CS 4120: Natural Language Processing

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Discourse

Discourse and Coherence

- Linguistic structure beyond the sentence?

- What makes…
  - An argument persuasive?
  - A story suspenseful?
  - A joke funny?

Discourse and Coherence

- Linguistic structure beyond the sentence?

- What makes…
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  - A joke funny?

- Put another way:
  - Grammaticality is the property that distinguishes well-structured sentences from random sequences of words.
  - Coherence has been proposed to play the same role at the multi-sentence level. But what are the properties of a coherent text?

John frowned. Mary kissed him.

John frowned. Mary kissed him.

John frowned. Mary kissed him.

events in a sequential relation:
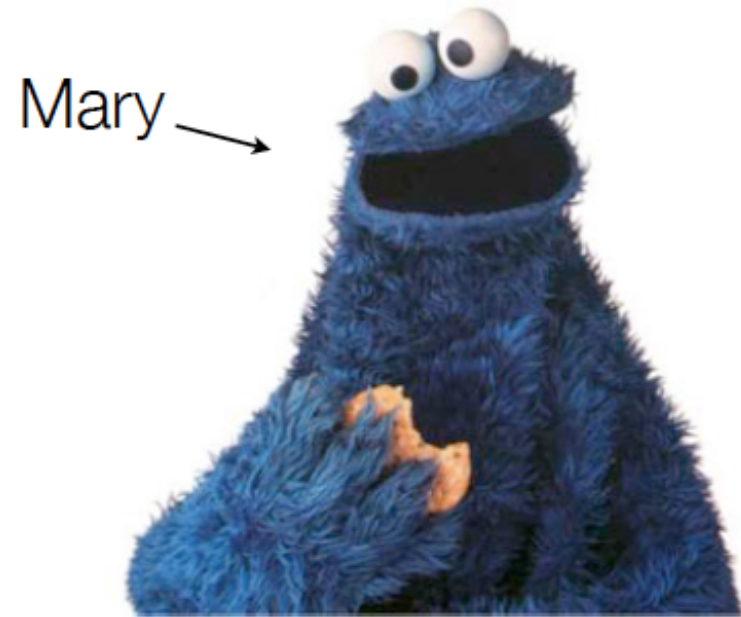*frowning* ➜ *kissing*

John frowned. Mary kissed him.

Coherence

- John hid Bill's car keys. He was drunk.
- John hid Bill's car keys. He likes spinach.

Coherence

- John hid Bill's car keys. He was drunk.
- John hid Bill's car keys. He likes spinach.

- Why one is more coherent than the other?
- How do you measure it?

Coherence

John went to his favorite music store to buy a piano.

He had frequented the store for many years.

He was excited that he could finally buy a piano.

He arrived just as the store was closing for the day.

John went to his favorite music store to buy a piano.

It was a store John had frequented for many years.

He was excited that he could finally buy a piano.

It was closing just as John arrived.

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Two entities --- John and the store: Depending on the sentence structure, the focus differs

Entity-based coherence (Centoring Theory)

Discourse

- Discourse is a coherent structured group of textual units (e.g., sentences)
- Monologues
  - Speaker/writer + hearer/reader
- Dialogues
  - Human-human
  - Human-computer

Discourse exhibits structure

- Writers use linguistic device to make certain discourse structure
  - e.g., cue phrases, paragraphs, content flow
- Speakers also use linguistic device to make certain discourse structure
  - e.g., intonation, gesture, cue phrases
- Readers/Listeners comprehend discourse by recognizing this structure

Discourse Relations

- Discourse relations (Coherence relations) specify the relations between sentences or clauses. Due to these relations, two adjacent sentences can look coherent.

- What is the discourse relation between the following two sentences?

➔ John hid Bill's car keys. He was drunk.

(in comparison to)
John hid Bill's car keys. He likes spinach.

Discourse Relations

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"Explanation" relation

➡ John hid Bill's car keys. He was drunk.

(in comparison to)

John hid Bill's car keys. He likes spinach.

More Discourse Relations

Elaboration

- Dorothy was from Kansas. She lived on the Kansas prairies.

Result

- The tin woodman was caught in the rain. His joints rusted.
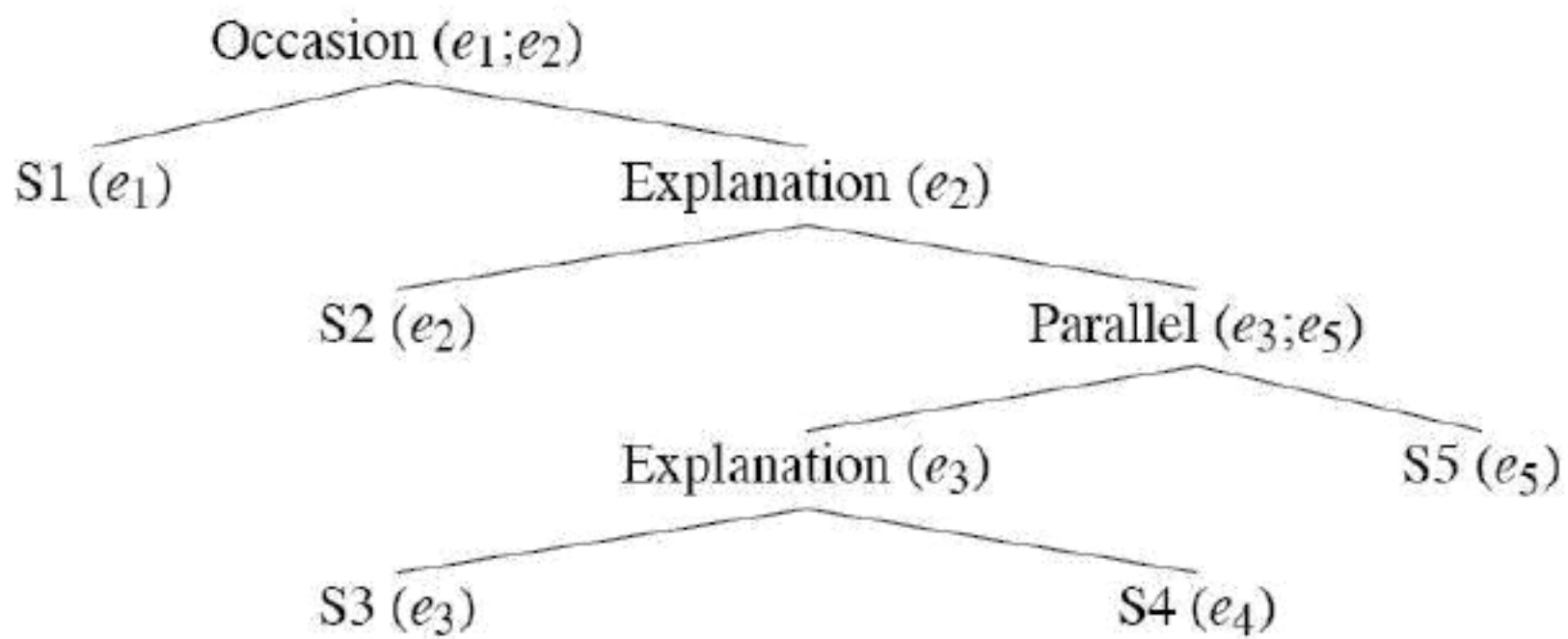
Parallel

- The scarecrow wanted some brains. The tin woodsman wanted a heart.

Occasion

- Dorothy picked up the oil-can. She oiled the Tin Woodman's joints.

Exercise

- [Explanation](#)
- [Elaboration](#)
- [Result](#)
- [Parallel](#)
- [Occasion](#)

- John went to the bank to deposit the paycheck. (e1)
- He then took a train to Bill's car dealership. (e2)
- He needed to buy a car. (e3)
- The company he works for now isn't near any public transportation. (e4)
- He also wanted to talk to Bill about their softball league. (e5)

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Occasion (e_1;e_2)

S1 (e_1)

Explanation (e_2)

S2 (e_2)

Parallel (e_3;e_5)

Explanation (e_3)

S5 (e_5)

S3 (e_3)

S4 (e_4)
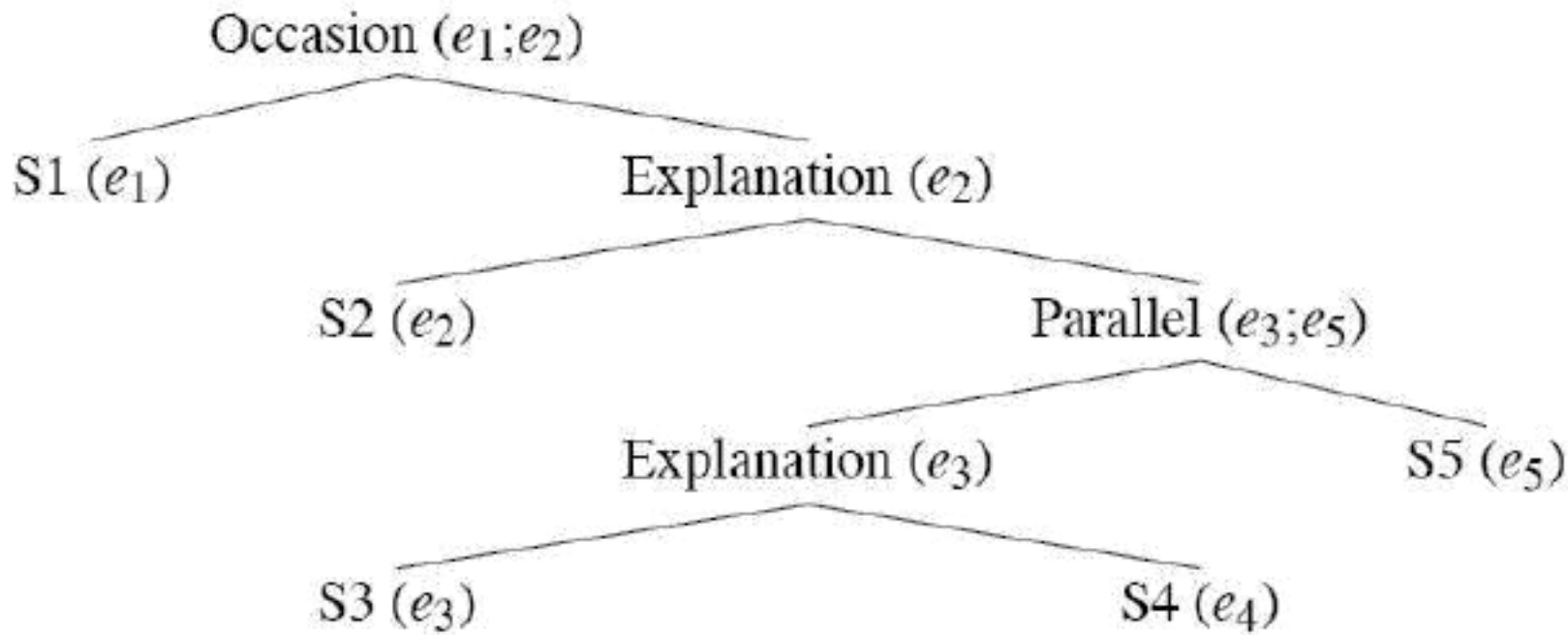
Similar idea to dependency parsing!

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Rhetorical structure theory (RST)

- **N**ucleus – the central unit, interpretable independently.
- **S**atellite – less central, interpretation depends on N

Mann and Thompson, 1987

RST relation is formally defined by a set of constraints on the nucleus and satellite, with respect to the goals/beliefs/effects of the writer (W) and the reader (R)
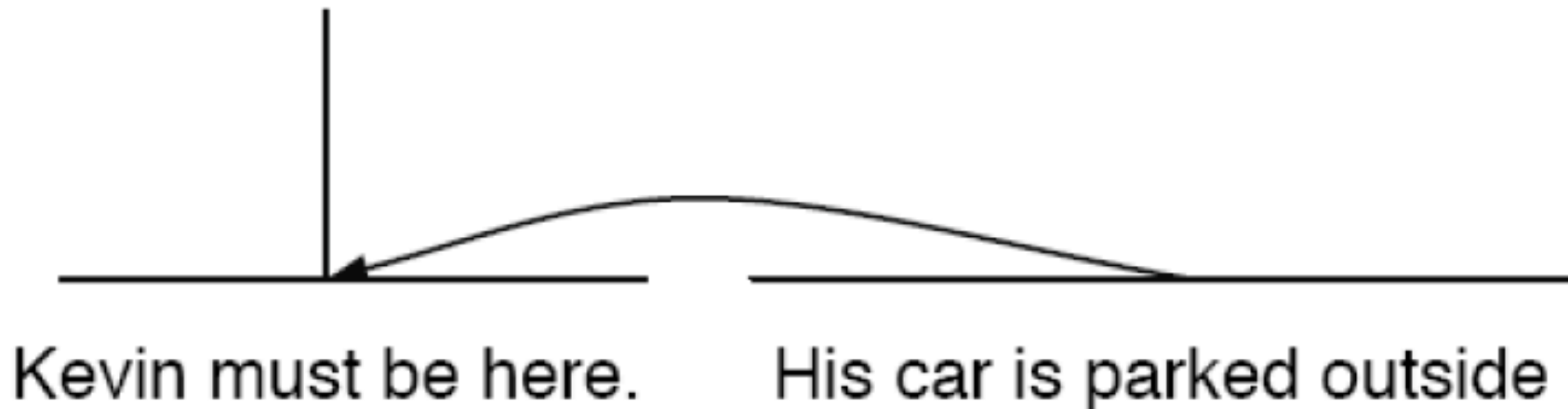
Kevin must be here.   His car is parked outside

Rhetorical structure theory (RST)

- **N**ucleus – the central unit, interpretable independently.
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Relation Name: Evidence
Constraints on N: R might not believe N to a degree satisfactory to W
Constraints on S: R believes S or will find it credible
Constraints on N+S: R's comprehending S increases R's belief of N
Effects: R's belief of N is increased

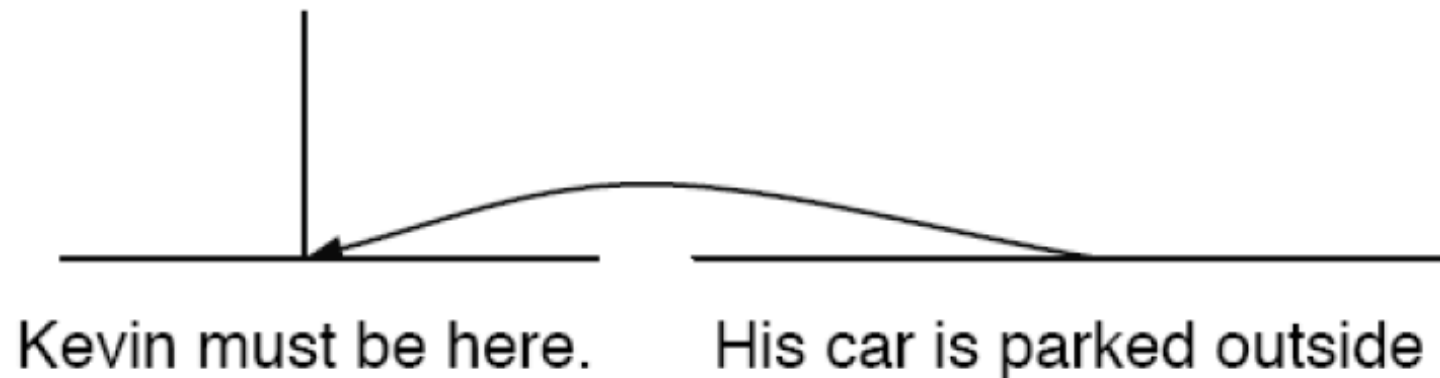Kevin must be here.   His car is parked outside

Rhetorical structure theory (RST)

- **N**ucleus – the central unit, interpretable independently.

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- RST TreeBank (Carlson et al., 2001) defines 78 different RST relations, grouped into 16 classes.

Examples of RST relations

Elaboration (S, N)

[The company wouldn't elaborate]

[citing competitive reasons]

Attribution (S, N)

[Analysts estimated,]

[that sales at U.S. stores declined in the quarter, too]

Background (S, N)

[T is the pointer to the root of a binary tree.]

[Initialize T.]

Examples of RST relations

Elaboration (S, N)

      [The company wouldn't elaborate]_N

      [citing competitive reasons]_S

Attribution (S, N)

      [Analysts estimated,]_S

      [that sales at U.S. stores declined in the quarter, too]_N

Background (S, N)

      [T is the pointer to the root of a binary tree.]_S

      [Initialize T.]_N

Examples of RST relations

Contrast (N, N)

[The priest was in a very bad temper,]_N

[but the lama was quite happy.]_N

List (N, N)
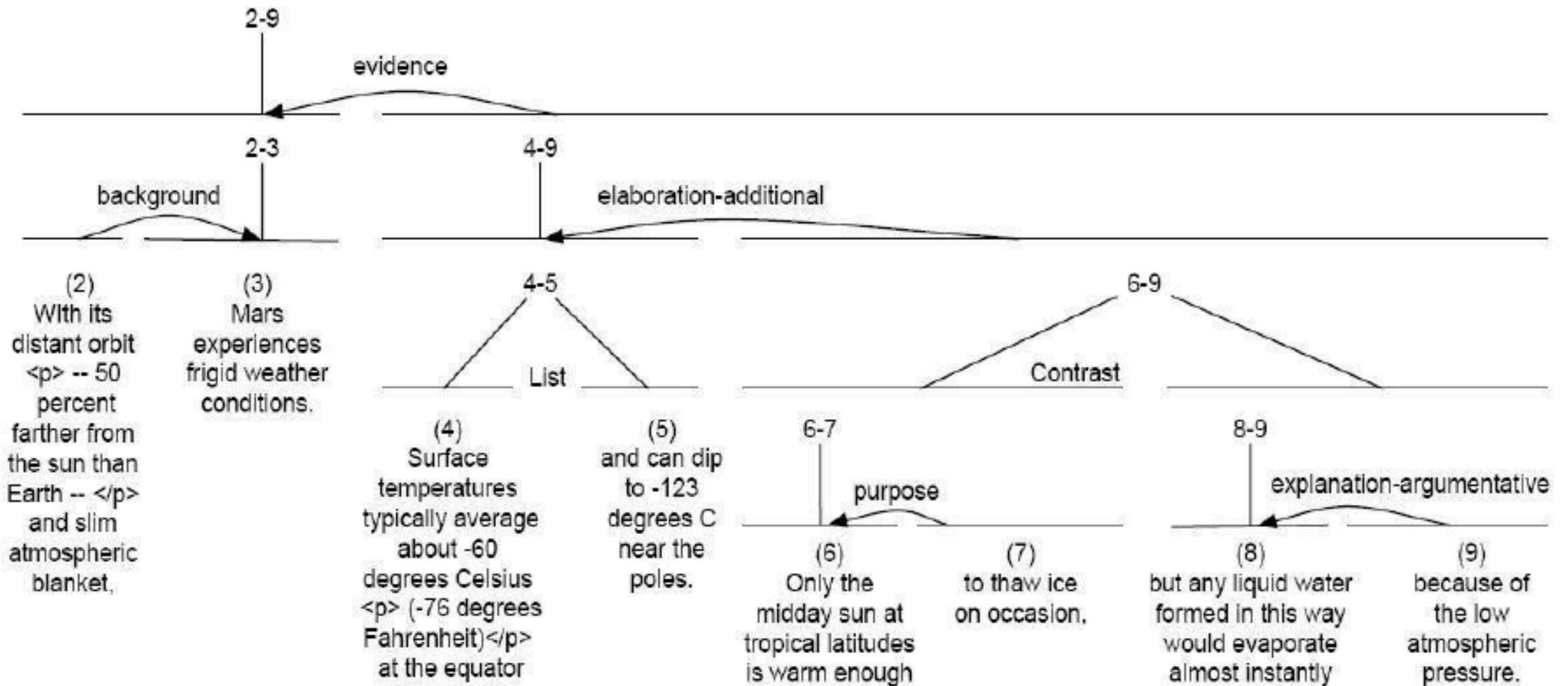
[Billy Bones was the mate;]_N

[Long John, he was quartermaster]_N

Discourse Parse Tree for an excerpt from *Scientific American* (Marcu (2000))

With its distant orbit-50 percent farther from the sun than Earth-and slim atmospheric blanket, Mars experiences frigid weather conditions. Surface temperatures typically average about -60 degrees Celsius (-76 degrees Fahrenheit) at the equator and can dip to -123 degrees C near the poles. Only the midday sun at tropical latitudes is warm enough to thaw ice on occasion, but any liquid water formed in this way would evaporate almost instantly because of the low atmospheric pressure.

Discourse Parse Tree for an excerpt from *Scientific American* (Marcu (2000))

2-9 — evidence

2-3 — background

4-9 — elaboration-additional

(2) With its distant orbit <p> -- 50 percent farther from the sun than Earth -- </p> and slim atmospheric blanket,

(3) Mars experiences frigid weather conditions.

4-5 — List

(4) Surface temperatures typically average about -60 degrees Celsius <p> (-76 degrees Fahrenheit)</p> at the equator

(5) and can dip to -123 degrees C near the poles.

6-9 — Contrast

6-7 — purpose

(6) Only the midday sun at tropical latitudes is warm enough

(7) to thaw ice on occasion,

8-9 — explanation-argumentative

(8) but any liquid water formed in this way would evaporate almost instantly

(9) because of the low atmospheric pressure.

Discourse Parsing

- Two related problems:
  - Discourse Segmentation
  - Discourse Relation Classification
- Automatic discourse parsing is a very hard problem. (open research problem)

Discourse Segmentation

- Loosely speaking, segmenting a given document into a sequence of subtopics.

- The unit of segmentation can be a sentence, or a clause, or even a set of sentences. (depending on how the result of discourse segmentation will be used.)

Discourse Segmentation

- **Discourse Marker** based Approach
- Broadcast News Segmentation: suppose you have a transcript of broadcast news

  - *good evening, I'm <PERSON>*

    -- typically the beginning of segments

  - *joining us now is <PERSON>*

    -- typically the beginning of segments

  - *Coming up*

    -- the end of segments

  ➔ Above phrases that are indicative of discourse segments are called as **Discourse Markers** or **Cue Phrases**

Discourse Segmentation

- **Cohesion** based Approach (Halliday & Hasan, 1976)

Lexical cohesion

- Use of the same word
  ➡ Before winter **I** built a chimney, and **shingled** the sides of the **house**...**I** have thus a tight **shingled** and plastered **house**.

- Use of synonyms, hypernyms
  ➡ Peel, core and slice **the pears and the applies**. Add **the fruit** to the skillet.

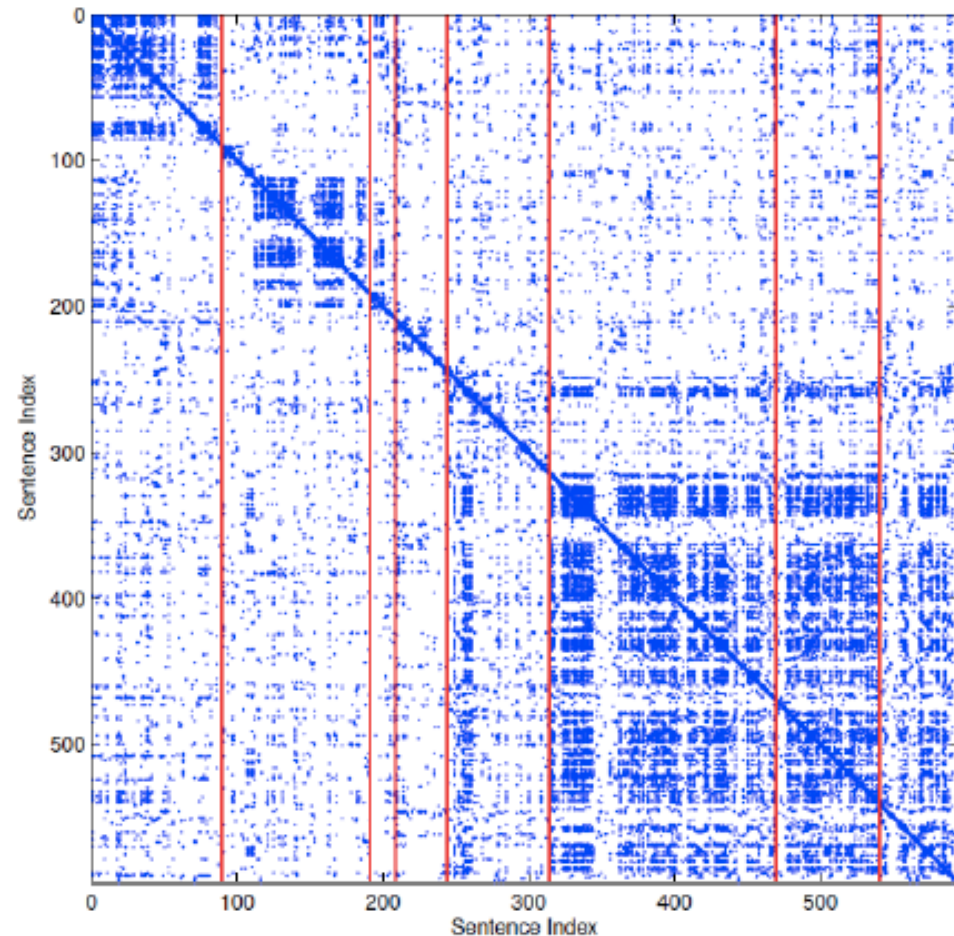Non-lexical cohesion

- **Anaphora** structure
  ➡ **John** went to the bank to deposit the paycheck. **He** then took a train to Bill's car dealership.

DotPlot Representation

Change in lexical distribution
indicates topic change
(Hearst (1994))

(i,j) – similarity between
sentence I and sentence j

Discourse Marker (Cue Phrase)

- A cue word/phrase is a word or phrase that functions to signal discourse structure, especially by linking together discourse segments.
  - e.g., although, but, for example, yet, with, and, well, oh
- Discourse Markers are useful for both
  - Discourse Segmentation
  - Discourse Relation Classification

Again, Ambiguity!

- Some discourse markers are ambiguous between "discourse use" V.S. "sentential (non-discourse) use"
  - **With** its distant orbit, Mars exhibits frigid weather conditions.
  - We can see Mars **with** an ordinary telescope.

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- Some discourse markers can be used more than one discourse relations
  - "because" can indicate CAUSE, EVIDENCE
  - "but" can indicate CONTRAST, ANTITHESIS, CONCESSION

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- Some discourse relations can appear without using any discourse markers.

Annotated corpora

- RST Treebank: 385 English newswire documents
- RST Spanish Treebank: several hundred documents, apparently academic abstracts, http://corpus.iingen.unam.mx/rst/corpus_en.html.
- Multilingual RST Treebank: 15 parallel technological abstracts, in English, Spanish, and Basque
- CSTNews Corpus: 50 documents in Brazilian Portuguese
- SFU Review Corpus: English and Spanish, 400 review documents each

No, you clearly don't know who you're talking to, so let me clue you in. I am not in danger, Skyler. I am the danger. A guy opens his door and gets shot, and you think that of me? No. I am the one who knocks!

https://www.youtube.com/watch?v=3HH9IiHMD2M#t=4s

Original	From French
You clearly don't know who you're talking to,	You do not know to whom you address.
so let me clue you in.	Let me be clear.
I am not in danger, Skyler.	I'm not in danger, Skyler.
I am the danger.	The danger is me.
A guy opens his door and gets shot,	A guy gets off at his door.
and you think that of me?	You see me in his place?
No. I am the one who knocks!	No. It is I who knocks on the door.

The more people you love, the weaker you are. You'll do things for them that you know you shouldn't do. You'll act the fool to make them happy, to keep them safe. Love no one but your children. On that front, a mother has no choice.

https://www.youtube.com/watch?v=49_cPvbNA54#t=3m47s

Original	From French
The more people you love, the weaker you are.	The more you love people, more you are weak.
You'll do things for them that you know you shouldn't do.	You will do things knowing that you should not do them.
You'll act the fool to make them happy, to keep them safe.	You will play the madness to make them happy, for their protection.
Love no one but your children.	Love nothing more than your children.
On that front, a mother has no choice.	In this world, women have no other choice.