https://deniz.fr/summers/egg2024/

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1. The details of your trip

It is no surprise that (parts of) natural language sentences describe *events* of different kinds, that they present them in certain ways (completed, iterated, etc.), and that they locate them in time.[1]

(1) a. Raquel coded the experiment.
There is a past event *e* of Raquel coding the experiment.
b. Anna is Dutch.
There is an ongoing state *s* of Anna being Dutch.

Even though one might not automatically be able to come up with the semi-formal paraphrases in (1), we all$_?$ know this. Be it from intuition, or from the experience of language classes.

What more is there to say? A lot!

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This will be clear throughout the course, but here are some pairs to suggest that the event-related properties of sentences stop feeling obvious very quickly—even in our familiar corner of English.

The members of the pairs below mean different things.

(2) a. Raquel coded the experiment.
b. Raquel coded experiments.

(3) a. Anna is Dutch.
b. Anna was Dutch.

(4) a. Gaja arrived.
b. Gaja has arrived.

Can you describe what the main meaning difference is between the pairs?

What causes the difference?

Why does that cause a difference?

This is not so easy. You might also have taken a class in <any language> that evokes event-semantic struggles—even if things were not necessarily described to you that way.

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[1] Some sentences describe *events* and some describe *states*. People sometimes use the word *event* to refer to both events and states. The word *eventuality* is also used (unambiguously) in this way.

Event semantics is the study of the meanings that (parts of) sentences have by virtue of the assumption that they describe events.

Another way of saying this is: We will assume that verbs (and possibly other expressions) introduce an event argument.

(5) a. code $\rightsquigarrow \lambda x_e \lambda y_e . code(y, x)$ out
b. code $\rightsquigarrow \lambda x_e \lambda y_e \lambda e_v . code(e, y, x)$ in

Event semantics studies that event argument, how it's described and what happens to it as sentence meanings are built up.

Sometimes, not much happens.

(6) Raquel coded the experiment.
$\exists e : code(e, raquel, the\text{-}experiment)$

But in general, sentences' event-related properties interact in non-trivial ways with tense, negation, quantification, modality, etc.

(7) Raquel didn't code the experiment.
a. $\neg \exists e : \quad code(e, raquel, the\text{-}experiment)$:)
b. $\exists e : \neg code(e, raquel, the\text{-}experiment)$:(

So we have work to do.

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By the end of this week, you will...

1. be able to assess empirically what properties sentences have by virtue of the assumption that they describe events (e.g., run empirical tests confidently).
2. be comfortable with the associated formalism, and the problems that emerge when events are incorporated (lambda practice).
3. be able to tackle new and different parts of the linguistic and philosophical literature.

Note that events pop up in the least expected places, so it's good to expect them.

Outline

- Day 1: Motivating the event argument, different flavors of event semantics
- Day 2: Tense & aspect
- Day 3: Mereology, formal properties of event predicates
- Day 4: Compositional event semantics
- Day 5: Negative events

Important! Please interrupt for clarifications, corrections, or other comments and questions that you might have.

2. Model theoretic semantics *sans* events

Take our running sentence again.

You might be used to capturing its truth conditions by translating it into a formal language, and assigning that an extension and an intension like (8a) and (8b).[2]

(8) Raquel coded the experiment.
$\rightsquigarrow$ $code(raquel, the\text{-}experiment)$ Translation
 a. $[\![code(raquel, the\text{-}experiment)]\!]^w = 1$ or 0 Extension
 b. $[\![code(raquel, the\text{-}experiment)]\!] = \{w : [\![code(raquel, the\text{-}experiment)]\!]^w = 1\}$ Intension

In doing so, we assume many things:

- Sentences denote truth values, from a domain D_t.
- Proper names and definite descriptions denote individuals, from a domain D_e.
- Verbs denote functions, e.g., from D_e to D_t for intransitive verbs.
- Sentences' truth values may vary from circumstance to circumstance—or possible world to possible world. D_s, usually, for the set of possible worlds.

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We also care about deriving these truth conditions compositionally.

(9) **The principle of compositionality**
The meaning of a complex expression is determined by its structure and the meanings of its constituents.

Here, this means that we want a procedure for building up (the meaning of) the expression $code(raquel, the\text{-}experiment)$ from (the meaning of) its component parts, namely:

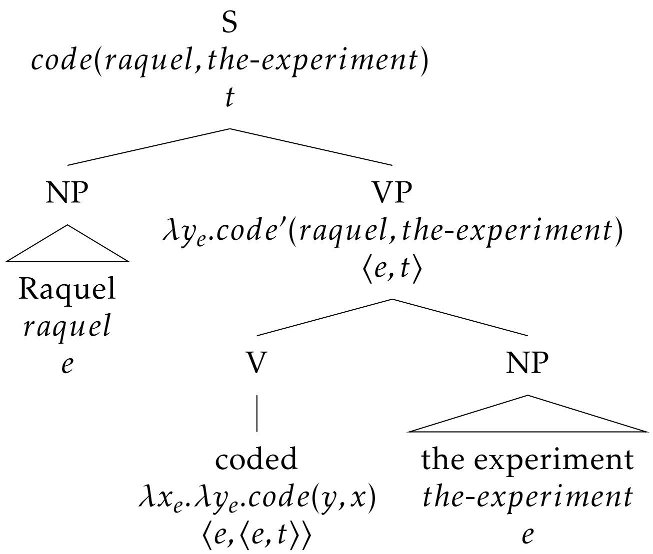
(10) code $\rightsquigarrow \lambda x_e \lambda y_e.code(y, x)$
Raquel $\rightsquigarrow raquel$
the experiment $\rightsquigarrow the\text{-}experiment$

This almost already gives us such a procedure. We also need the rule of *function application*.

(11) **Function application** Coppock and Champollion (2024)
 a. *Syntax*
 For any types σ and τ, if α is an expression of type $\langle\sigma, \tau\rangle$ and β is an expression of type σ then $\alpha(\beta)$ is an expression of type τ
 b. *Semantics*
 For any types σ and τ, if α is an expression of type $\langle\sigma, \tau\rangle$ and β is an expression of type σ then $[\![\alpha(\beta)]\!]^{w,g} = [\![\alpha]\!]^{w,g}([\![\beta]\!])^{w,g}$

[2]The translation step might look unfamiliar if you're coming from Heim & Kratzer. See Coppock & Champollion (2024) for an equally excellent introduction to this two-step procedure.

(12)



(In drawing this tree and translating "coded" with its arguments ordered a certain way, we rely on syntacticians passing us down the correct structure. Different assumptions here will yield different results, including systems where syntax doesn't necessarily determine the order in which a function composes with its arguments. Glue semantics?)

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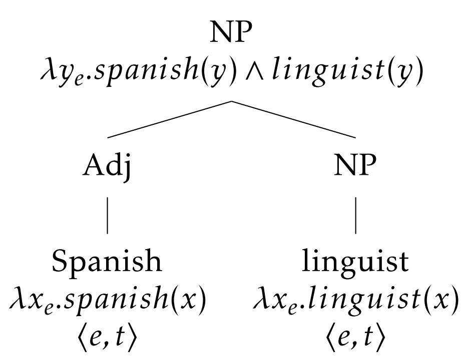
A second interpretation rule will be crucial for us as well:

(13) **Predicate modification** (modified from Coppock & Champollion)
If:
  H is a tree whose only two subtrees are F and G,
  F $\rightsquigarrow f$,
  G $\rightsquigarrow g$,
  f and g are both of type $\langle \sigma, t\rangle$, for any σ
Then:
  H $\rightsquigarrow \lambda u_\sigma.f(u) \wedge g(u)$

In systems without events, this rule is usually used to compose intersective adjectives with NPs. We will later use it to combine verbs, their modifiers & arguments.

(14) Raquel is a Spanish linguist. $\Rightarrow$ Raquel is Spanish and a linguist.

(15)



Do we *need* predicate modification to combine 'Spanish' with 'linguist,' or can we do just with function application? If yes, what alternative assumption(s) do we need to make?

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Upshot This base system already has a broad empirical coverage. But it can't yet capture contrasts like (16) and (17), for which we need events and times, and ways of describing and manipulating them:

(16) a. Raquel is coding the experiment.
b. Raquel was coding the experiment.

(17) a. Raquel coded the experiment.
b. Raquel coded experiments.

3. Introducing events

3.1. Events are like individuals

> Strange goings on! Jones did it slowly, deliberately, in the bathroom, with a knife, at midnight. What he did was butter a piece of toast. We are too familiar with the language of action to notice at first an anomaly: the 'it' of 'Jones did it slowly, deliberately, ...' seems to refer to some entity, presumably an action, that is then characterized in a number of ways. Davidson (1967) *The logical form of action sentences*[3]

Davidson proposes that the truth conditions of action sentences resemble (18).[4]

(18) Jones buttered the toast slowly, in the bathroom, with a knife, at midnight.
$\exists e : butter(e, j, t) \wedge slow(e) \wedge location(e) = b \wedge instrument(e) = k \wedge runtime(e) \circ m$

Key:
Jones $\rightsquigarrow j$ the toast $\rightsquigarrow t$ the bathroom $\rightsquigarrow b$ ... $\circ$ means "overlaps in time"

This states that there exists an *event* e that satisfies certain properties: It is a buttering of the toast by Jones, it is slow, located in the bathroom, etc.
Some clarificatory points:

- We assume that there is a domain D_v of events, and that these are things that we can refer to or predicate things of, just like individuals.
- Any n-place (action) predicate is treated now as an $n+1$-place predicate.

Old:	$rain$	$\lambda x_e.jump(x)$	$\lambda y_e \lambda x_e.butter(x, y)$
New:	$\lambda e_v.rain(e)$	$\lambda x_e \lambda e_v.jump(x)$	$\lambda y_e \lambda x_e \lambda e_v.butter(x, y)$

[3]The contents of this section are also based on Parsons (1990) and Coppock & Champollion's (2022) textbook chapters on Event semantics.

[4]We leave what an action sentence is at the level of intuition, they may be opposed to stative sentences like *Maribel is Spanish*. We'll be more specific with these categories when we get to lexical aspect. We'll also discuss whether stative predicates also make available an eventuality variable or not.

- We can define functions from events onto their locations, instruments, agents, runtimes, etc.
- Not all verb modifiers fall into this pattern, e.g., *allegedly*, *nearly* or *partway*, but this doesn't invalidate the appraoch.

3.2. Some advantages

This treatment does well on a number of points.

3.2.1. It

[T]he 'it' of 'Jones did it slowly, deliberately...' seems to refer to some entity

(19) a. A cat_1 walked in. Miriam saw it_1.
b. Jones buttered the toast. (≈There is such an event.) It happened slowly.

3.2.2. Events as arguments

Davidson's *did it* or *it happened* also implies the existence of predicates with arguments of type v. I illustrate with verbs of perception, but this also concerns, e.g., causatives.

(20) John felt *Mary shuffle her feet*. (Parsons 1990)

Two ways of analyzing (20), where (21a) bites the Davidsonian bullet and (21b) attempts to do things without events.

(21) a. $\exists e : e$ is a Mary shuffling her feet and John feels e
b. John felt Mary and Mary shuffled her feet.

The problem with (21b) is that its truth is independent of the truth of (20) (hence (21b) can't be the truth conditions of (20)).

Can you come up with contexts to convince ourselves of this?

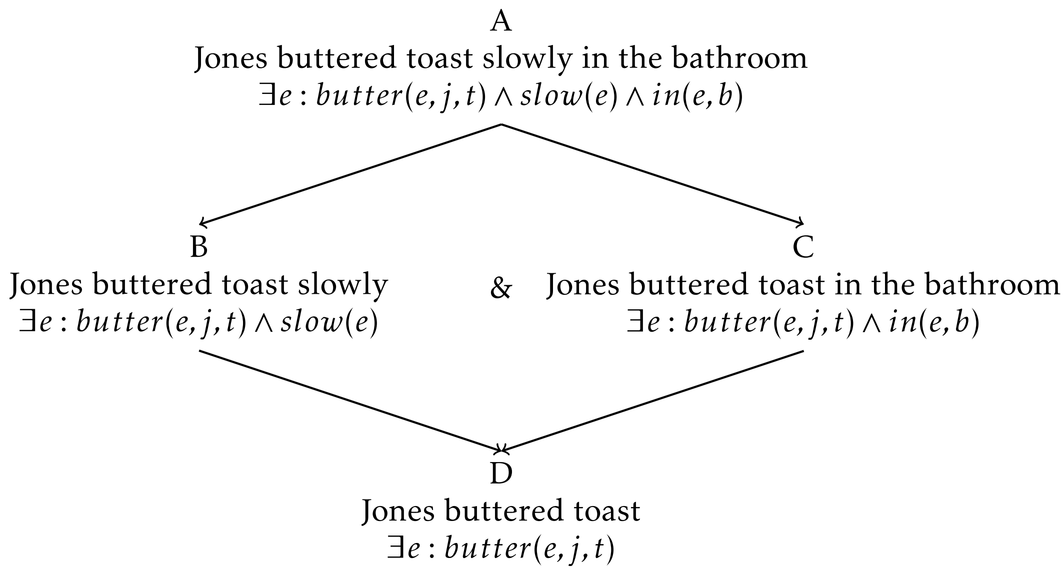
3.2.3. The logic of modifiers

Treating (22a) as (22b) captures the sentence's entailment pattern, illustrated in (22).

The material in this section is based on my reading of lecture notes by Fred Landman (linked from the class website).

(22) a. Jones buttered toast slowly in the bathroom.
b. $\exists e : butter(e, j, t) \wedge slow(e) \wedge in(e, b)$

(23)



Note in particular that A entails both B and C, but B & C does not entail A (because of the existential quantifiers).[5]

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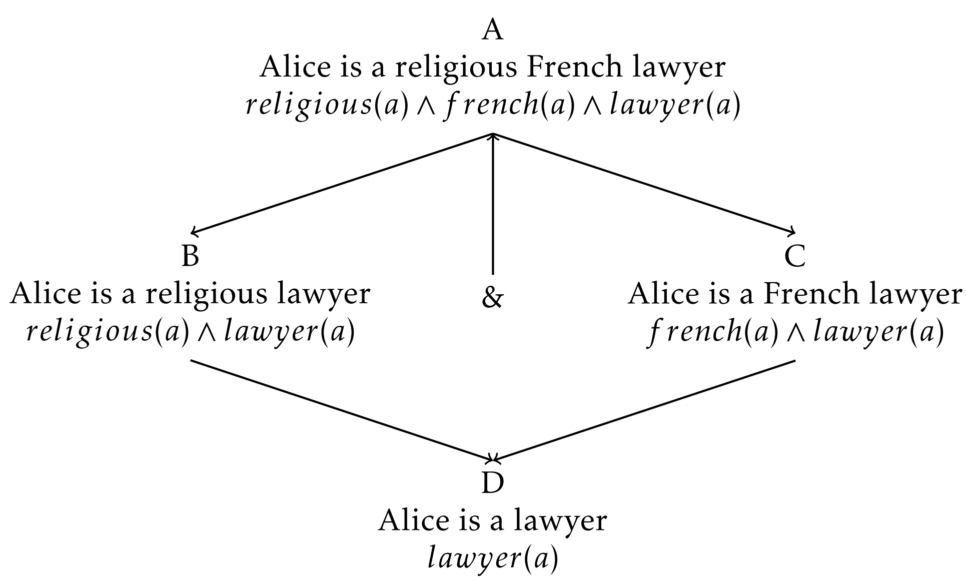
This resembles the behavior of adjectives. Relevant classes of adjectives and adverbs can be dropped and give rise to entailment patterns like (23), and they can permute, without (truth conditional) effects on meaning.

One difference in (24) is that the conjunction of B & C does entail A, except. . .

(24) Alice is a religious French lawyer.
$religious(a) \wedge french(a) \wedge lawyer(a)$

(25)



[5]You might notice that I dropped the *the* in *the toast*.

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Why this is a big deal is best seen by comparing it to an alternative analysis of modifiers like *slowly* and *in the bathroom*.

Assume that we don't have events at our disposition. (Attempts A and B are non-starters, but they're interesting.)

1. Attempt to treat *slowly* as a predicate of individuals:

   (26) a. Jones buttered the toast slowly.
   b. $butter(j,t) \wedge slow(j)$

   This predicts that sentences like (27) should be contradictory.

   (27) Jones buttered the toast slowly and the brioche quickly.
   $butter(j,t) \wedge slow(j) \wedge butter(j,b) \wedge quick(j)$
   $\Rightarrow slow(j) \wedge quick(j)$
   $\Rightarrow \bot$

2. Attempt to treat *slowly* as a function from t to t.

   (28) a. Jones buttered the toast slowly.
   b. $slow(butter(j,t))$

   There's only 4 such functions.

3. C. Attempt to treat *slowly* as a function from verb denotations to verb denotations

   Go to **Day 2**.