Segmented Discourse Representation Theory

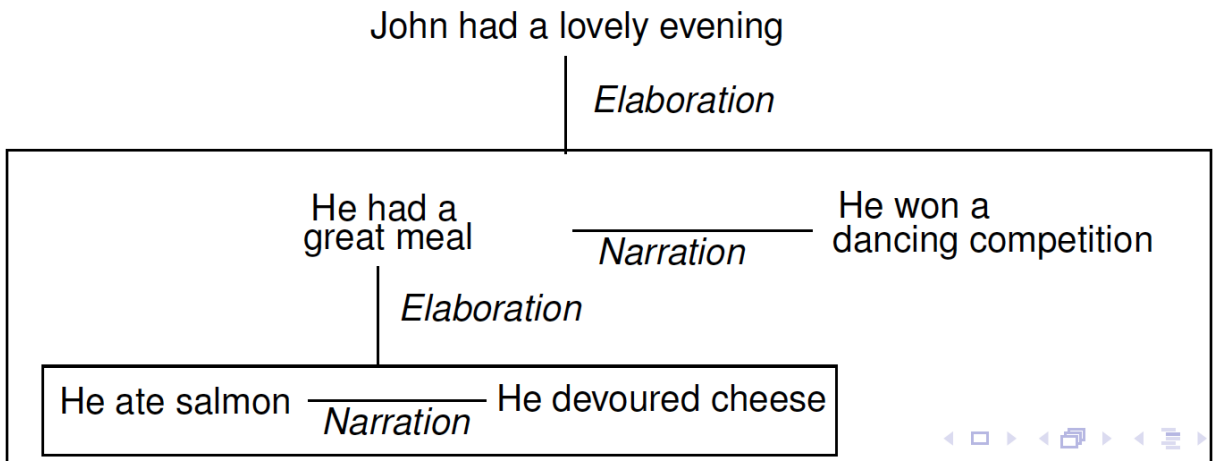
Asher and Lascarides (2003) - Slides from Alex Lascarides ☺

- A dynamic semantic theory of discourse interpretation
- It uses rhetorical relations to model the semantics/pragmatics interface.
- semantic underspecification is expressed as partial descriptions of logical forms, and
- a glue logic which uses commonsense reasoning to construct logical forms, relating the semantically underspecified forms that are generated by the grammar to their pragmatically preferred interpretations

The Need for Rhetorical Relations: Data

Pronouns

(2)
a. John had a great evening last night.
b. He had a fantastic meal.
c. He ate salmon.
d. He devoured lots of cheese.
e. He won a dancing competition.
f. ??It was a beautiful pink.



The Need for Rhetorical Relations: Data

Tense

(3) Max fell. John helped him up.

(4) Max fell. John pushed him.

(5) John hit Max on the back of his neck. Max fell. Joh pushed him. Max rolled over the edge of the cliff.

Words

(6)
a. A: Did you buy the apartment?
b. B: Yes, but we rented it./ No, but we rented it.

Bridging

(7)
a. John took an engine from Avon to Dansville.
b. He picked up a boxcar./He also took a boxcar.

The Strategy

1. SDRSs: Extend DRT with rhetorical relations.
2. $\mathcal{L}_{ulf}$: Supply a separate logic for describing SDRSs (semantic underspecification).
3. *Glue logic:* Construct logical form for discourse via:
   1. default reasoning, over
   2. $\mathcal{L}_{ulf}$-formulae for clauses which are generated by the grammar and
   3. 'shallow' representations of lexical semantics, domain knowledge, cognitive states...

   Glue logic entails more consequences about content than the grammar does. These are *implicatures*.

Logic of Information Content: Syntax

SDRS-formulae:

- DRSs
- $R(\pi, \pi')$, where R is a rhetorical relation and π and π' are labels.
- Boolean combinations of these

An SDRS is a structure $\langle A, \mathcal{F}, LAST \rangle$

- A is a set of labels
- $\mathcal{F}$ maps labels to SDRS-formulae (i.e., labels tag content)
- $LAST$ is a label (of the last utterance)
- Where $Succ(\pi, \pi')$ means $R(\pi', \pi'')$ or $R(\pi'', \pi')$ is a literal in $\mathcal{F}(\pi)$: A forms a partial order under $Succ$ with a unique root.

SDRSs allow Plurality

Of Relations: *Contrast*(π_1, π_2), *Narration*(π_1, π_2)

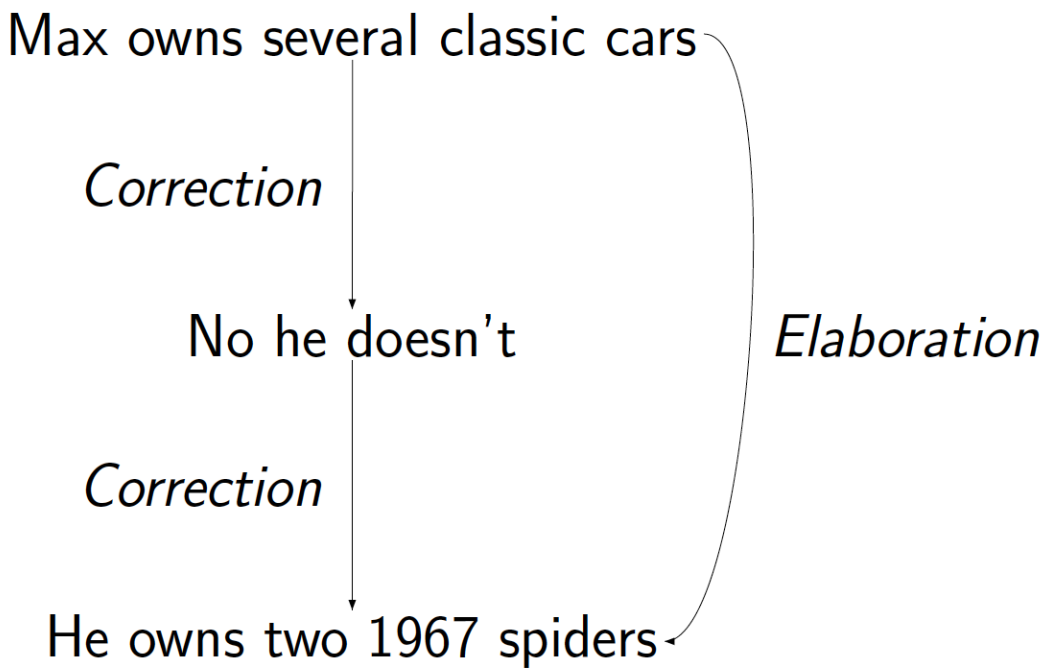
(6)
a. A: Did you buy the apartment?
b. B: Yes, but we rented it.

Of Attachment sites: *Correction*(π_2, π_3), *Elaboration*(π_1, π_3)

(8)
π_1 A: Max owns several classic cars.
π_2 B: No he doesn't.
π_3 A: He owns two 1967 Alfa spiders.

- A single utterance can make more than one *illocutionary contribution* to the discourse.

A Diagram


Max owns several classic cars
Correction
No he doesn't
Elaboration
Correction
He owns two 1967 spiders

Example

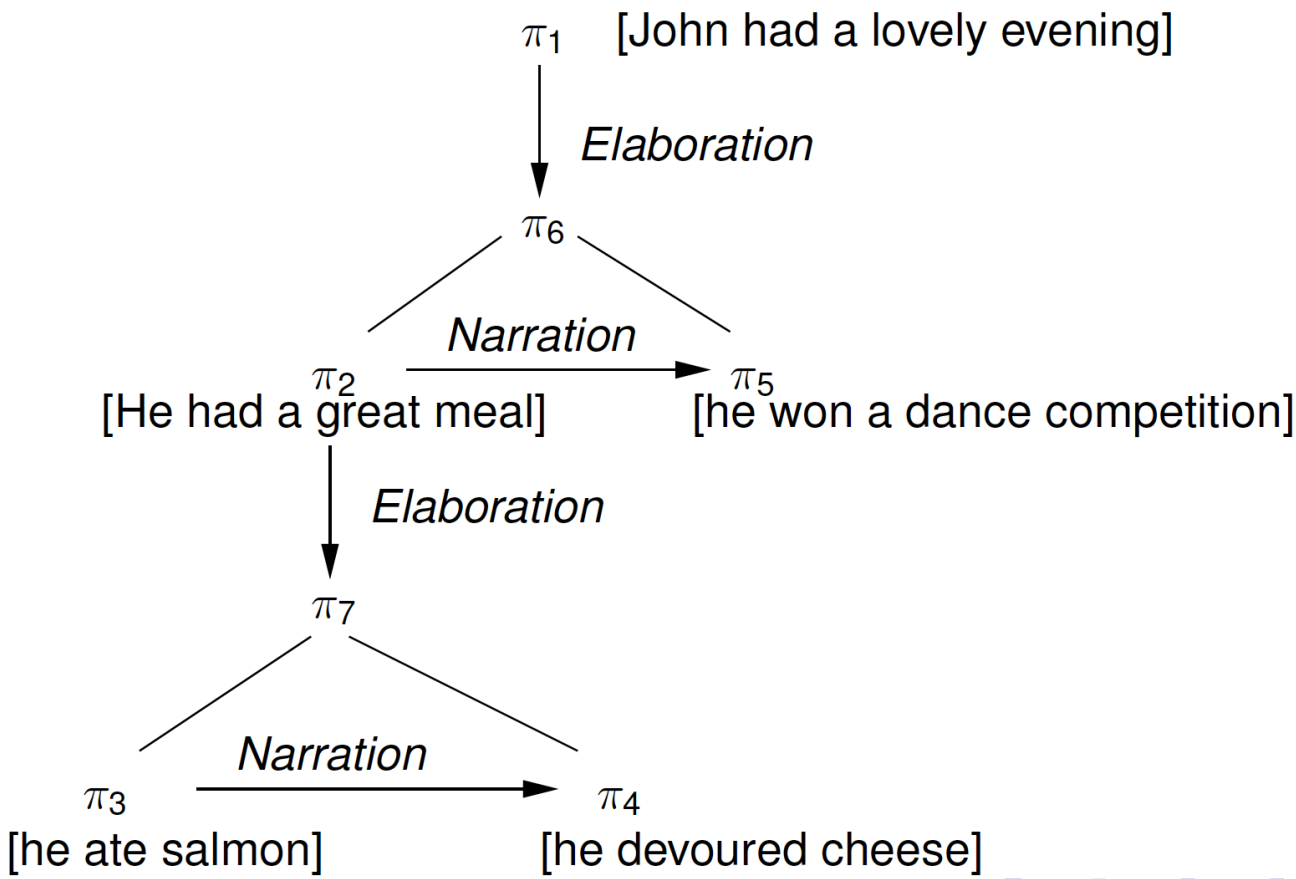
(2)

π_1 John had a great evening last night.
π_2 He had a great meal.
π_3 He ate salmon.
π_4 He devoured lots of cheese.
π_5 He then won a dancing competition.

(2)′ $\langle A, \mathcal{F}, LAST \rangle$, where:

- $A = \{\pi_0, \pi_1, \pi_2, \pi_3, \pi_4, \pi_5, \pi_6, \pi_7\}$
- $\mathcal{F}(\pi_1) = K_{\pi_1}$, $\mathcal{F}(\pi_2) = K_{\pi_2}$, $\mathcal{F}(\pi_3) = K_{\pi_3}$,
  $\mathcal{F}(\pi_4) = K_{\pi_4}$, $\mathcal{F}(\pi_5) = K_{\pi_5}$,
  $\mathcal{F}(\pi_0) = \mathit{Elaboration}(\pi_1, \pi_6)$
  $\mathcal{F}(\pi_6) = \mathit{Narration}(\pi_2, \pi_5) \wedge \mathit{Elaboration}(\pi_2, \pi_7)$
  $\mathcal{F}(\pi_7) = \mathit{Narration}(\pi_3, \pi_4)$
- $LAST = \pi_5$

Other Ways of Showing This



Availability: You can attach things to the right frontier

New information β can attach to:

1. The label $\alpha = \mathit{LAST}$;
2. Any label γ such that:
   1. $\mathit{Succ}(\gamma, \alpha)$; or
   2. $\mathcal{F}(I) = R(\gamma, \alpha)$ for some label I, where R is a subordinating discourse relation (*Elaboration*, *Explanation* or $\Downarrow$)

   We gloss this as $\alpha < \gamma$
3. Transitive Closure:
   Any label γ that dominates α through a sequence of labels $\gamma_1, \ldots, \gamma_n$ such that $\alpha < \gamma_1, \gamma_1 < \gamma_2, \ldots, \gamma_n < \gamma$.

Improvement on DRT: The Dansville Example

(7)
π_1 John took an engine to Dansville. (π_1)
π_2 He picked up a boxcar (π_2)
π_3 It had a broken fuel pump (π_3)

DRT:

- Flat structure:
  An engine is accessible to *it*

SDRT:

- *Narration*(π_1, π_2);
- So π_1 isn't available to π_3: $R(\pi_1, \pi_3)$ can't hold for any R
- So the engine is not an available antecedent to *it*

Semantics: Veridical Relations - Speech Acts

- `Satisfaction Schema for Veridical Relations:`
  $f[R(\pi_1, \pi_2)]_M g$ iff $f[K_{\pi_1}]_M \circ [K_{\pi_2}]_M \circ [\phi_{R(\pi_1,\pi_2)}]_M g$

Veridical:	*Explanation*, *Elaboration*, *Background*, *Contrast*, *Parallel*, *Narration*, *Result*, *Evidence*...
Non-veridical:	*Alternation*, *Consequence*
Divergent:	*Correction*, *Counterevidence*

Defining $\phi_R(\alpha, \beta)$ for various R

- Axiom on Explanation:

  (a) $\phi_{Explanation(\alpha,\beta)} \Rightarrow (\neg e_\alpha \prec e_\beta)$
  (b) $\phi_{Explanation(\alpha,\beta)} \Rightarrow (event(e_\beta) \Rightarrow e_\beta \prec e_\alpha)$

  Max went to bed. He was sick. Max fell. John pushed him.

- Axiom on Elaboration:

  $\phi_{Elaboration(\alpha,\beta)} \Rightarrow Part\text{-}of(e_\beta, e_\alpha)$

  Max ate a big dinner. He had salmon.

Defining $\phi_R(\alpha, \beta)$ for various R

- `Axiom on Background:`
  $\phi_{\textit{Background}(\alpha,\beta)} \Rightarrow \textit{overlap}(e_\beta, e_\alpha)$

  Max entered. The room was dark.

- `Axiom on Narration:`
  $\phi_{\textit{Narration}(\alpha,\beta)} \Rightarrow$ (a) $e_\alpha \prec e_\beta$ and
  (b) things don't move location between the end of e_α and start of e_β (unless adverbials indicate otherwise).

  Max went to Paris. He visited a friend.