Compositional semantics and event semantics:
a case study in inter-theoretic relations

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1 Introduction

- Eventless compositional semantics: a verb is a relation over its arguments

\[ [\text{stab}] = \lambda y \lambda x. \text{stab}(x, y) \approx \{(y, \langle x \rangle | \langle x, y \rangle \in \text{STAB})\} \]

- Neo-Davidsonian event semantics (Davidson, 1967; Castañeda, 1967; Parsons, 1990): a verb is a predicate of events; linked to its arguments by thematic roles. Event bound by existential quantifier.

\[ [\text{stab}] = \lambda e. \text{stabbing}(e) \approx \{e | e \in \text{STAB}\} \]

\[ \text{Brutus stabbed Caesar.} \]

Eventless semantics: \( \text{stab}(b, c) \)

Neo-Davidsonian event semantics: \( \exists e[\text{stabbing}(e) \land \text{agent}(e) = b \land \text{theme}(e) = c] \)

2 Compositional semantics

- Following Montague (1974), many successful theories of scope-taking expressions that have counterparts in predicate logic:

\[ a. \text{Quantifiers (some, every): (e.g. Montague, 1974)} \]

\[ b. \text{Coordination (and, or) (e.g. Partee and Rooth, 1983)} \]

\[ c. \text{Truth-functional negation (not) (e.g. Horn, 1989)} \]

- Here are three issues in which compositional semantic theories disagree, and in which event semantics has been claimed to favor one view over another:
2.1 Intertheoretic relations: Quantification ↔ event semantics

- Some theories analyze quantifier scope as covert syntactic movement

(5) John kissed every girl.
   - Montague (1974): Quantifying-In
   - May (1985): Quantifier Raising (QR)

(6) \[ [\text{every girl}] \ 1 [\text{John kissed } t_1]\]

- Some theories provide semantic accounts:

  - Hendriks (1993): argument raising
  - Barker (2002): continuation semantics

(7) \[ [\text{John [TYPE-SHIFT(kissed)] [every girl] }] \]

- I will show that event semantics is compatible with both syntactic and semantic accounts of quantifier scope.

**Why should we care?**

- Some people believe otherwise (Beaver and Condoravdi, 2007; Eckardt, 2009)
- Syntactic accounts are sometimes viewed as problematic (e.g. Beaver and Condoravdi, 2007; Eckardt, 2009), for example because it entails the presence of a representational level (Logical Form) (Jacobson, 1999; Barker, 2002)
- QR is probably absent in some languages such as Chinese (Huang, 1998).

2.2 Intertheoretic relations: Conjunction ↔ event semantics

- Does and mean “Intersect”? (Partee and Rooth, 1983; Winter, 2001; Champol- lion, 2013, 2014f)

(8) John walks and talks. \[ j \in \text{WALK} \cap \text{TALK} \]

- Or does and mean “Form a collective entity”? (Krifka, 1990; Lasersohn, 1995; Heycock and Zamparelli, 2005)

(9) John and Mary met. \[ j \oplus m \in \text{MEET} \]

- I will show that event semantics is compatible with both.

**Why should we care?**
2.3 Intertheoretic relations: Negation ↔ event semantics

- Does truth-functional not correspond to classical negation? (Horn, 1989)

  \[(10)\]
  a. It did not rain today.
  b. “It is not the case that (there was an event in which) it rained today.”

- Or does it involve reference to maximal fusions? (Krifka, 1989)

  \[(11)\] “The fusion(-state) of all the events that took place today does not contain any subevents in which it rained.”

- I will show that event semantics is compatible with both.

**Why should we care?**

- Fusion-based negation has been both influential and controversially debated (de Swart, 1996; de Swart and Molendijk, 1999; Zucchi and White, 2001; Condoravdi, 2002; Giannakidou, 2002; Csirmaz, 2006).

- Krifka (1989): event semantics requires the fusion theory.

3 Quantification

- **Generalization:** (adapted from Landman (2000)): The event quantifier always takes scope under all other quantifiers

  \[(12)\] Spot didn’t bark.
  a. =“There is no event in which Spot barks”
  b. ≠“There is an event in which Spot did not bark”

  \[(13)\] No dog barks.

  \[(14)\]
  a. \(\neg\exists x[\text{dog}(x) \land \exists e[\text{barking}(e) \land \text{agent}(e) = x]]\)
  “There is no barking event that is done by a dog”
  b. \(*\exists e[\neg\exists x[\text{dog}(x) \land \text{barking}(e) \land \text{agent}(e) = x]]\)
  “There is an event that is not a barking by a dog”

  \[(15)\] Every dog barks.

  \[(16)\]
  a. \(\forall x[\text{dog}(x) \rightarrow \exists e[\text{barking}(e) \land \text{agent}(e) = x]]\)
  “For every dog there is a barking event that it did”
b. $\exists e \forall x [\text{dog}(x) \rightarrow [\text{barking}(e) \land \text{agent}(e) = x]]$  
   "There is a barking event that was done by every dog"

• Thematic roles are partial functions (Carlson, 1984; Dowty, 1989; Parsons, 1990; Landman, 2000) so there have to be different barking events

• Situating this analysis:

<table>
<thead>
<tr>
<th></th>
<th>No Events</th>
<th>Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>Covert movement</td>
<td>e.g. May (1985)</td>
<td>e.g. Landman (2000)</td>
</tr>
<tr>
<td>Type shifting</td>
<td>e.g. Hendriks (1993)</td>
<td>this presentation</td>
</tr>
</tbody>
</table>

3.1 Neo-Davidsonian semantics: the standard analysis

• Neo-Davidsonian semantics lends itself to a natural compositional process in terms of intersection with an existential quantifier at the end (Carlson, 1984; Parsons, 1990, 1995; Landman, 2000).

• This is found in state-of-the-art analyses (e.g. Kratzer, 1996; Landman, 2000):
  - Verbs and their projections (VP, v’, vP...) are predicates over events
  - Functional heads introduce thematic roles
  - A silent operator (“existential closure”) binds the event variable

(17) a. $[[\text{agent}]] = \lambda x \lambda e [\text{ag}(e) = x]$
   b. $[[\text{theme}]] = \lambda x \lambda e [\text{th}(e) = x]$
   c. $[\text{stab}] = \lambda e [\text{stab}(e)]$
   d. $[[\text{ag} \text{ Brutus}]] = \lambda e [\text{ag}(e) = \text{brutus}]$
   e. $[[\text{th} \text{ Caesar}]] = \lambda e [\text{th}(e) = \text{caesar}]$
   f. $[\text{Brutus stab Caesar}] = (17c) \cap (17d) \cap (17e)$ (sentence radical)
   g. $[\text{Brutus stabbed Caesar}] = \exists e. e \in (17c) \cap (17d) \cap (17e)$

• This has been elevated to a principle, *conjunctivism*, in Pietroski (2005, 2006).

• A VP has to apply to an event, but there is no single event to which a verb phrase like “kiss every girl” and “kiss no girl” could apply.

(18) $[[\text{kiss every/no girl}]] = \lambda e.??$

• One solution is quantifier raising: give an assignment-dependent meaning

(19) $[[\text{kiss } t_1]] = \lambda e.\text{kissing}(e) \land \text{th}(e) = x$

• Problem: this analysis requires a syntactic level of representation (LF) distinct from surface order. This is shown in Fig. 1.
Figure 1: “No dog barks”, Neo-Davidsonian style
4 The proposal

- Core idea: Include existential quantification into the meaning of the verb.

\[(\text{kiss}) = \lambda f_{(\text{ut})}. \exists e. \text{kiss}(e) \land f(e) \approx \{ F | F \cap \text{KISS} \neq \emptyset \}\]

- Start with a verb and successively apply its arguments and adjuncts to it, as in event semantics.

- This will automatically derive the fact that all other quantifiers always have to take scope above the event quantifier.

- Every argument is semantically a modifier.

\[(\text{kiss Mary[th]}) = \lambda f. \exists e. \text{kiss}(e) \land f(e) \land \text{theme}(e) = \text{mary}\]

- Now, “kiss every girl” applies to any set of events that contains a potentially different kissing event for every girl. Noun phrases can retain their usual analysis as quantifiers over individuals.

\[(\text{every girl}[\text{th}]) = \lambda V. \forall x. [\text{girl}(x) \rightarrow V(\lambda e. \text{theme}(e) = x \land f(e))]\]

\[(\text{kiss every girl}[\text{th}]) = \lambda P. \forall x. \text{girl}(x) \rightarrow \exists e. \text{kiss}(e) \land P(e) \land \text{theme}(e) = x\]

- “kiss no girl” is similar.

- For scope ambiguities, type-shift the thematic roles (Champollion, 2014f).

- Finally apply (24) to assert that the predicate is true of the set of all events.

\[(\text{[closure]} = \lambda e. \text{true}\]

\[(\text{[it rains]} = \lambda f. \exists e. [\text{rain}(e) \land f(e)]\]

\[(\text{[[closure] it rains]} = \exists e. [\text{rain}(e) \land \text{true}]\]

\[(\text{[John kissed every girl]} = \lambda f. \forall x. [\text{girl}(x) \rightarrow \exists e. \text{kiss}(e) \land \text{ag}(e) = j \land \text{th}(e) = x \land f(e)]\]

\[(\text{[[closure] John kissed every girl]} \forall x. [\text{girl}(x) \rightarrow \exists e. \text{kiss}(e) \land \text{ag}(e) = j \land \text{th}(e) = x \land \text{true}]\]

- For full detail, see Figure 2.

5 Conjunction

- Lasersohn (1995, ch. 14) claims that event semantics favors the collective theory.
Figure 2: Illustration of this framework, using the sentence “John kissed every girl.”
Lasersohn translates sentence radicals as event predicates.

(27) a. \[\text{[and]}_{\text{Lasersohn}} = \lambda P_1.\lambda P_2.\lambda e.\exists e_1\exists e_2. P_1(e_1) \land P_2(e_2) \land e = \{e_1, e_2\}\]

b. \[\text{[sing and dance]}_{\text{Lasersohn}} = \lambda e.\exists e_1\exists e_2. \text{sing}(e_1) \land \text{dance}(e_2) \land e = \{e_1, e_2\}\]

I will show that event semantics is also compatible with the intersective theory.

The intersective theory identifies \textit{and} with intersection (suitably generalized – see (e.g. Partee and Rooth, 1983)).

Applied to event predicates and event quantifiers:

(28) **Conjunction of sets of events:** (no event quantifier!)
\[
\lambda e.\text{sing}(e) \cap \lambda e.\text{dance}(e)
= \lambda e.\text{sing}(e) \land \text{dance}(e)
\]

In set terms: we intersect SING and DANCE. This might yield the empty set.

The one-event view in (28) doesn’t work well because it forces both verbal predicates to apply to the same event.

But there must be two events involved on pain of contradiction:

(29) The ball rotated quickly and heated up slowly. (Davidson, 1969)

This is immediately predicted on the two-event view.

(30) **Conjunction of sets of sets of events:** (two event quantifiers!)
\[
\lambda f.\exists e.\text{sing}(e) \land f(e) \cap \lambda f.\exists e.\text{dance}(e) \land f(e)
= \lambda f.\exists e.\text{sing}(e) \land f(e) \land \lambda e'.\text{dance}(e') \land f(e')
\]

Intersect the set of all sets that contain a singing event, and the set of all sets that contain a dancing event. Result: the set of all sets that contain one of each.

(31) \[\text{[rotate quickly]} \cap \text{[heat up slowly]} = \lambda f.\exists e.\text{rotate}(e) \land \text{quickly}(e) \land f(e) \]
\[\land \lambda e'.\text{heat-up}(e') \land \text{slowly}(e') \land f(e')\]

See Champollion (2014f) for more details (interaction with \textit{alternately}, sentences like \textit{John caught and ate a fish}).

6 Negation

Negation has been considered difficult for event semantics (Krifka, 1989).
• We have seen earlier that negation always takes scope above the event quantifier.

• But on the old approach, we get the wrong reading:

\[
\begin{align*}
(32) & \quad a. \quad \textbf{[bark]} = \lambda e. \text{bark}(e) \\
& \quad b. \quad \textbf{[not bark]} = \lambda e. \neg \text{bark}(e) \\
& \quad c. \quad \textbf{[Spot[ag] didn’t bark]} = \exists e [\text{ag}(e) = s \land \neg \text{bark}(e)]
\end{align*}
\]

• Krifka (1989) suggests that negation takes scope under the event quantifier.

• But this decision requires translating negation in a nonstandard way. Krifka uses fusion (mereological sum) for this purpose.

\[
(33) \quad [\text{did not}]_{\text{Krifka}} = \lambda P \lambda e \exists t [e = \text{FUSION}(\lambda e' [\tau (e') \leq t]) \land \neg \exists e'' [P(e'') \land e'' \leq e]]
\]

• For Krifka, Spot didn’t bark means that there is a fusion of all the events within some time, and that none of them is an event of Spot barking:

\[
(34) \quad \textbf{[Spot did not bark]} = \\
\exists e \exists t [e = \text{FUSION}(\lambda e' [\tau (e') \leq t]) \land \neg \exists e'' [e'' \leq e \land \text{bark}(e'') \land \text{ag}(e'') = \text{spot}]]
\]

• We can formulate the meaning of not in terms of logical negation, without fusions.

\[
(35) \quad a. \quad \textbf{[not]} = \lambda V \lambda f \neg V(f) \\
& \quad b. \quad \textbf{[bark]} = \lambda f \exists e [\text{bark}(e) \land f(e)] \\
& \quad c. \quad \textbf{[not bark]} = \lambda f \neg \exists e [\text{bark}(e) \land f(e)] \\
& \quad d. \quad \textbf{[spot [ag]]} = \lambda V \lambda f, V(\lambda e. \text{ag}(e) = s \land f(e)) \\
& \quad e. \quad \textbf{[spot [ag] (did) not bark]} = \lambda f \neg \exists e [\text{bark}(e) \land \text{ag}(e) = s \land f(e)] \\
& \quad f. \quad \textbf{[[closure] spot [ag] (did) not bark]} = \neg \exists e [\text{bark}(e) \land \text{ag}(e) = s]
\]

• See Champollion (2014f) for more details (interaction with tense and aspectual adverbials) and for a treatment of modals in this style.

7 Conclusion

• Neo-Davidsonian event semantics does not pose a particular problem when it is combined with standard accounts of quantification, conjunction, and negation.

• I have provided a simple account for the fact that argument quantifiers always take scope above existential closure.

• The framework proposed here combines the strengths of event semantics and type-shifting accounts of quantifiers.
• It is well suited for applications to languages where word order is free and quantifier scope is determined by surface order.

7.1 Further Reading

• Champollion (2010): an early version. Available online at http://dx.doi.org/10.4148/bicyc1c.v6i10.1563


• Schwarzschild (2014) and Champollion (2014e): integrating the system presented here with Champollion (2014a,d). Second citation available online at http://ling.auf.net/lingbuzz/002165

• Active research program, comments welcome at champollion@nyu.edu.

References


Schwarzschild, R. (2014). Distributivity, negation and quantification in event semantics: Recent work by l. champollion. Manuscript, MIT.

