

T-(538|725)-MALV, Natural Language Processing Discourse Structure and Discourse Markers

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1 Discourse Structure and Discourse Segments

2 Attentional Stack and Discourse Markers

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First a quick review...

- We have been looking at how individual sentences are structured.
- Their **Information Structure** relates mainly to their local context.
- But sentences are only part of a much larger whole, which is the entire discourse.
- How is the *discourse* structured?

Example

- 1 **A:** So you have the engine assembly finished.
- 2 **A:** Now attach the rope to the top of the engine.
- 3 **A:** By the way, did you buy gasoline today?
- 4 **B:** Yes. I got some when I bought the new lawn mower wheel.
- 5 **B:** I forgot to take my gas can with me, so I bought a new one.
- 6 **A:** Did it cost much?
- 7 **B:** No, and I could use another anyway to keep with the tractor.
- 8 **A:** OK
- 9 **A:** Have you got it attached yet?

The need for Discourse Structure (í. orðræðuskipan)

- The pronoun **it** in sentence 9 refers to an entity that was last mentioned 7 sentences earlier!
- New discourse entities have been created in between that could have matched this pronoun.
- The simple *Recency List Discourse Model* would have failed to resolve this.
- In fact, no linear representation of this text structure could provide a good solution.

Discourse Segments (í. orðræðueiningar)

- Humans easily understand what is going on in this text.
- Sentences 3-7 are simply a **digression** that doesn't have anything to do with the rope.
- In sentence 8 the producer indicates the end of the digression with an "OK".
- Therefore line 9 is interpreted in context of line 2, but not in the context of the part that has concluded.
- This explanation requires the concept of a **Discourse Segment** (í. orðræðuhluta).
- Roughly, a segment corresponds to a part in the discourse related by topic.

Discourse Segmentation

Even though a good segmentation of the discourse is required, people do not agree on the method to use. There is no exact definition of a segment, only the *feeling* that certain sentences seem to fit well together (as shown by experiments with subjects).

Two Main Concerns

There are two main concerns when identifying segments.

- How are sentences within a segment related?
- How are segments related to each other?

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The Structure of a Segment

These are the structural requirements of a segment:

- The recency approach to reference resolution is possible.
- Single time and place, or a simple progression (narrative).
- Fixed set of speakers and hearers.
- Fixed set of background assumptions (no hopping from real to fantasy!)

Definition of a Segment

There are two approaches to characterizing what defines a segment.

- **Intentional View**

The same intention is behind the segment.

- **Informational View**

The information in the segment belongs together.

Definition of a Segment

- The intentional view has often proven to be useful and intuitive:
 - A new topic makes a new segment clear in line 3 of the example.
- The information view can provide a finer grained analysis:
 - A chain of temporally related events may produce a series of segments.

Intent vs. Information View

- **Intent** is a good tool for analyzing discussions and debates.
- **Information** is better for analyzing stories and essays.

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Hierarchical Structure of Discourse

- Each segment contains a set of sentences and possibly other smaller segments.
- This is therefore a **hierarchical structure**.
- From the *intentional view* the entire hierarchy has a particular **Discourse Purpose** (Global Purpose).
- Each segment fulfils a part of this purpose through their own **Discourse Segment Purpose**.
- This corresponds to the **Hierarchical Planning** approach to reaching goals.

Local Context

- The hierarchical structure explains why the reference **it** in line 9 could not refer to the **tractor**.
- These occur in separate segments, so the discourse entities of the inner segment are not available to the referring expression in the outer segment.
- Each segment contains its own recency lists for discourse entities.
- Each segment tracks its own **local context**, which then can be used to resolve references from within it.

Hierarchical Structure

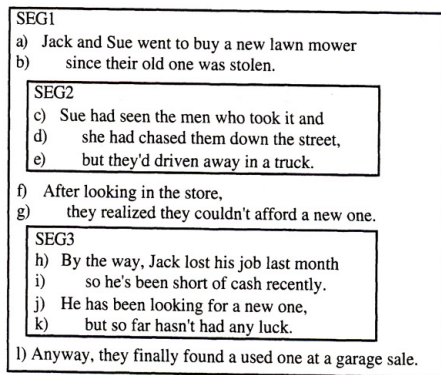


Figure: Hierarchical Structure of Discourse Segments

Hierarchical Structure

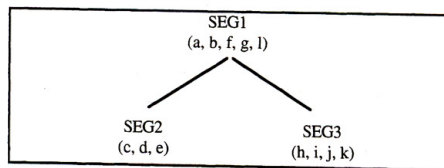


Figure: Hierarchical Structure of Discourse Segments as a Tree

Connecting New Sentences

The hierarchical structure provides a certain approach to how new sentences are connected to the ongoing discourse. One can choose the level in the hierarchy at which a new sentence is connected.

Discourse State

Each segment in the hierarchy is described by a **Discourse State**, which includes:

- The **segment purpose**
- The **local context** and information structure
- The **sentences** contained within this segment

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Attentional Stack

When processing a text, sentence by sentence, the **Discourse States** are put on an **Attentional Stack**. This stack represents what is the focus of attention at any given point.

Attentional Stack

Stack of States

The *Discourse States* on the *Stack* provide possible points for continuing the discourse.

- The state at the **top** of the stack points to the **deepest** (most embedded) *Segment*.
- Each state points to a segment that **contains** the segments **above** it on the stack.

Pushing and Popping

- To **add a new segment**, a new state is **pushed** on the stack.
- To **continue a segment**, all states above have to be **popped** off.

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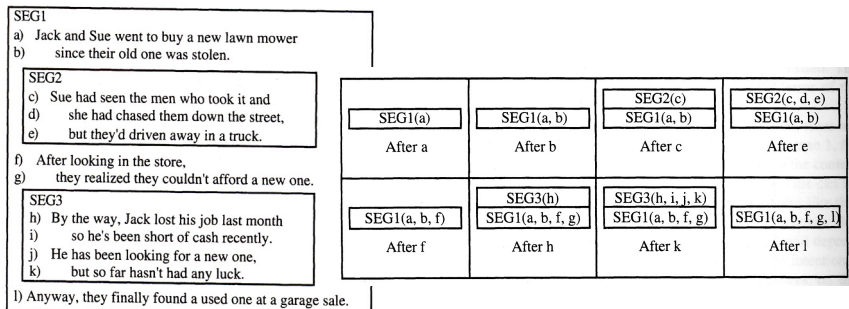


Figure: A Snap-shot of an Attentional Stack

Figure: Discourse
Segments

Discourse Markers (or Cue Words)

- One of the best clues about the structure of discourse are the so-called **Discourse Markers** or **Cue Words** found in the text.
- Discourse Markers are *Discourse Devices* that indicate how new sentences connect to the *Discourse Structure* that has been built so far.

Discourse Markers

Discourse Markers fall into two categories based on their function:

- Those that **manipulate the Discourse Structure** directly
- Those that **create semantic relations** between new and existing sentences

Direct Manipulation of Structure

Those Discourse Markers that manipulate the Discourse Structure directly, perform stack operations on the Attentional Stack without creating any particular semantic relations.

- **Pushing** a new state onto the stack
 - By the way
 - Incidentally
- **Popping** states off the stack
 - Anyway
 - OK

Creating Semantic Relations

Discourse Markers that indicate particular semantic relations between the new sentence and the current state on the stack, could also perform a push or a pop, but don't need to.

- and then
- but
- therefore
- however
- furthermore

Rhetoric Relations

- This latter category of Discourse Markers defines so-called **Rhetoric Relations** between segments.
- These relations and how they tie into the overall Discourse Structure is described by the **Rhetorical Structure Theory** (see 14.8).

The Organization of Discourse

A Theory of Three Parts

From the preceding discussion, one can say that the organization of discourse, or **Discourse Structure**, can be described by three distinct parts (as elaborated on by Grosz and Sidner):

- **Linguistic Structure**

The division into **Discourse Segments** according to discourse markers.

- **Intentional Structure**

The **Discourse Purpose** and the segment purposes.

- **Attentional State**

The stack of **Discourse States** describing each local context.