Discourse Structure

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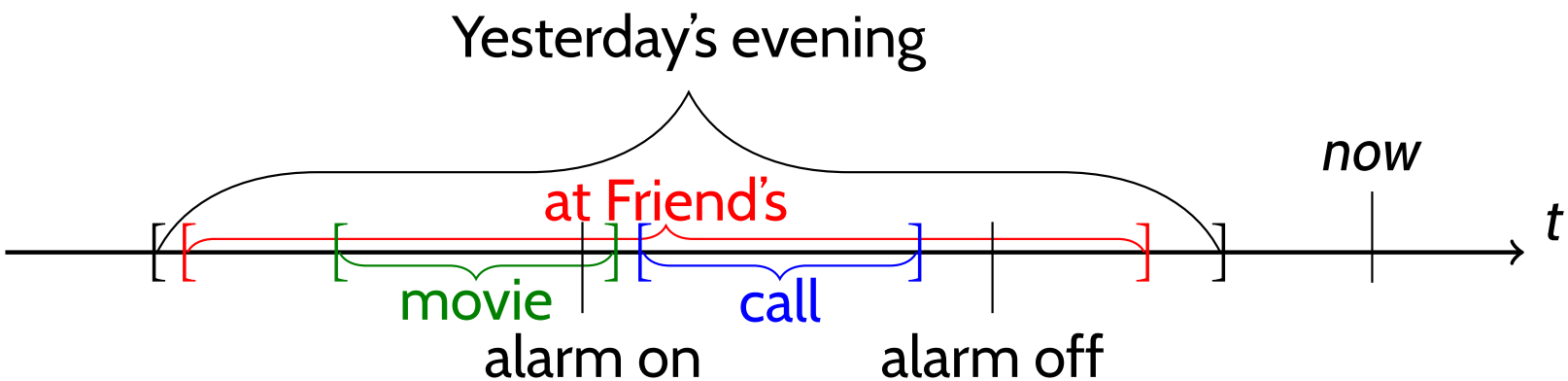
- *Discourse structure* describes these interractions.
- Is crucial for a wide range of tasks.

Example tasks

Retrieve temporal information.

- I was at my fiend's yesterday evening.
- We were watching a movie.
- The fire alarm suddenly went on.
- We could switch it off only after a while.
- Because we had to call tech. support for instructions first.



Some challenges already.

Compositional challenges.

- The fire alarm went on. Something was burning in the kitchen.
- The fire alarm went on. We switched it off.

- Same first sentence
- No markers for temporal relations. lots of implicit information!
- Opposite temporal successions!

Syntactic clues not enough:

- The food burned slowly. The fire alarm was on.
- Food burned slowly. There was nothing left for us to eat .

- Same first sentence, same succession of tenses!

Structure guides interpretation.

Example:

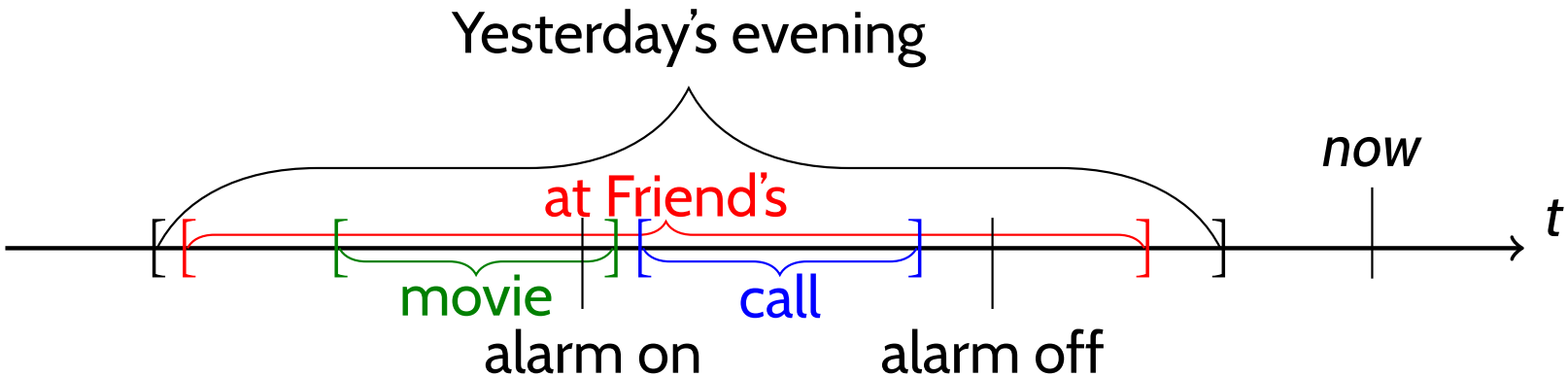
- I was at my fiend's yesterday evening.
- We were watching a movie.
- The fire alarm suddenly went on.
- It took us time to switch it off.
- Because we had to call tech. support for instructions first.

temp-frame

background

temp-sequence

cause



Summarization:

Subordination/coordination:

- I was at my fiend's yesterday evening.
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- temp-seq: *coordinating, multinuclear* relation.
- background, cause: *subordinating, satellite nucleus, nucleus/satellite* relations.
- for some relations, hierarchical ordering of arguments can vary to some extent.

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Other example tasks:

Sentiment analysis

- This movie has somewhat predictible scenarios
- and some terrible dialogs.
- **Nevertheless**, I strongly recommend it for its terrific action scenes.

And much more

- Coreference resolution, event coreference, briding,...
- Discourse generation.
- Implicatures, commonsense reasoning.
- Presupositions, attitude reports.

Agreements and disagreements

Inter-theoretical agreements.

- Discourse consists in a sequence of *elementary discourse units* (EDUs)
- Linked together by mean of *discourse relations*.
- Relations induce hierarchy on their arguments.
- Units linked together with other units form compounds (*complex discourse units*, (CDUs)).

Inter-theoretical disagreements

- Exact nature of discourse units.
- Nature, classification and grain of relations. Though correspondence and translation tables have been proposed.
- Interpretation of the structure.

Elementary discourse units

Finite clause

A clause with a finite verb, that is, a verb with a subject and tense information. Can stand alone as an independence sentence.

- [We **were** watching a movie.] [The alarm **went** on.]

- General agreement that finite clause make elementary discourse units.
- Some exceptions varying with theories.
- Segmentation granularity ultimately driven by need to target specific units by relations while leaving other out.

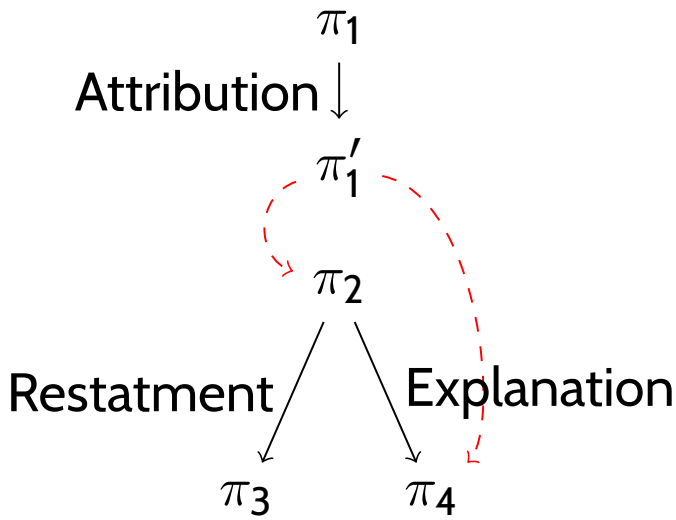
Non-finite clauses

- Infinitive complements: [*May told me*] [*to come early this morning.*]
- Parenthetics: [*Guy Hosneld,* [*55 years old*], *was ...*] Note: recusive units!
- Detached adverbials': [*For two decases,*] [*he worked at the library.*]

Segmented discourse representation theory

- A theory driven by semantics: structure has a model theoretic interpretation.
- *e.g.*, *Elaboration*$(\alpha, \beta) \vdash e_\alpha \subseteq e_\beta$.
- Directed acyclic graphs with complex discourse units.
- Subordinating (NS) and coordinating (NN) relations.

$[$Interprovincial Pipe Line Co. said$]_{\pi_1}$ $[$it will delay a proposed two-step, 830 million dollar $[$(US$ 705 million)$]_{\pi_3}$ expansion of its system$]_{\pi_2}$ $[$because Canada's output of crude oil is shrinking.$]_{\pi_4}$



Graph representation

directed acyclic graph where each DU is a vertex and

Directed labelled edges for rhetorical relations.

Directed unlabelled edges link CDUs to their components.

Pro and cons

- Workable representation of meaning.
- Many successful contributions in formal linguistics.
- Straightforward interpretation of the structure: *What you see is what you get.*
- Rather unconstrained **complex discourse units**:
- Accurate semantic representation at the cost of huge search space for parsing!

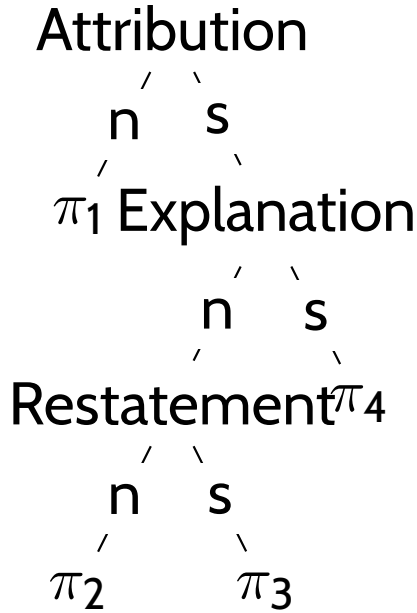
Rhetorical Structure Theory

- Bottom up construction of a tree by recursive identification and application of *schemas*.
- Most common schemas: Nucleus-Satellite *e.g.* *Explanation*(a_N, b_S), Satellite-nucleus, nucleus-nucleus (*Sequence*(a_N, b_N)).
- Handful of *n*-ary schemas: *n*-ary *lists* with nuclei only, pair of SN-NS relations with common central nucleus.
- In most approaches, *n*-ary structures are binarized (with right-branching strategies) in preprocessing, and assumed as such for parsing and evaluation.
- Constraints on the respective *communicative function* of Nucleus, Satellite, and NS combination must be checked.

Illustration

Example

$[\text{Interprovincial Pipe Line Co. said}]_{\pi_1}$
$[\text{it will delay a proposed two-step, 830 million dollar } [\text{(US\$ 705.6 million)}]_{\pi_3} \text{ expansion of its system}]_{\pi_2}$
$[\text{because Canada's output of crude oil is shrinking.}]_{\pi_4}$



Semantic Scopes

Wysiwyg interpretation:

- $[\![R(t_1, t_2)]\!] = [\![R]\!]([\![t_1]\!], t_2]\!])$
  $\text{Restatement}(\pi_2, \pi_3) \wedge$
- $\text{Explanation}([\pi_2, \pi_3], \pi_4) \wedge$
  $\text{Attribution}(\pi_1, [\pi_2, \pi_3, \pi_4])$.

Nuclearity Principle:

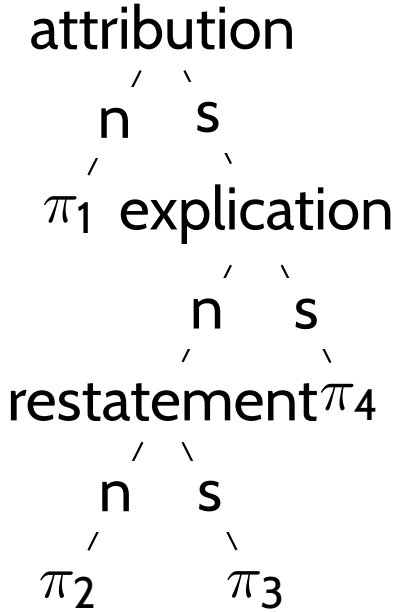
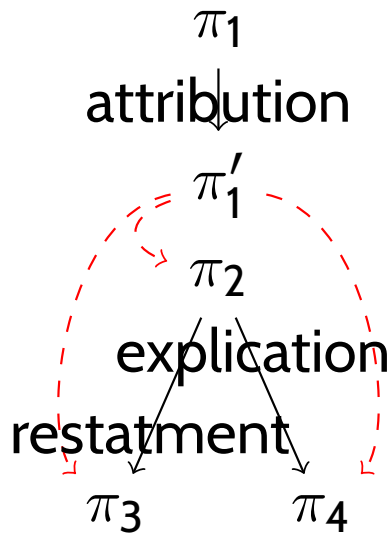
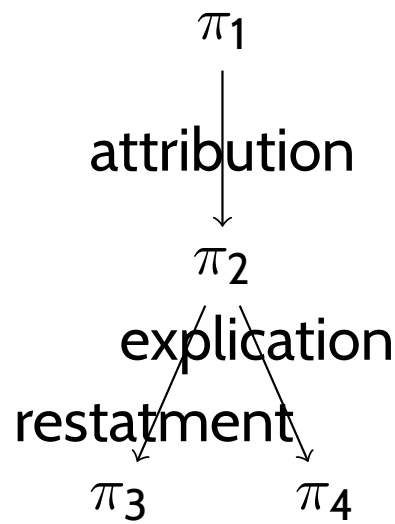
- NS nodes only pass on their nuclei to a parent relation.
  $\text{Restatement}(\pi_2, \pi_3) \wedge$
- $\text{Explanation}(\pi_2, \pi_4) \wedge$
  $\text{Attribution}(\pi_1, \pi_2)$.

RST–Pros and cons

- Tree structures, projective structures.
- More constrained – restricted search space.
- More data!
- Successful parsing algorithms.
- Interpretation of the structure not cristal clear.
- Somewhere between syntax and semantics.

A third possibility: dependency structures

Get rid of complex units in SDRT graphs. Impose projectivity, or relax it.
Adapt dependency algorithms to discourse.

RST	SDRT	Discourse DAG
		
NP: $\text{attr}(\pi_1, \pi_2)$ $\text{rest}(\pi_2, \pi_3)$ $\text{expl}(\pi_2, \pi_4)$	Immediatly: $\text{attr}(\pi_1, [\pi_2, \pi_3, \pi_4])$ $\text{rest}(\pi_2, \pi_3)$ $\text{expl}(\pi_2, \pi_4)$	Immediatly: $\text{attr}(\pi_1, \pi_2)$ $\text{rest}(\pi_2, \pi_3)$ $\text{expl}(\pi_2, \pi_4)$