Event semantics

EGG 2024 in Braşov
Deniz Özyıldız, Universität Konstanz
https://deniz.fr/summers/egg2024/

---

3. Introducing events

(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.

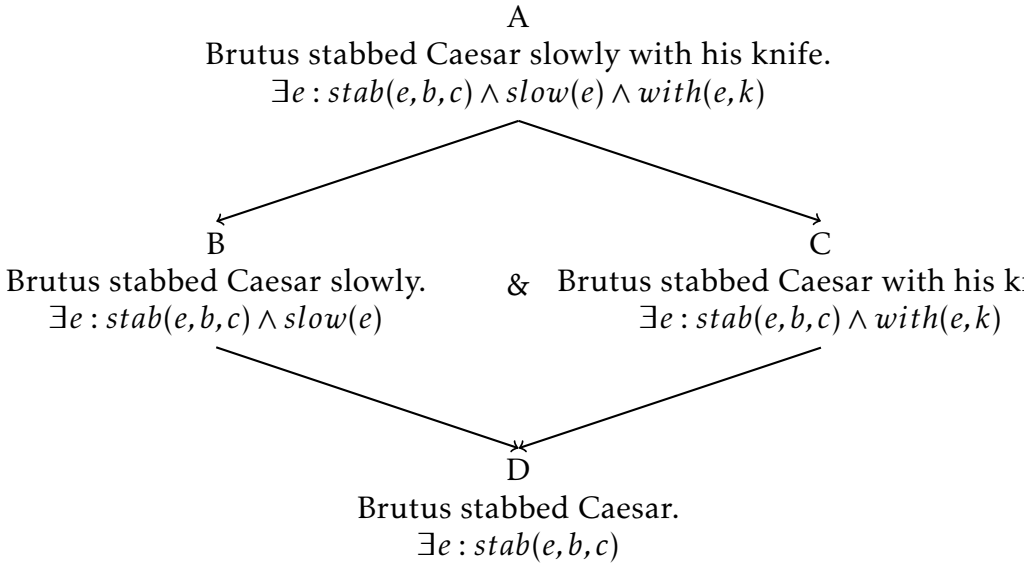
3.2.3. The logic of modifiers

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. Brutus stabbed Caesar slowly with his knife.
b. $\exists e : stab(e, b, c) \wedge slow(e) \wedge with(e, k)$

(23)



Note in particular that A entails both B and C, but B & C does not entail A (because of the existential quantifiers).[1]

[1] Fixed from last time: It is less clear that the entailment from "Jones buttered *the* toast slowly and Jones buttered

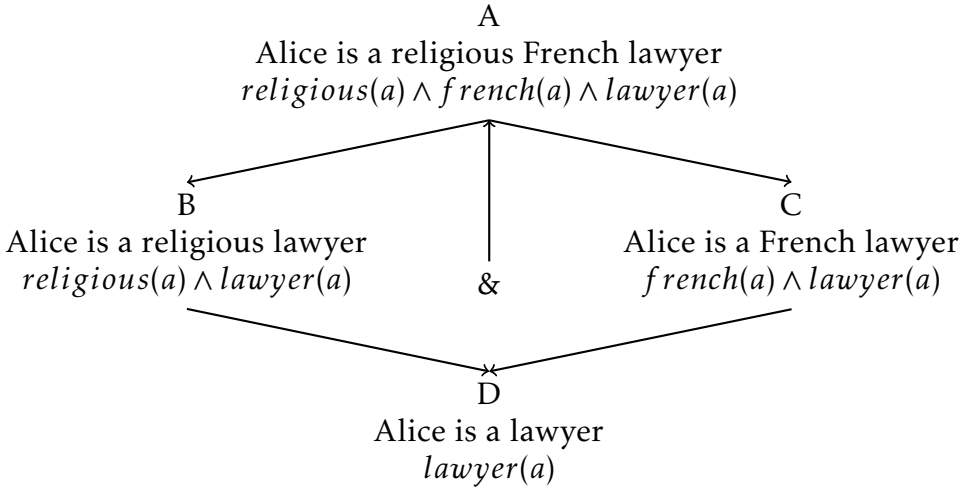
✧

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.

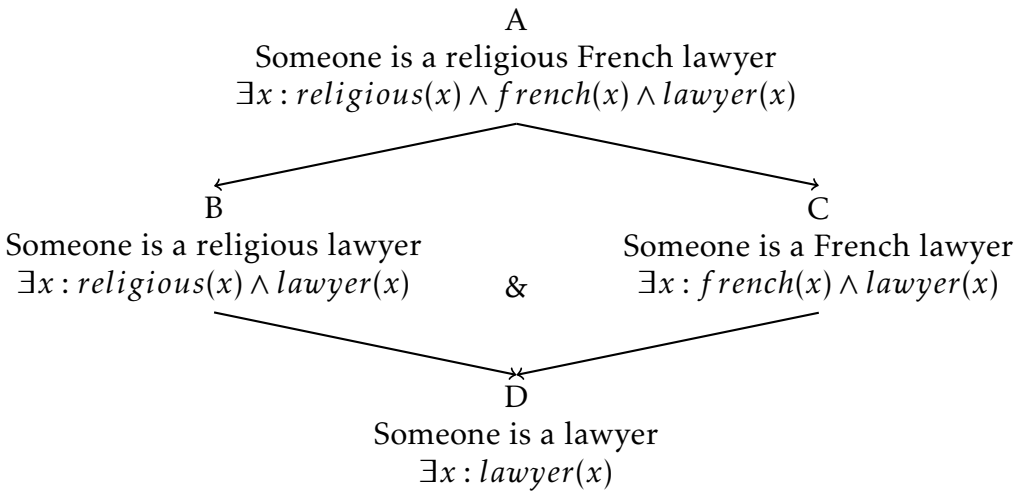
(24) Alice is a religious French lawyer.
$religious(a) \wedge french(a) \wedge lawyer(a)$

(25)



When the subject is replaced with an indefinite, this upwards entailment disappears again.

(26)



✧

the toast in the bathroom" to "Jones buttered the toast slowly in the bathroom" doesn't go through. We discussed how this might be an effect of the semantics of *the*. And $\exists e : butter(e, j, t)$ where t translates mass noun *toast* wasn't an ideal choice. See notes from Day 1.

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 1 and 2 are non-starters, but they're interesting.)

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

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

   This predicts that sentences like (28) should be contradictory.

   (28) 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.

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

   There's only 4 such functions: One is the constant function, one is negation, one maps 0 and 1 to 1, and one maps 0 and 1 to 0.

   None of these functions characterize the meaning contribution of an adverb like *slowly*: adding *slowly* may change the truth value of a sentence (not the constant function), *slowly* is not negation, adding *slowly* to a false sentence does not suffice to make it true, adding *slowly* to a true sentence does not suffice to make it false.[2]

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

   Here, let's switch to an intransitive predicate as it'll simplify the formulas.

   (30) Jones ran slowly.[3]

   a. ran $\rightsquigarrow run$ $\lambda x_e.run(x)$
   b. slowly $\rightsquigarrow \lambda f_{\langle e,t\rangle}.slowly(f)$ $\lambda f_{\langle e,t\rangle}\lambda y_e.slowly(f)(y)$
   c. ran slowly $\rightsquigarrow slowly(run)$ $\lambda y_e.slowly(\lambda x_e.run(x))(y)$
   d. Jones ran slowly $\rightsquigarrow slowly(run)(j)$

   Of note:

   - *slowly* maps any $\langle e,t\rangle$ function f onto another (arbitrary) $\langle e,t\rangle$ function.
   - j never gets to be an argument of run, only of $slowly(run)$

[2] Thanks to Flavia for the clarification.

[3] The translations on the left are obtained from the ones on the right via eta-reduction. 'Ran' and 'ran slowly' both denote functions of type $\langle e,t\rangle$.

Issue #1: No entailment

Because *slowly* maps *run* to an arbitrary $\langle e, t \rangle$, (31a) doesn't entail (31b).

(31) a. Jones ran slowly.
b. Jones ran.

To see this, assume we have $D_e = \{j, k, l\}$ and define the functions *run* and *slowly*(*run*) as follows.

(32) a. $[\![run]\!]^w = \begin{bmatrix} j \mapsto 0 \\ k \mapsto 0 \\ l \mapsto 0 \end{bmatrix}$ (nobody runs)

b. $[\![slowly(run)]\!]^w = \begin{bmatrix} j \mapsto 1 \\ k \mapsto 0 \\ l \mapsto 0 \end{bmatrix}$ (j runs slowly)

This will ensure that at w, "Jones ran slowly" is true, while "Jones ran" is false: No entailment.

Solution #1: Subsectivity

Adverbials' verb to verb mappings clearly need to be constrained. One constraint is Subsectivity:

(33) **Subsectivity**
An adverb A is subsective iff for any (possibly complex) VP denotation V
$A(V)(x) \Rightarrow V(x)$

This notion is familiar to us from the semantics of adjectives.

If we assume that adverbs lke "slowly" are subsective, the choice of functions in (32) is invalid.

But, changing *run*, we could instead have:

(34) a. $[\![run]\!]^w = \begin{bmatrix} j \mapsto 1 \\ k \mapsto 1 \\ l \mapsto 0 \end{bmatrix}$ (j and k run)

b. $[\![slowly(run)]\!]^w = \begin{bmatrix} j \mapsto 1 \\ k \mapsto 0 \\ l \mapsto 0 \end{bmatrix}$ (only j runs slowly)

This is better, but not enough.

Issue #2: No entailment again

Example (35a) entails (35b), with the middle adverb dropped.

(35) a. Jones ran slowly for miles.

b. Jones ran for miles.

If $for\text{-}miles$ and $slowly$ are both subsective, we can infer that Jones ran slowly, and that he ran.

But we can't infer that he ran for miles.

Here's a way of interpreting (35) such that the entailment to "Jones ran" succedes, but the one from (35a) to (35b) fails:

(36) a. $[\![for\text{-}miles(slowly(run))]\!]^w = \begin{bmatrix} j \mapsto 1 \\ k \mapsto 0 \\ l \mapsto 0 \end{bmatrix}$

b. $[\![for\text{-}miles(run)]\!]^w = \begin{bmatrix} j \mapsto 0 \\ k \mapsto 0 \\ l \mapsto 0 \end{bmatrix}$

c. $[\![run]\!]^w = \begin{bmatrix} j \mapsto 1 \\ k \mapsto 0 \\ l \mapsto 0 \end{bmatrix}$

Per (36a), John ran slowly for miles, but per (36b), he didn't run for miles...

Solution #2: Monotonicity

We could further assume that these adverbs are monotonic:

(37) **Monotonicity**:
An adverb A is monotonic iff if for any (possibly complex) VP denotations V and W, if $A(V)(x)$ and $V(x) \Rightarrow W(x)$ then $A(W)(x)$.

Take A as $for\text{-}miles$, V as $slowly(run)$ and W as run.

(38) a. $for\text{-}miles(slowly(run))(j)$ assumption
b. $slowly(run)(j) \Rightarrow run(j)$ Subsectivity
c. $for\text{-}miles(slowly(run))(j) \Rightarrow for\text{-}miles(run)(j)$
from a. b. and Monotonicity

Issue #3: We can't assume monotonicity for adverbial modification?

Now, Landman argues, based on the following example, that adverbial modification can't be assumed to be monotonic.

(39) a. If you talk to a crowd, you move your thorax.
b. John talks to the crowd through a megaphone.
c. Hence, John moves his thorax through a megaphone.

We can all agree that the inference from a. and b. to c. doesn't go through.

If you talk through a megaphone, and talking entails moving your thorax, by monotonicity, you should also be moving your thorax through the megaphone. That inference is not valid, so monotonicity must not be valid.

(40) is a simpler and at least as accurate model of these sentences' entailments.

(40) Jones ran slowly for miles.
$\exists e : run(e, j) \wedge slow(e) \wedge for\text{-}miles(e)$

3.3. Different flavors of event semantics

In Davidson (just seen) verbs keep their original n-place denotations and just *gain* an additional event argument.

There are other ways of conceptualizing verb denotations and how a verb's event argument is related to its other arguments and modifiers: the *neo-Davidsonian* and the *Kratzerian* ways.[4]

There is often no right or wrong way of doing things here. But it's useful to know about these different ways so as not to get sidetracked during your readings, and… it's extra finger practice.

3.3.1. Neo-Davidsonian (Parsons 1990, Higginbotham 1986)

Verbs denote 1-place predicates of events regardless of their syntactic valence.

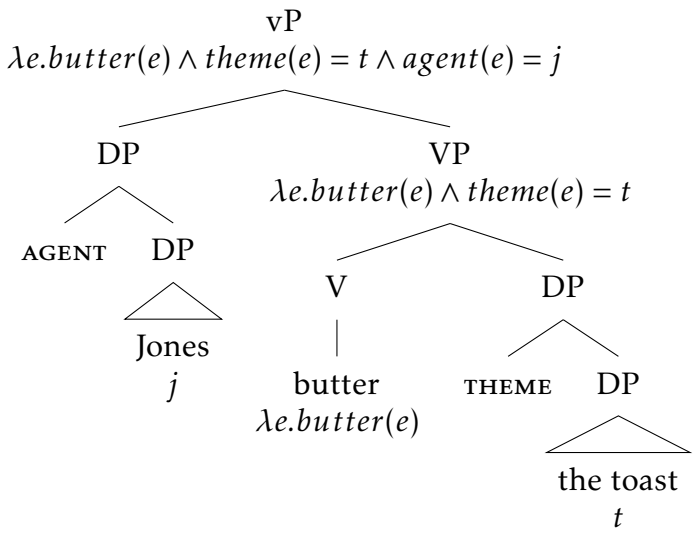
Their other arguments are introduced via thematic heads, which resemble VP modifiers from above.

(41) a. butter $\rightsquigarrow \lambda e_v.butter(e)$
b. Jones butter the toast $\rightsquigarrow \lambda e_v.butter(e) \wedge agent(e) = j \wedge theme(e) = t$

One way of deriving similar truth conditions compositionally is to assume that thematic heads combine with individual arguments in the syntax.

[4] See also Champollion (2015) and Coppock & Champollion (2022) section 11.3.1 *Verbs as event quantifiers*, which we'll get to in a couple of days.

(42)



Exercises:

- Define THEME and AGENT.
- There are alternatives to free floating thematic heads in the syntax.
  Can you think of any?

✧

This account treats arguments and modifiers the same (i.e., as conjuncts).

But, usually, the latter can be iterated or dropped, the former can't.

⇒ Additional constraints are required to avoid being able to interpret examples like (43). These come from "general information about the language, supplemented by particular information about [verbs]." (This, and the constraints below are from Parsons 1990: ch. 5.)

(43) a. *stab Caesar
$\exists e : stab(e) \wedge theme(e) = c$

b. *Miriam hugged Amra, Ravi.
$\exists e : hug(e) \wedge agent(e) = m \wedge theme(e) = a \wedge theme(e) = r$

For (43a), one could say, e.g., "each simple sentence must have a subject."

For (43b), if we read $theme(e) = a$ as *the theme of e is identical to a* and $theme(e) = r$ as *the theme of e is identical to r*, we get $a = r$, which is a contradiction.

There are ways of forming pluralities of individuals however:

(44) Miriam hugged Amra and Ravi.
$\exists e : hug(e) \wedge agent(e) = m \wedge theme(e) = a + r$
where $a + r$ refers to the plural individual formed by Amra and Ravi.

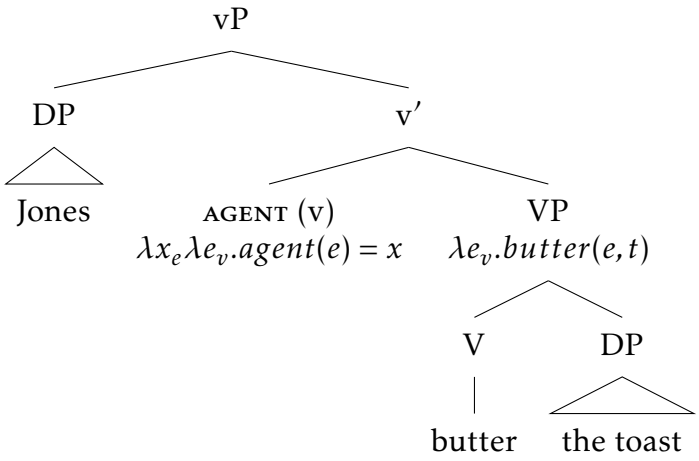
3.3.2. Kratzerian (Kratzer 1996)

According to Kratzer (1996) transitive verbs denote functions from their direct objects to event descriptions, in (45a). For subjects, she assumes thematic heads like (45b).[5]

(45) a. butter $\rightsquigarrow \lambda x_e \lambda e_v . butter(e, x)$
b. AGENT $\rightsquigarrow \lambda x_e \lambda e_v . agent(e) = x$

But, now, v and VP can neither compose through function application nor through predicate modification.

(46)



Kratzer uses a special composition rule to combine the v with the subject: *Event identification*.

(47) For any function f of type $\langle e, \langle v, t \rangle \rangle$ and g of type $\langle v, t \rangle$, event identifying f and g yields that function h of type $\langle e, \langle v, t \rangle \rangle$ s.t.:

$h = \lambda x_e . \lambda e_v . f(e, x) \wedge g(e)$ (modified from Kratzer 1996)

Exercise: Compute the denotation of v′.

✧

One property of this approach is that it treats objects and subjects asymmetrically. Kratzer attributes to Marantz (1994) an empirical argument for the possibility of such an asymmetry:

> [T]here are many instances where a particular kind of internal argument triggers a particular interpretation of the verb, [...] few (if any) instances where an external argument does the same.

[5] This is the same denotation as what we saw for neo-Davidson, except that Kratzer places AGENT on the spine, rather than with the subject.

The examples in (48) illustrate the object case. (Do any similar facts come to mind with subjects?)

(48)
a. throw a baseball
b. throw support behind a candidate
c. throw a boxing match (i.e., take a dive)
d. throw a party
e. throw a fit

a. kill a cockroach
b. kill a conversation
c. kill an evening watching TV
d. kill a bottle (i.e., empty it)
e. kill an audience (i.e., wow them)

Marantz, via Kratzer

How does this constitute an argument for *severing the external argument from the verb*?

Functions can be defined such that they place restrictions on their arguments, or the natural classes that they belong to. Here's a simple example:

(49) $f : \mathbb{N} \to \mathbb{N}$

$$f(x) = \begin{cases} x+1 & \text{if } x \text{ is even} \\ x & \text{if } x \text{ is odd} \end{cases}$$

Similarly for us, we could say (something like):

(50) $kill : D_e \to D_e \to D_t$

$$kill(x)(y) = \begin{cases} 1 & \text{iff } y \text{ kills } x, \text{ if } x \text{ is animate} \\ 1 & \text{iff } y \text{ empties } x, \text{ if } x \text{ is a container} \\ \dots & \end{cases}$$

It doesn't matter how many arguments, their order, etc.

Treating verbs as taking their direct objects (when they take any) as arguments allows us define such restrictions.

If subjects are not arguments of verbs, there is no way of (directly) formulating such restrictions on subjects—which would account for Marantz's generalization.