Events, arguments, and adjuncts

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1 Adding events

- Our current view of semantics: verbs denote Curry'd n-ary relations on individuals, and compose with their arguments via functional application.
- We have, however, not said very much about how *adjuncts* fit into this picture.

(1) John saw Mary in the garden on Tuesday with the binoculars.

(2) John saw Mary in the garden on Tuesday.

(3) John saw Mary in the garden.

(4) John saw Mary.

- Each of (1)–(4) entails all the sentences below it. You could imagine writing this one-by-one into the semantics of adjuncts (i.e., if VPs denote sets of indiviudals, modifiers always select some subset of that set). But in principle, nothing would rule out a language with adjuncts that weren't 'restrictive' in this way.
- That is, you might think there was something properly *grammatical* about the restrictivity of adjuncts.
- Event semantics logical forms:

$$
\begin{aligned}
[\![(1)]\!]^g &= \exists e.\, \textsf{saw}\,(e, \textsf{j}, \textsf{m}) \wedge \textsf{loc}\, e = \textsf{garden} \wedge \textsf{time}\, e = \textsf{tues} \wedge \textsf{instr}\, e = \textsf{binocs} \\
[\![(2)]\!]^g &= \exists e.\, \textsf{saw}\,(e, \textsf{j}, \textsf{m}) \wedge \textsf{loc}\, e = \textsf{garden} \wedge \textsf{time}\, e = \textsf{tues} \\
[\![(3)]\!]^g &= \exists e.\, \textsf{saw}\,(e, \textsf{j}, \textsf{m}) \wedge \textsf{loc}\, e = \textsf{garden} \\
[\![(4)]\!]^g &= \exists e.\, \textsf{saw}\,(e, \textsf{j}, \textsf{m})
\end{aligned}
$$

- The verb has an extra argument. This extra argument is a hook which adjuncts get hung on, conjunctively. This *guarantees* that incorporating adjuncts gives the right entailment profile. This basic idea is originally due to Davidson (1967, 'The logical form of action sentences').
- Today: cashing this out compositionally. Seeing how a number of choice points arise, and exploring them.

2 Going compositional

- Verbs have an extra argument slot, for events.

$$[\![\text{saw}]\!]^g = \lambda x.\, \lambda y.\, \lambda e.\, \textsf{saw}\,(e, y, x)$$

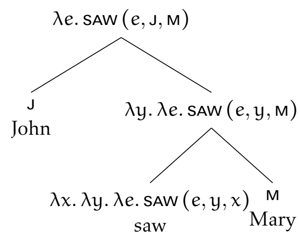

Figure 1: Deriving *John saw Mary*. The verb combines with its arguments, and a closure operator closes off the event.

- An example of how we compose up *John saw Mary* is given in Figure 1.
- The result in Figure 1 is a predicate of events. We can make this a truth value by invoking *event closure*:

$$[\![\mathcal{E}]\!]^g = \lambda f.\, \exists e.\, f\, e$$

- Applying this to what was derived in Figure 1 gives:

$$\exists e.\, \textsc{saw}\,(e, \textsc{j}, \textsc{m})$$

- Modifiers are then treated as *predicates of events*, which are folded in via predicate modification:

$$[\![\text{in the garden}]\!]^g = \lambda e.\, \textsc{loc}\, e = \textsc{garden}$$
$$[\![\text{on Tuesday}]\!]^g = \lambda e.\, \textsc{time}\, e = \textsc{tues}$$
$$[\![\text{with the binoculars}]\!]^g = \lambda e.\, \textsc{instr}\, e = \textsc{binocs}$$

- See Figure 2 for an example derivation. Notice that this derivation treats adjuncts as sentential modifiers. This is simply necessitated by the types. We'll see other versions later on today that allow us to treat adjuncts as proper VP modifiers.

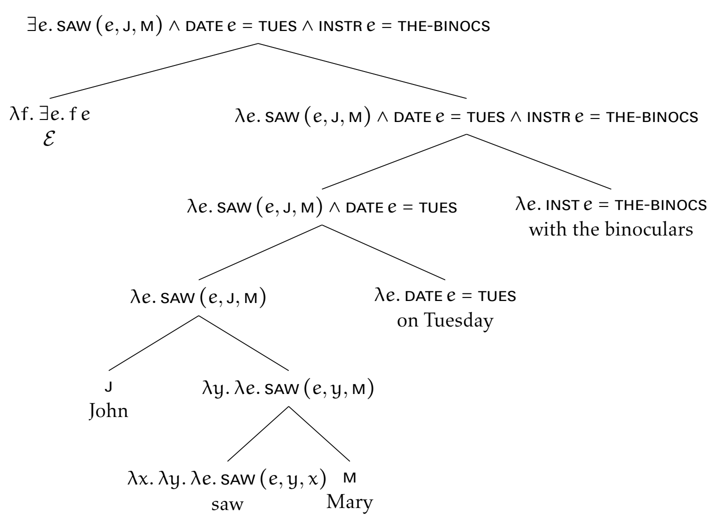

Figure 2: Deriving *John saw Mary on Tuesday with the binoculars*. The adjuncts denote predicates of events (e.g., predicates of events whose instrument was the binoculars, ...), and are semantically incorporated by predicate modification.

- Exercise: convince yourself that this approach yields the right entailment relationships between the sentences in (1)–(4).

3 Severing the external argument

- Internal arguments seem more closely linked to verbs than external arguments:

(5) 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

(6) 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)

(Examples from Marantz 1984 ['On the nature of grammatical relations'], *apud* Kratzer 1995 ['Severing the external argument from the verb'].)

- Specifically, internal arguments can trigger a particular (non-idiomatic) interpretation of a verb. Few or no instances of *external* arguments doing the same thing (according to Marantz).
- Idea: internal arguments are true arguments, on whose meaning the verb can "depend", in some sense. External arguments are closer to adjuncts.
- Kratzer proposes to account for this by only treating *internal* arguments as true arguments of the verb:

$$[\![\text{throw}]\!]^g = \lambda x.\, \lambda e.\, \textsf{THROW}\,(e, x)$$

- External arguments are introduced by little-v:

$$[\![v]\!]^g = \lambda y.\, \lambda e.\, \textsf{AGENT}\, e = y$$

- Then, need a new compositional principle, which Kratzer dubs 'event identification':

$$[\![\text{X Y}]\!]^g = \lambda y.\, \lambda e.\, [\![\text{X}]\!]\, y\, e \wedge [\![\text{Y}]\!]\, e, \text{ when defined}$$

- Putting it all together:

$$[\![v\ [\text{throw the ball}]]\!]^g = \lambda y.\, \lambda e.\, \textsf{AGENT}\, e = y \wedge \textsf{THROW}\,(e, \textsf{THE-BALL})$$

4 Severing *all* the arguments[!]

- We can actually get rid of *any* semantic distinction between arguments and adjuncts!
- Semantically, everything has the same profile. Selection done in the syntax. No semantic role for it.
- Meanings of verbs:

$$[\![\text{see}]\!]^g = \lambda e.\, \textsf{SEE}\, e$$

- Theta roles link verbs to their arguments by way of identifying how the arguments participate in the event characterized by the verb ('agent' is roughly subject, 'theme' is roughly object):

$$\llbracket \Theta_{\mathrm{Ag}} \rrbracket^g = \lambda x.\, \lambda e.\, \textsc{agent}\; e = x$$
$$\llbracket \Theta_{\mathrm{Th}} \rrbracket^g = \lambda x.\, \lambda e.\, \textsc{theme}\; e = x$$
$$\ldots$$

- An example of how we can derive a meaning for *John saw Mary* is given in Figure 3:

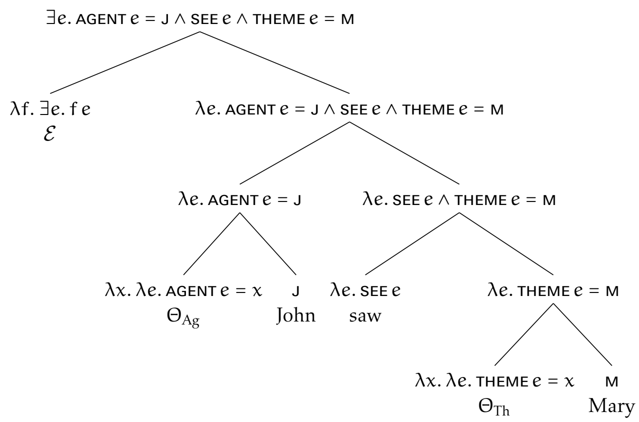

Figure 3: Deriving *John saw Mary*, without semantic selection.

5 Quantifiers and negation

- Quantifiers and negation always take scope over event closure:

(7) Spot didn't bark.

a. $= \neg\exists e.\, \textsc{bark}\; e \wedge \textsc{agent}\; e = \textsc{s}$

b. $\neq \exists e.\, \neg(\textsc{bark}\; e \wedge \textsc{agent}\; e = \textsc{s})$

(8) Exactly one dog barked.

a. $= \exists! x.\, \textsc{dog}\; x \wedge \exists e.\, \textsc{bark}\; e \wedge \textsc{agent}\; e = x$

b. $\neq \exists e.\, \exists! x.\, \textsc{dog}\; x \wedge \textsc{bark}\; e \wedge \textsc{agent}\; e = x$

- The (b) formulas here are way too easy to satisfy: (7-b) is made true by John tying his shoe, and (8-b) is true even if two dogs barked (since there's still an event with exactly one dog barking in it).
- But in principle, we predict an ambiguity: event closure, since it is a quantifier, could take scope, either above negation/quantifiers, or below.
- Champollion's (2015, 'The interaction of compositional semantics and event semantics') solution: building existential closure into the meaning of the verb. I.e., verbs are treated as generalized quantifiers of events:

$$\llbracket \text{saw} \rrbracket^g = \lambda f.\, \exists e.\, f\, e$$

- Here, we implement in the no-arguments framework, but you probably just as well have a version for a semantics that semantically distinguishes arguments and adjuncts in the denotation of the verb.

- Then Θ-heads and adjuncts will be higher-typed modifiers:

$$[\![\Theta_{\mathsf{Ag}}]\!]^g = \lambda x.\, \lambda V.\, \lambda f.\, V\,(\lambda e.\, \textsc{agent}\, e = x \wedge f\, e)$$

- An example derivation is given in Figure 4:

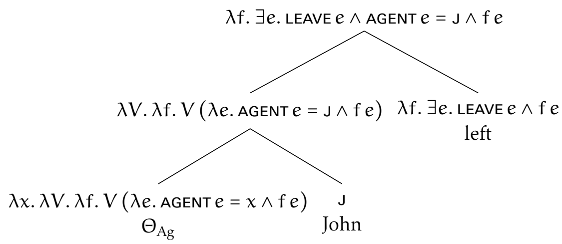

Figure 4: *John left*, with existential closure over events built into the semantics of the verb.

- We still need some sort of closure operation to give something of type $\mathtt{t}$:

$$[\![\textsc{stop}]\!]^g = \lambda e.\, \textsc{true}$$

- Applying this at the top node of Figure 4:

$$\begin{aligned} &\exists e.\, \textsc{leave}\, e \wedge \textsc{agent}\, e = \textsc{j} \wedge \textsc{true} \\ &= \exists e.\, \textsc{leave}\, e \wedge \textsc{agent}\, e = \textsc{j} \end{aligned}$$

- If negation is Boolean (i.e., type $\mathtt{t} \to \mathtt{t}$), it can only apply at this point in the derivation:

$$\neg \exists e.\, \textsc{leave}\, e \wedge \textsc{agent}\, e = \textsc{j}$$

- Something similar holds of quantifiers, which remain of type $(\mathtt{e} \to \mathtt{t}) \to \mathtt{t}$: the only place we can possibly interpret them is above the event closure. Exercise: work this out![1]
- Seems to lose some of the appeal of conjunctivism! The entailments in (1)–(4) no longer follow from the grammar, per se, but from the lexical semantic entries for Θ-roles.
- And notice that we'll need to prevent the verb (itself typed as a quantifier over events!) from QRing, else we allow the existential quantifier over events to again out-scope negation and quantificational DPs.

[1] *Pace* Champollion, it seems like the choices here are independent of QR *vs.* semantic theories of scope.