Back to events:
More on the logic of verbal modification

Lucas Champollion
NYU
champollion@nyu.edu

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1 Introduction

- Beaver and Condoravdi (2007, here: B&C) propose to move away from event semantics (Davidson, 1967) as a theory of verbal modification.
- B&C's system provides a clean and compositional account of the interaction of events and quantifiers. But their rejection of event semantics brings problems.
- The main point of this talk is that we can have our cake and eat it too: we can reconcile B&C with Davidsonian event semantics and keep the strengths of both systems.
- This is part of a larger project about integrating Montague semantics with event semantics (Champollion 2011, submitted).

2 Problems

2.1 Argument reduction

- In event semantics, modifiers (*at noon*, *on the forum*) are interpreted conjunctively.
- So, entailments like (1) are modeled as logical entailments (2).

(1) Jones buttered the toast at noon. $\Rightarrow$ Jones buttered the toast.

(2) $[\exists e.\mathbf{butter}(e) \wedge \mathbf{ag}(e) = j \wedge \mathbf{th}(e) = t \wedge \tau(e) = \mathbf{noon}]$
$\Rightarrow [\exists e.\mathbf{butter}(e) \wedge \mathbf{ag}(e) = j \wedge \mathbf{th}(e) = t]$

- This is considered to be a very powerful argument in favor of event semantics.
- For B&C, verbs and VPs denote sets of partial functions called "role assignments".

Label	Value
ARG1 (agent)	john
ARG2 (theme)	toast
T (time)	noon

Table 1: An example of a role assignment, called g_1.

- These role assignments map a small number of labels to appropriate values (Table 1).
- So in a model where John kicked Bill at 1pm, the sets denoted by *kick*, by *kick Bill* and by *John kick Bill* each contain at least the role assignment g_1 in Table 1.
- For B&C, the entailment in (3) is nonlogical, ie. it no longer comes for free.

(3) $\textbf{butter}([\textsc{arg}1, j;\ \textsc{arg}2, toast;\ \textsc{t}, noon]) \Rightarrow \textbf{butter}([\textsc{arg}1, j;\ \textsc{arg}2, toast])$

- So they need to enforce it for each verb via an "argument reduction" principle:

(4) **Argument reduction axiom.** For any verb V and model M, if $f \in [\![V]\!]_M$, $g \subset f$, and every argument of V is in dom(g), then $g \in [\![V]\!]_M$.

- This says that if V holds of a role assignment R, it also holds of any restriction of R.
- Thus, a major motivation for event semantics does not carry over to B&C.

2.2 Overgeneration

- B&C also resort to stipulation for their treatment of time.
- They represent the surface scope reading of a sentence like (5a) as in (5b).

(5) a. A diplomat visited every country.
b. $\exists t.t < \textsc{now} \wedge \exists x.\textbf{diplomat}(x) \wedge \forall y.\textbf{country}(y) \rightarrow \textbf{visit}([\textsc{arg}1, x; \textsc{arg}2, y; \textsc{t}, t])$

- This by itself requires all the visits to happen simultaneously at time t.
- To relax this requirement, B&C stipulate a "temporal closure" principle:

(6) **Temporal closure axiom.** For any verb V and model M, if $f \in [\![V]\!]_M$, $f(\textsc{t})$ is temporally included in $g(\textsc{t})$ and f differs from g at most with respect to the value it gives to T, then $g \in [\![V]\!]_M$.
(If a verb applies to a role assignment which maps T to a given interval t, then for each of its superintervals t', the verb also applies to an otherwise equal role assignment that maps T to t'.)

- This hard-wired approach overgenerates:

(7) a. It took John five years to learn Russian.
  b. $\not\Rightarrow$ It took John ten years to learn Russian.

- This invalid argument is predicted valid since temporal closure makes (8a) entail (8b).

(8) a. $\exists t.t < \textsc{now} \wedge \mathbf{years}(t) = 5 \wedge \mathbf{learn}([\textsc{arg}1, j; \textsc{arg}2, r; \textsc{t}, t])$
  b. $\exists t.t < \textsc{now} \wedge \mathbf{years}(t) = 10 \wedge \mathbf{learn}([\textsc{arg}1, j; \textsc{arg}2, r; \textsc{t}, t])$

3 Solution: Back to events

- The basic insight is that role assignments are very similar to sets of events.
- So g_1 above corresponds to the property of being an event whose agent is John, etc.
- This could in principle apply to more than one event (e.g. a slapping and a kicking).
- So a role assignment corresponds to a set of events and not just to one event.
- Since B&C's verbal projections denote sets of role assignments, we need to move to an event semantics in which verbal projections denote sets of sets of events.
- The system in Champollion (2011, submitted, which I will call C) fits the bill.
- The B&C-style derivation shown in (9) translates to its C-style counterpart in (10).
- Here f, g range over role assignments, k over sets of events, L over sets of role assignments, V over sets of sets of events.
- Roughly, $f + [\textsc{arg}1, m]$ extends f by a new entry that maps $\textsc{arg}1$ to m.

(9) a. $[\![\text{Mary}]\!] = \lambda P.P(m)$
  b. $[\![\text{Mary:}\textsc{arg}1]\!] = \lambda L \lambda f.L(f + [\textsc{arg}1, m])]$
  c. $[\![\text{-ed}]\!] = \lambda L \lambda f.L(f) \wedge f(\textsc{t}) < \textsc{now}$
  d. $[\![\text{laugh -ed}]\!] = \lambda g.\mathbf{laugh}(g) \wedge g(\textsc{t}) < \textsc{now}$
  e. $[\![\text{Mary:}\textsc{arg}1 \text{ laugh -ed}]\!] = \lambda f.\mathbf{laugh}(f + [\textsc{arg}1, m]) \wedge f(\textsc{t}) < \textsc{now}$
  f. $M \models$ Mary laughed iff $\exists t[\mathbf{laugh}([\textsc{t}, t; \textsc{arg}1, m]) \wedge t < \textsc{now}]$

(10) a. $[\![\text{Mary}]\!] = \lambda P.P(m)$
  b. $[\![\text{[ag] Mary}]\!] = \lambda V \lambda k.V(\lambda e.[k(e) \wedge \textsc{ag}(e) = m])]$
  c. $[\![\text{-ed}]\!] = \lambda V \lambda k \exists t[t < \textsc{now} \wedge V(\lambda e[k(e) \wedge \tau(e) \subseteq t])]$
  d. $[\![\text{[closure]}]\!] = \lambda V.V(\lambda e.\top)$
  e. $[\![\text{laugh}]\!] = \lambda k \exists e[\mathbf{laugh}(e) \wedge k(e)]$
  f. $[\![\text{[closure] [ag] M. laugh -ed}]\!] = \exists t[t < \textsc{now} \wedge \exists e[\mathbf{laugh}(e) \wedge \textsc{ag}(e) = m \wedge \tau(e) \subseteq t]]$

- In (10), I have deviated from B&C in distinguishing between the runtime of the event, $\tau(e)$, and the reference time interval of the sentence, t.
- Following standard practice, the morpheme *-ed* contributes both past tense and perfective aspect, so it relates $\tau(e)$ and t by temporal inclusion, written as $\subseteq$ (10c). This removes the need for B&C's temporal closure principle.
- I represent (5a) (repeated below as (11)) as in (12). The underlined bit requires that each visit is contained within the reference interval, but does not require all visits to take place at the same time.

(11) A diplomat visited every country.

(12) $\exists t.t < \textsc{now} \wedge \exists x.\mathbf{d}(x) \wedge \forall y.\mathbf{c}(y) \rightarrow \exists e.\mathbf{v}(e) \wedge \mathbf{ag}(e) = x \wedge \mathbf{th}(e) = x \wedge \underline{\tau(e) \subseteq t}$

- I translate the matrix clauses of (7) as in (13).

(13) $[\![\text{It took John } n \text{ years to}]\!]$
$= \lambda V \exists t.t < \textsc{now} \wedge \mathbf{years}(t) = n \wedge V(\lambda e.\mathbf{ag}(e) = j \wedge \tau(e) = t)$

- The embedded clause does not have past tense, and therefore does not contribute $\subseteq$.
- The underlined parts of (14a) and (14b) block the undesired inference in (7).

(14) a. $\exists t.t < \textsc{now} \wedge \underline{\mathbf{years}(t) = 5} \wedge \exists e[\mathbf{learn}(e) \wedge \mathbf{ag}(e) = j \wedge \mathbf{th}(e) = r \wedge \tau(e) = t]$
b. $\exists t.t < \textsc{now} \wedge \underline{\mathbf{years}(t) = 10} \wedge \exists e[\mathbf{learn}(e) \wedge \mathbf{ag}(e) = j \wedge \mathbf{th}(e) = r \wedge \underline{\tau(e) = t}]$

4 Conclusion

- Verbal modification remains a strong motivation for Davidsonian event semantics.

References

Beaver, D. and Condoravdi, C. (2007). On the logic of verbal modification. *Proceedings of AC 16*. Online at `http://stanford.edu/~cleoc/linksem-ac.pdf`

Champollion, L. (2011). Quantification and negation in event semantics. *The Baltic International Yearbook of Cognition, Logic and Communication*, 6. Online at `http://dx.doi.org/10.4148/biyclc.v6i0.1563`

Champollion, L. (submitted). The interaction of Montague semantics and event semantics.

Davidson, D. (1967). The logical form of action sentences. In *The logic of decision and action*.

Landman, F. (2000). *Events and plurality: The Jerusalem lectures*. Kluwer.