Einführung in Pragmatik und Texttheorie

Discourse Coherence

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Discourse Coherence

Lecture Plan:

- Discourse cohesion and coherence
- Coherence relations
- Sources of discourse structure
- Discourse Structure Theory (Grosz&Sidner'86)
  - intentional structure
  - attentional structure
  - linguistic structure
- Rhetorical Structure Theory (Mann and Thompson 1987)

Reading: Jurafsky et al. 2000 [Chapter 16]
Grosz et al. 1990; Grosz and Sidner 1986; Hobbs 1979, 1985; Mann and Thompson 1987

Motivation

(1) a. John hid Bill's car keys.
b. He was drunk.

(2) a. John took the train from Paris to Istanbul.
b. He likes spinach.

Motivation

(3) a. John can open Bill's safe.
b. He knows the combination.

(4) a. Bill is worried because his safe can be opened by John.
b. He knows the combination.

What constitutes a discourse?

- Units of language and language use, consisting of more than a single utterance.
- More than an arbitrary collection/sequence of well-formed utterances.
- Connected in some way, e.g. by
  - some system of related topics
  - coherence of events in the world/situation
  - a need to relate what has been said to some goal of communication

(5) John hid Bill's car keys. He was drunk.

(6) John hid Bill's car keys. Whales are mammals.

Discourse Coherence and Cohesion

Parts of discourse are tied together:

Cohesion non-structural text-forming relations, e.g., reference (esp. anaphora), ellipsis, conjunction, lexical cohesion. The interpretation of elements is inter-dependent.

Coherence structural relations between elements/segments of discourse, involving functional predicate-argument or modification relations, e.g., explanation, result, justification, etc.

What mechanisms make certain sequences of utterances (more) coherent and cohesive?

Discourse Coherence

A coherent discourse consists of discourse units (segments) connected by discourse relations (coherence relations).

$$\forall w, e \; Sentence(w, e) \Rightarrow Segment(w, e)$$

$$\forall w_1, w_2, e_1, e_2, e$$
$$Segment(w_1, e_1) \wedge Segment(w_2, e_2) \wedge CoherenceRel(e_1, e_2, e) \Rightarrow Segment(w_1, w_2, e$$

To interpret a coherent discourse W, we must prove that it is a segment:
$\exists e \; Segment(W, e)$

The meaning of a discourse is more than the summ of its parts: Discourse relations are semantic predicates that take other bits of propositional content as arguments. They add semantic content.

Discourse Relations: Example

(7) A:

a. John went to jail.

b. He was caught embezzling funds from the pension plan. Explanation

B:

a. Yes, John was caught embezzling funds.

b. But he went to jail

c. because he was convicted of tax fraud.

B':

a. No, that's not right.
b. Although John was caught embezzling funds,
c. he went to jail
d. because he was convicted of tax fraud.

Discourse Connectives

Discourse relations can be implicit or explicitly signaled by discourse connectives. Discourse connectives are linguistic means to express (or at least signal or constrain) cherence relations between discourse segments.

(8) On the one hand, John is very generous. For example, if you need money, you only have to ask him for it. On the other hand, he is very hard to find.

(9) John loves barollo. So he ordered three cases of the '97. But then he had to cancel the order, because he discovered he was broke.

Arguments of Discourse Relations

(10) a. One plaintiff had never received full pay.
b. He had also been passed over for promotion three times.
c. Moreover, he had been denied a job because of his race.
d. *Nevertheless* he had never filed a complaint until now.

(11) a. One plaintiff had never received full pay.
b. He had also been passed over for promotion three times.
c. Moreover, he had been denied a job because of his race.
d. *Nevertheless* he had never filed a complaint until now.

(12) If the light is red, stop.
a. Otherwise you might get run over.
b. Otherwise you can go straight on.

Discourse Relations and Anaphora

Individual anaphora

(13) John can open Bill's safe. He knows the combination.

(14) John hid Bill's car keys. He was drunk.

(15) a. The police prohibited the women from demonstrating.
b. They feared violence.

Tense/Aspect/Mood dependencies:

(16) Peter fell. Max kicked him.

(17) Peter fell. Max pushed him.

(18) Peter fell. Max had pushed him.

Discourse Segmentation and Anaphora

(19) a. One plaintiff had never received full pay.
b. Another had been passed over for promotion three times.
c. Yet another had been denied a job because of his race.
d. But the jury didn't believe *this*.

(20) a. One plaintiff had never received full pay.
b. Another had been passed over for promotion three times.
c. Yet another had been denied a job because of his race.
d. *These people were really badly treated.*
e. But the jury didn't believe *this*.

Sources of Discourse Structure

- Discourse participants are embodied in a **domain**, which has its own internal structure. The speaker/hearer are aware of the domain structure, and use it this knowledge to produce/interpret the discourse.

- Discourse participants have **intentions**: They are engaged in tasks and have communicative goals. Speaker wants to communicate something to the hearer, she wants the hearer to recognize her **communicative purpose(s)**, such making H believe p, making H adopt some action/plan.

- Discourse participants have **limited resources**: Both speaker and hearer only have limited short-term memory, and therefore there are limits to what they can recover from what has been previously said; however, this may not be a purely sequential matter, hierarchical organization seems to play a role.

Sources of Discourse Structure

(21) A. Can you please describe your house?

B. . . . then in the kitchen . . . there's a large window which faces the backyard with two smaller windows directly flanking it and . . . if we're facing . . . towards the backyard now on the righthand side is . . . a sliding glass door and a small window . . . on the left is a stove and a refrigerator . . .

Sources of Discourse Structure

(22) . . . Melt the butter in a large pan
and add the vegetables;
saute them for 7-8 minutes,
but don't let them brown,
then add the butter beans,
water or stock,
the milk and
the bouquet garni.
Simmer gently, with lid half on the saucepan, for about 1.25 hours, or until the butter beans are tender.
. . . Reheat the soup,
but don't let it boil.

Sources of Discourse Structure

(23) E. Good morning. I would like for you to re-assemble the compressor.

. . .

E. I suggest you begin by attaching the pump to the platform.

(other subtasks)

E. Good. All that remains then is to attach the belt housing cover to the belt housing frame.

A. All right.

I assume the belt housing cover opens to the pump pulley rather than to the motor pulley.

E. Yes, that is correct. . . .

A. All right, the belt housing cover is on and tightened down.

E. Fine. Now, let's see if it works.

Sources of Discourse Structure

(Uttered on April 10th)

(24) A. Let's have the one-day workshop in July.
B. OK.
B. Are you available on the 15th?
A. I'm afraid not. But I am free on the 17th.
B. OK. Let's meet at 10 a.m.
B. How about the HCRC seminar room?
A. It's not available on the 17th.
B. So let's meet in 6BP.

Approaches to Discourse

- resolution of anaphoric reference: various approaches to restricting the search space, i.e., non-linear precedence and heuristics

- determination of discourse structure: theories of discourse structure postulate different types of information as central to the computation of discourse structure.

  – a notion of discourse grammar analogous to sentence grammar
  – recognition of communicative intentions using a set of coherence/rhetorical relations
  – planning & action
  – inference based on domain-specific or commonsense knowledge

Discourse Structure Theory (Grosz and Sidner 1986)

Three inter-related and co-constraining aspects of discourse structure:

Linguistic: discourse segments and their relations (e.g., embedding) are signalled in the linguistic form of expressions: cue phrases, intonation, etc.

Attentional: at every point in the discourse, a set of entities is salient (i.e., in the center of attention); there are transitions between attentional states

Intentional: each discourse segment has a unique purpose (DSP); there are relations between DSPs (satisfaction-precedence vs. dominance)

The three aspects of discourse structure supply the information needed by discourse participants to determine *how an individual utterance fits with the rest*, i.e., why it was said and what it means.

Also, certain *expectations* about what is to come are thus formed.

Discourse understanding relies on recognizing DSPs and the relations among them.

Linguistic Structure

- basic elements are *utterances*, they get aggregated into *discourse segments*
- *embedding relationship* can hold between segments
- discourse segmentation has been observed accross a wide range of discourse types: task-oriented dialogues, descriptions of appartments, Watergate transcripts, informal debates, explanations, therapeutic discourse, narratives
- two-way interaction between discourse segment structure and utterances
  - utterances can convey information about structure: cue phrases, intonation, etc.
  - structure can constrain interpretation of utterances: referring expressions

Example

(25) E. Good morning. I would like for you to re-assemble the compressor.

. . .

E. I suggest you begin by attaching the pump to the platform.

(other subtasks)

E. Good. All that remains then is to attach the belt housing cover to the belt housing frame.

A. **All right**.

I assume the belt housing cover opens to the pump pulley rather than to the motor pulley.

E. Yes, that is correct. . . .

A. **All right**, the belt housing cover is on and tightened down.

E. Fine. **Now,** let's see if it works.

Intentional Structure

- *Discourse segment purpose* (DSP): the intention that leads to the initiation of a new discourse segment (other intentions are not part of Intentional Structure), e.g. int. that some agent: intends to perform some task; believes some prop.; intends to identify an object; knows some property of an object.

- DSPs are intentions that are meant to be recognized, i.e. recognition of the DSP is essential to its achieving its intended effect (cf. "meaning-nn" in (Grice 1969))

- A discourse segment can only serve a single DSP, though a later DSP can take advantage of what has been achieved by an earlier one.

Intentional Structure

- DSPs form a tree-structure of sub-intentions eventually grounded in communicative actions.
  - DSP_1 dominates DSP_2 if the satisfaction of DSP_1 comes (in part) from the satisfaction of DSP_2
  - DSP_1 satisfaction-precedes DSP_2 if DSP_1 must be satisfied before DSP_2
- Isomorphism between explicit realization of DSPs and embedding of discourse segments.

Intentional Structure

Discourse understanding relies on recognizing DSPs and the structural relations between them. To interpret a discourse, incrementally:

- Determine illocutionary force and DSP.
- Work out the relation between this DSP and the preceding DSPs.
- Work out what is in focus of attention.

Subsequently, G&S focus on the kinds of plans underlying dialogue, which must involve both participants: i.e., **collaborative plans**: dialogue collaboration requires that participants make clear to one another how their discourse actions will coordinate and contribute to the discourse purpose.
$\Rightarrow$ Intention (recognition), planning, action.

Attentional State

- = an abstraction of the participants' focus/center of attention as their discourse unfolds
- Modelled by a set of *focus spaces*, arranged in a *stack*.
- A focus space is associated with each discourse segment. It contains those entities that are *salient* (explicitly mentioned or implicitly involved).
- Dynamics: transition rules specifying conditions for adding (=PUSH) and deleting (=POP) spaces.
- The relationships among DSPs, i.e., intentional structure, determine pushing and popping of focus spaces.

Attentional State

- While the intentional structure provides a complete record of the DSPs, the attentional state only contains information relevant to purposes in a portion of the intentional structure.

- Normally, the attentional state is empty at the conclusion of a discourse.

- It is the attentional state that can directly constrain the interpretation of referring expressions.

$\Rightarrow$ **Right-frontier constraint** on discourse anaphora and discourse relations.

Application of the Theory: "Interruptions"

Because processing an utterance requires ascertaining how it fits with previous discourse, it is crucial to decide which parts of the previous discourse are relevant to it and which cannot be.

- **true interruption**: different unrelated purposes, different entities,i.e., spearate focus spaces
- **flashback and filling in missing places**: DSP satisfaction-precedes the DSP of the interrupted segment and is dominated by another segment's DSP
- **digression**: separate DSP, but overlapping focus spaces
- **semantic returns** (noninterruptions): explicit reintroduction of entities and/or DSP

Application of the Theory: Cue Words

Discourse segment boundaries and/or transitions in intentional and/or attentional structure can be signalled by linguistic means, so called "cue words" or **discourse markers**. For example:

- segment boundary:
  (i) opening: "now", "well";
  (ii) closing: "anyway", "OK"

- new dominance: "for example", "because" and other discourse connectives

- new satisfaction-precedence: "first", "second", "further", . . . , "finally", etc.

Rhetorical Structure Theory (RST) (Mann and Thompson 1987)

For more details, see http://www.sil.org/~mannb/rst/

- Goal: to describe organization of texts in terms of meaningful relations between their parts
  - originally, for computer-based text generation
  - subsequently, for (human) text analysis
- describes text structure rather than the processes of creating or reading and understanding texts
- on the basis of extensive studies of texts

Elements of RST

Relations define relationships between text spans in terms of *constraints* on relata plus *effect*

Schemas define abstract patterns in which text spans are analyzed in terms of other text spans — loosely analogous to grammar rules; but schemas do not define a fixed order!

Schema application conventions define the way schemas can be instantiated

Structures are defined in terms of compositions of schema applications

Schemas + Schema Application Conventions define all possible RST text structures.

RST Relations

For every part of a coherent text, there is some function, some plausible reason for its presence, evident to readers.

- relations are defined to hold between two non-overlapping text spans, called *nucleus* and *satellite*
- a relation definition consists of four fields:
  - constraints on Nucleus
  - constrains of Satellite
  - constraints on the N+S combination
  - effect (= plausible reason for including the text span) plus locus of effect (N, S, N+S)
- a few multi-nuclear relations, with no satellite(s) (e.g., SEQUENCE, CONTRAST)

Example Relation Definition: Evidence

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
effect:	R's belief of N is increased
locus of effect:	N

The program as published for calendar year 1980 really works.

In only a few minutes, I entered all the figures from my 1980 tax return and got a result which agreed with my hand calculations to the penny.

RST Repertoire of Relations

See http://www.sil.org/~mannb/rst/

Examples of RST Relations

(26) Justify, Concessive

1. The next music day is scheduled fro July 21 (Saturday), noon-midnight.
2. I'll post more details later,
3. but this is a good time to reserve the place on your calendar.

(27) Antithesis

1. Every rule has exceptions,
2. but the tragic and too-common tableaux of hundreds or even thousands of people snake-lining up for any task with a paycheck illustrates a lack of jobs,
3. not laziness.

(28) Circumstance

1. Probably the most extreme case of Visitors Fever I have ever witnessed was a few summers ago
2. when I visited relatives in the Midwest.

(29) Background

1. Home addresses and tel. numbers of employees will be protected from public disclosure under a new bill . . .
2. Assembly Bill 3100 amends the Government Code, which required that the public records . . . be open to public inspection.

Examples of RST Relations

(30) Solutionhood, Elaboration

1. One difficulty . . . is with sleeping bags in which down and feather fillers are used as insulation.
2. This insulation has a tendency to slip towards the bottom.
3. You can redistribute the filler.

(31) Enablement

1. Training on jobs. A series of informative, inexpensive pamphlets and books . . .
   (units 2-5)
2. For a catalogue and order form write . . .

Examples of RST Relations

(32) Motivation, Enablement

1. The Los Angeles Chamber Ballet is giving 4 concerts next week.
2. Tickets are . . .
3. The show is made up of new choreography and should be very interesting.
4. I'm in three pieces.

(33) Volitional Cause/Result

1. Writing has almost become impossible
2. so we had the typewriter serviced
3. and I may learn to type decently after all these years

(34) Non-volitional Cause/Result, Background

1. The elimination of mass poverty is necessary . . .
2. Other countries should assist . . .
3. not least because they have a moral obligation to do so.

Examples of RST Relations

(35) Purpose

1. To see which Syncom diskette will replace the ones you're using now,
2. send for our free "Flexi-finder" selection guide and the name of the supplier nearest you.

(36) Condition

1. Employees are urged to . . .
2. whenever . . .

(37) Otherwise

1. It's new brochure time,
2. and that means a chance for new project write-ups.
3. Anyone
4. desiring to update their entry in this brochure
5. should have their copy in by Dec. 1
6. Otherwise the existing entry will be used.

RST Text Analysis Examples

see http://www.sil.org/~mannb/rst/

- It's not laziness
- The Syncom Text
- ZPG letter

Nuclearity

Most RST relation are asymmetric.

- often one member of the pair is incomprehensible without the other
- often one member of the pair is more suitable for substitution than the other
- often one member of the pair is more essential to the author's purposes than the other

Nucleus deletion makes significance of satellite material unclear; "text" may become incoherent.

Satellite deletion results in a coherent text, a "synopsis".

Satellite Deletion: example

2) Ask for SYNCOM diskettes, with burnished Ectype coating and dust-absorbing jacket liners.
4) a Syncom diskette is working four ways to keep loose particles and dust from causing soft errors, dropouts.
5) Cleaning agents on the burnished surface of the Ectype coating actually remove build-up from the head,
7) A carbon additive drains away static electricity
9) Strong binders hold the signal-carrying oxides tightly within the coating.
10) And the non-woven jacket liner, . . . provides thousands of tiny pockets to keep what it collects.
13) send for our free "Flexi-finder" selection guide and the name of the supplier nearest you.

Nucleus Deletion: example

1) What if you're having to clean floppy drive heads too often?
3) As you floppy drive writes or reads,
4) to keep loose particles and dust from causing soft errors, dropouts.
6) while lubricating it at the same time.
8) before it can attract dust or lint.
11) more than just wiping the surface, provides thousands of tiny pockets to keep what it collects.
12) To see which Syncom diskette will replace the ones you're using now,

RST Schemas

- define the structural constituency arrangements of text
- abstract patterns consisting of a small number of constituent spans, specification of the relations between them, and specification of certain spans (nulclei) are related to the whole collection
- loosely analogous to grammar rules
- definitions of RST relations can be either independent of schemas or included with schema definitions
- RST defines five schemas

RST Schemas

Schema Application Conventions

Unordered spans: schemas do not constrain order of N and S (though canonical orders can be defined):

- $S\ before\ N$: Antithesis, Background, Concessive, Conditional, Justify, Solutionhood
- $N\ before\ S$: Elaboration, Enablement, Evidence, Purpose, Restatement

Optional relations: for multi-relational schemas, all individual relations are optional, but at least one must be present

Repeated relations: a relation that is part of a schema can be applied any number of times in the application of that schema

Text Structure

A structural analysis of a text is a set of schema applications satisfying the following constraints:

Completeness The set contains one schema application that contains a set of text spans that constitute the entire text.

Connectedness Each non-maximal text span in the analysis is either a minimal unit or a constituent of another schema application of the analysis.

Uniqueness Each schema application consists of a different set of text spans, and within a multi-relation schema each relation applies to a different set of text spans.

Adjacency The text spans of each schema application constitute one text span.

Text Structure

Legal text structures

- can be represented by trees!
- only uninterrupted texts
- only one relation (can be relaxed: "overlaps")
- no crossing

Relational Propositions

Presence of structural relations in text has consequences that closely resemble the consequences of clausal assertions, i.e., the text structure conveys propositions!

- RPs are not clausally expressed
- RPs can be conveyed without formal signals
- one RP arises from each relation of the text structure

Recognizing RPs in a text is tantamount to recognizing its RST structure and the basis of its coherence, and thus is essential to understanding the text.

Conclusions

- Coherent discourse is structured and connected
- Entity-based connectivity (anaphoric links)
- Communicative intention-based connectivity (coherence relations)
- The meaning of a discourse is more than the sum of the meanings of its parts
- Hierarchichal organization of discourse segments
- Linguistic means reflecting discourse structure: discourse markers and/or discourse connectives, intonation, etc.