

NLG Lecture 6: Discourse coherence

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Slides adapted from Jon Oberlander (with thanks to *numerous* attributed sources)



Coherence: A matter of organisation?

1. No problem, I thought. I also paid an extra \$350 for 3 years of HP care with Fed Ex pick up & delivery. I am writing this review on my 7 yr old Dell, however, because the new HP only displays the following message: "Operating System Not Found". The screen is enormous and the notebook worked well for the first 2 weeks. Just a minor glitch--I'll call for 24-7 tech support. I bought the ZD7000 as a desktop replacement for work and home use.
2. I bought the ZD7000 as a desktop replacement for work and home use. The screen is enormous and the notebook worked well for the first 2 weeks. I am writing this review on my 7 yr old Dell, however, because the new HP only displays the following message: "Operating System Not Found". No problem, I thought. Just a minor glitch--I'll call for 24-7 tech support. I also paid an extra \$350 for 3 years of HP care with Fed Ex pick up & delivery.

Taboada and Renkema (2008)

Discourse coherence

- Discourse
 - Multi-sentence linguistic units
- Discourse coherence
 - Structure and meaning of discourses (monologues and dialogues)

Cohesion vs Coherence

- Cohesion

Wash and core six cooking apples.
Put them/the apples in a fireproof dish.
(Halliday & Hasan, 1976)

- This discourse is **cohesive**:
 - Both sentences are cooking instructions.
- Indicators of cohesion:-
 - Lexical repetition (*cooking apples.. apples*)
 - Pronominal references (*cooking apples...them*)
 - Ellipsis
 - ...

Adapted from slide by Julia Hockenmaier

Using lexical cohesion

- Cohesive discourse often uses **lexical chains**
 - sets of the same or related words that appear in consecutive sentences
- A longer piece of text usually contains different discourse segments.
- Lexical chains (repetition of similar words) can be used to identify discourse segments:
 - When the topic shifts, different words will be used

Adapted from slide by Julia Hockenmaier

Example - (Morris and Hirst 1991)

Example 14

1. I spent the first 19 years of my life in the suburbs, the initial 14 or so relatively contented, the last four or five wanting mainly to be elsewhere.
2. The final two I remember vividly: I passed them driving to and from the University of Toronto in a red 1962 Volkswagen 1500 afflicted with night blindness.
3. The car's lights never worked — every dusk turned into a kind of medieval race against darkness, a panicky, mournful rush north, away from everything I knew was exciting, toward everything I knew was deadly.
4. I remember looking through the windows at the commuters mired in traffic beside me and actively hating them for their passivity.
5. I actually punched holes in the white vinyl ceiling of the Volks and then, by way of penance, wrote beside them the names and phone numbers of the girls I would call when I had my own apartment in the city.
6. One thing I swore to myself: I would never live in the suburbs again.
7. My aversion was as much a matter of environment as it was traffic — one particular piece of the suburban setting: the "cruel sun."
8. Growing up in the suburbs you can get used to a surprising number of things — the relentless "residentialness" of your surroundings, the weird certainty you have that everything will stay vaguely new-looking and immune to historic soul no matter how many years pass.

Adapted from slide by Marti Hearst

TextTiling (Hearst 1994, 1997)

- Goal: find subtopical segments and the topics they cover
- Example: 21 paragraph article called Stargazers

- 1—3 Intro - the search for life in space
- 4—5 The moon's chemical composition
- 6—8 How early earth-moon proximity shaped the moon
- 9—12 How the moon helped life evolve on earth
 - 13 Improbability of the earth-moon system
- 14—16 Binary/trinary star systems make life unlikely
- 17—18 The low probability of nonbinary/trinary systems
- 19—20 Properties of earth's sun that facilitate life
- 21 Summary

Adapted from slide by Marti Hearst

Intuition behind TextTiling

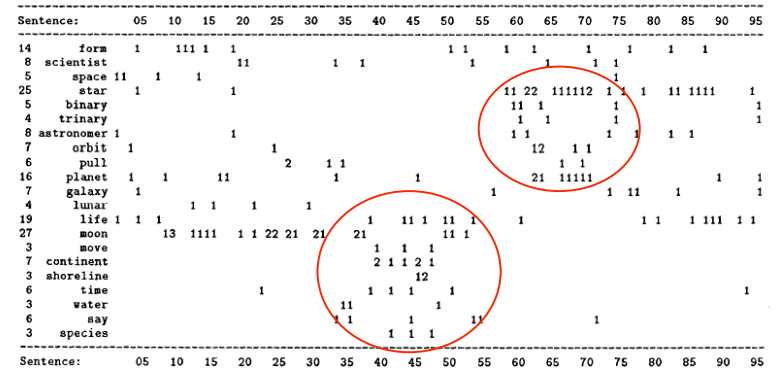


Figure 2: Distribution of selected terms from the Stargazer text, with a single digit frequency per sentence number (blanks indicate a frequency of zero).

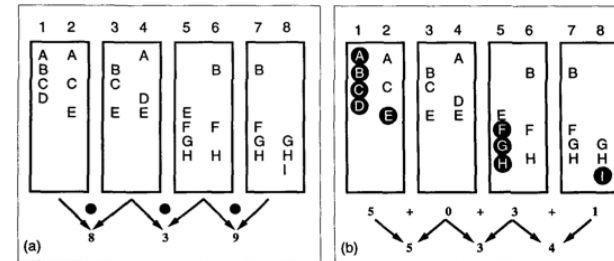
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TextTiling Algorithm

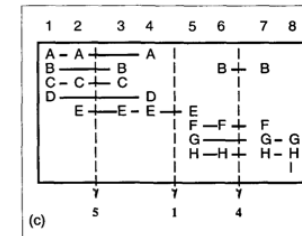
- Tokenize
- Compute Lexical Cohesion Scores
 - Blocks
 - Vocabulary Introductions
 - Chains
- Boundary Identification

Adapted from slide by Marti Hearst

Computing Lexical Cohesion



3 ways to compute lexical score at gaps between sentences



- (a) **Blocks:** dot product of vectors of word counts in the block on left and block on right
- (b) **Vocabulary introduction:** # words that occur for first time within the interval centered at the gap
- (c) **Chains:** # active chains or terms that repeat within threshold sentence and span the sentence gap

Determining Scores

- Compute a score at each token-sequence gap
- Score based on lexical occurrences
- Block algorithm: normalized dot product

$$score(i) = \frac{\sum_t w_{t,b_1} w_{t,b_2}}{\sqrt{\sum_t w_{t,b_1}^2 \sum_t w_{t,b_2}^2}}$$

(Hearst, *Computational Linguistics* 23:1, 1997)

Boundary Identification

- Smooth the plot (average smoothing)
- Assign depth score at each token-sequence gap
- “Deeper” valleys score higher
- Order boundaries by depth score
- Choose boundary cut off ($mean - sd / 2$)

Adapted from slide by Marti Hearst

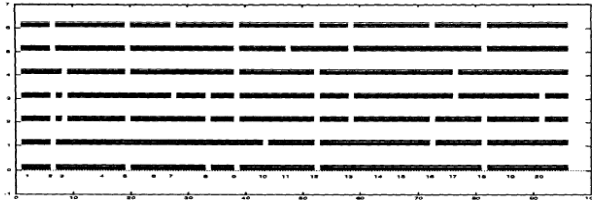


Figure 3: Judgments of seven readers on the *Stargazer* text. Internal numbers indicate location of gaps between paragraphs; x-axis indicates token-sequence gap number, y-axis indicates judge number, a break in a horizontal line indicates a judge-specified segment break.

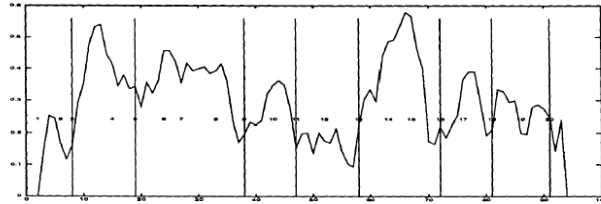


Figure 4: Results of the block similarity algorithm on the *Stargazer* text. Internal numbers indicate paragraph numbers, x-axis indicates token similarity gap number, y-axis indicates similarity between blocks centered at the corresponding token-sequence gap. Vertical lines indicate boundaries chosen by the algorithm; for example, the leftmost vertical line represents a boundary after paragraph 3. Note how these align with the boundary gaps of Figure 3 above.

Adapted from slide by Marti Hearst

Coherence vs cohesion

- Cohesion without coherence:
 - *Wash and core six apples.*
 - *Use them to cut out the material for your new suit.*
- This discourse is about apples, but it is incoherent (doesn't make sense)
- Coherence without cohesion:
 - *I came home from work at 6:00pm.*
 - *Dinner consisted of two chicken breasts and a bowl of rice.*
- This discourse 'makes sense' (it's about somebody's evening), but there are no overt signs of cohesion (e.g., no lexical repetition)

Adapted from slide by Julia Hockenmaier

But Discourse is Hierarchical!

What Can Hierarchical Structure Tell Us?

Welcome to word processing.

That's using a computer to type letters and reports.

Make a typo?

No problem.

Just back up, type over the mistake, and it's gone.

→And, it eliminates retyping.

←And, it eliminates retyping.

Theories of Discourse Structure

- Grosz and Sidner's Discourse Theory (GSDT, 1986)
- Rhetorical Structure theory (RST, Mann and Thompson, 1988)

Grosz and Sidner's Discourse Theory (GSDT) 1986

- But discourse is hierarchically structured
 - has “embedding” within it
- GSDT has three levels:
 - Linguistic structure
 - What is actually said/written
 - Intentional structure
 - Speaker's goal and purposes
 - Attentional structure
 - Speaker's focus of attention

Intentional Structure

- Discourse purpose (DP): basic purpose of the whole discourse
- Discourse segment purpose (DSP): how this segment contributes to the overall DP
- Segment relations:
 - Satisfaction-precedence: DSP1 must be satisfied before DSP2
 - Dominance: DSP1 dominates DSP2 if fulfilling DSP2 constitutes part of fulfilling DSP1

Attentional State

- **Focus stack:**
 - Stack of **focus spaces**, each containing objects, properties and relations **salient** during each DS, plus the DSP (content plus purpose)
 - State changes modeled by transition rules controlling the addition/deletion of focus spaces
 - Information at lower levels may or may not be available at higher levels
 - Focus spaces are **pushed** onto the stack when
 - new DS or embedded DS (e.g. DS that are dominated by other DS) are begun
 - **popped** when they are completed

GSDT solves this problem

Welcome to word processing.

That's using a computer to type letters and reports.

Make a typo?

No problem.

Just back up, type over the mistake, and it's gone.

<pop>

→ And, it eliminates retyping.

← And, it eliminates retyping.

GSDT and NLG

- Generate spoken/textual cues that make these structures easier to recognize
 - tense and aspect
 - cue phrases
 - intonational variation
 - Discourse “now” vs. sentential “now”

But we need more for generation.

Cohesion vs coherence: entity coherence

- Discourse 1:
*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.*
- Discourse 2:
*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.*
- Discourse 2 is more coherent than discourse 1
 - Discourse 2 is about John. Discourse 1 is first about John, then about the store, then about John, then about the store ...

Adapted from slide by Julia Hockenmaier

Relational coherence

1. *John hid Bill's car keys. He was drunk.*
2. *John hid Bill's car keys. He likes spinach.*

- (1) is more coherent than (2):
He (= Bill) was drunk provides an explanation
- Hearers/readers search for coherence when phrases are juxtaposed
I'm hungry. Let's go to the Fuji Gardens.
- What kind of relations between two consecutive utterances (= sentences, clauses, paragraphs,...) make a discourse coherent?

Adapted from slide by Julia Hockenmaier

The Explanation relation (Hobbs, 1978)

- The reader can infer that the state/event in S1 provides an explanation (could cause) the state/event asserted in S0:

S0: *John hid Bill's car keys.*
S1: *He was drunk.*
- This can be rephrased as:
 - S0 because S1
- Hobbs developed an inference-driven approach to recovering coherence relations between text segments.

Rhetorical Structure Theory (RST)

RST (Mann & Thompson, 1988) put less emphasis on inference, and described coherence relations between utterances.

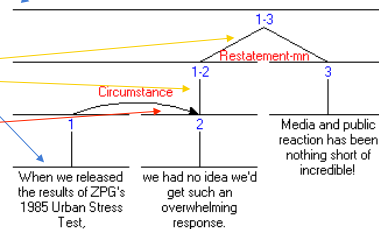
- Rhetorical relations include:
 - Evidence, Elaboration, Solutionhood, Contrast, Sequence,...
 - Most relations hold between a nucleus (N) and a satellite (S).
 - Some relations (e.g., Contrast) have multiple nuclei (and no satellite).
 - Every relation imposes constraints on its arguments (N,S), that describe the goals and beliefs of the reader R and writer W, and the effect of the utterance on the reader.

Adapted from slide by Julia Hockenmaier

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Graphical representation of RST analysis

- A **horizontal line** covers a span of text (possibly made up of further spans)
- A **vertical line** signals the nucleus or nuclei
- A **curve** represents a relation, and the direction of the arrow, the direction of satellite towards nucleus



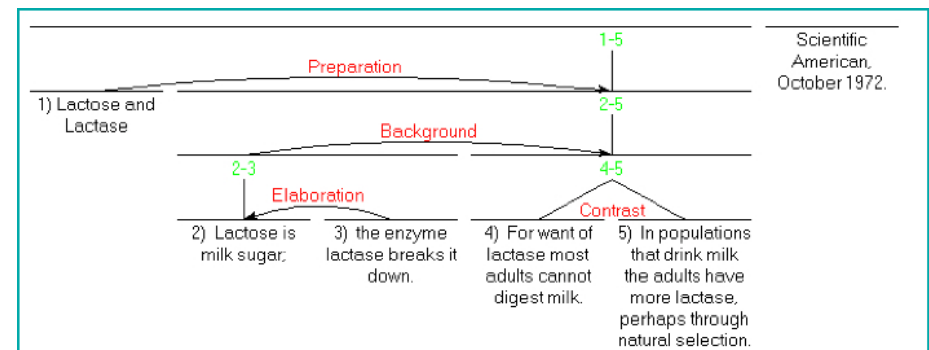
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Example: Evidence

- Constraints on the Nucleus
 - The reader may not believe N to a degree satisfactory to the writer
 - Constraints on the Satellite
 - The reader believes S or will find it credible
 - Constraints on the combination of N+S
 - The reader's comprehending S increases their belief of N
 - Effect (the intention of the writer)
 - The reader's belief of N is increased
- Assuming a written text and readers and writers; extensions of RST to spoken language exist
- Definitions of most common relations are available from the RST web site (<http://www.sfu.ca/rst>)

The text:

- Lactose and Lactase
- Lactose is milk sugar; 3) the enzyme lactase breaks it down.
- For want of lactase most adults cannot digest milk.
- In populations that drink milk the adults have more lactase, perhaps through natural selection.
- Norman Kretchmer, Scientific American, page 70, October 1972.



Example - product review

I bought the ZD7000 as a desktop replacement for work and home use. The screen is enormous and the notebook worked well for the first 2 weeks. I am writing this review on my 7 yr old Dell, however, because the new HP only displays the following message: "Operating System Not Found".

(Taboada and Renkema, 2008)

Example - product review

```
<body>
  <segment id="1">I bought the ZD7000 as a desktop
  replacement for work and home use.</segment>
  <segment id="2" parent="22" relname="joint"> The screen is
  enormous</segment>
  <segment id="3" parent="22" relname="joint"> and the
  notebook worked well for the first 2 weeks.</segment>
  <segment id="4" parent="6" relname="result"> I am writing this
  review on my 7 yr old Dell, however,</segment>
  <segment id="6" parent="23" relname="span"> because the
  new HP only displays the following message: &quot;Operating
  System Not Found&quot;.</segment>
...
<group id="22" type="multinuc" />
<group id="23" type="span" />
<group id="24" type="multinuc" />
</body>
```

(Taboada and Renkema, 2008)

Discourse coherence

Identifying rhetorical structure automatically (Marcu 1999)

- Train a parser on a discourse treebank
 - 90 RS trees, hand-annotated for rhetorical relations
 - Elementary discourse units (edu's) linked by RR
 - Parser learns to identify N and S and their RR
 - Features: Wordnet-based similarity, lexical, structural
- Uses discourse segmenter to identify discourse units
 - Trained to segment on hand-labeled corpus (C4.5)
 - Features: 5-word POS window, presence of discourse markers, punctuation, seen a verb?, ...
 - Eval: 96-8% accuracy

Evaluation

- Evaluation of rhetorical parser:
 - Id edu's:
 - Recall 75%, Precision 97%
 - Id hierarchical structure (2 edu's related):
 - Recall 71%, Precision 84%
 - Id nucleus/satellite labels:
 - Recall 58%, Precision 69%
 - Id RR:
 - Recall 38%, Precision 45%
- Later errors due mostly to edu mis-identification
 - Id of hierarchical structure and N/S status comparable to human when hand-labeled edu's used
- Hierarchical structure is easier to id than RR

Problems with RST - Moore & Pollack 1992

- (a) George Bush supports big business.
- (b) He's sure to veto House Bill 1711.

- What's going on here? Consider the possible relations ...

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Relation 1: An intentional relation

- Relation name:
 - EVIDENCE
- Constraints on Nucleus:
 - H might not believe Nucleus to a degree satisfactory to S.
- Constraints on Satellite:
 - H believes Satellite or will find it credible.
- Constraints on Nucleus + Satellite combination:
 - H's comprehending Satellite increases H's belief of Nucleus.
- Effect:
 - H's belief of Nucleus is increased.

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Relation 2: An informational relation

- Relation name:
 - VOLITIONAL-CAUSE
- Constraints on Nucleus:
 - presents a volitional action or else a situation that could have arisen from a volitional action.
- Constraints on Satellite:
 - none.
- Constraints on Nucleus + Satellite combination:
 - Satellite presents a situation that could have caused the agent of the volitional action in Nucleus to perform that action; without the presentation of Satellite, H might not regard the action as motivated or know the particular motivation; Nucleus is more central to S's purposes in putting forth the Nucleus-Satellite combination than Satellite is.
- Effect:
 - H recognizes the situation presented in Satellite as a cause for the volitional action presented in Nucleus.

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Problems with RST - Moore & Pollack 1992

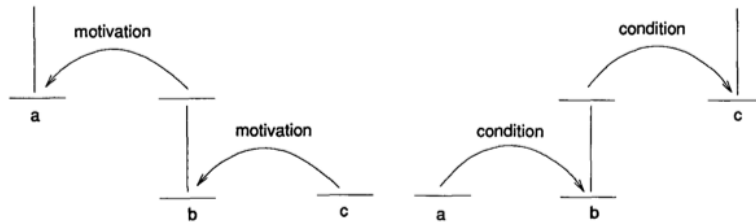
- (a) George Bush supports big business.
- (b) He's sure to veto House Bill 1711.

- So, is (a) evidence for (b), or is (a) the volitional cause of (b)?
- It can be both.
 - That is, both intentional, and informational relations may hold simultaneously
- And different hearers can reason from one to the other.
 - If hearer knows content of Bill 1771, may infer that speaker wanted them to come to see Bush's stance as evidence for truth of (b)
 - If not, and knowing that people usually offer evidence for their position, may infer that Bush's support for business in (a) offers a cause for believing (b)

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It gets worse ...

- S:(a) Come home by 5:00. (b) Then we can go to the hardware store before it closes. (c) That way we can finish the bookshelves tonight.



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RST's theory of span structure: core assumptions

- Compositionality
 - Complex span can be linked to another span iff its nucleus span can be so linked.
 - So, for linking purposes, semantics of span is semantics of nucleus
 - Cf. Deletion test for nuclearity
- Continuous constituency
 - A nucleus N and satellite S of relation R must be adjacent spans, or if not, any intervening spans must also be satellites of N under R.
- Tree structure
 - In a coherent text, each text span must be involved in exactly one schema application, so:
 - No subspans are unlinked
 - No complex spans overlap

Joint work with Alistair Knott

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Some problems with RST's Elaboration relation

- Several assumptions have been questioned previously:
 - Tree structure - Sibun
 - Continuous constituency - Kittredge et al.
- One view: structural trouble is attributable to Elaboration, which gives rise to:
 - Span-structural problems
 - Relation-semantic problems

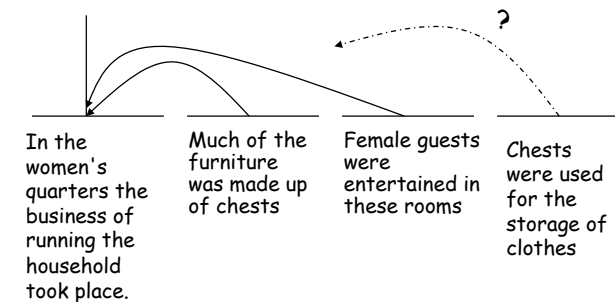
Joint work with Alistair Knott

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Structural problem: Discontinuous constituency

In the women's quarters the business of running the household took place. Much of the furniture was made up of chests arranged vertically in matching pairs (...). Female guests were entertained in these rooms, which often had beautifully crafted wooden toilet boxes with fold-away mirrors and sewing boxes (...).

Chests were used for the storage of clothes (...). The type of chest known as a bandaji is rectangular ...



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Some further problems with RST

- Many variations in expression
 - [I have not read this book.] [It was written by Bertrand Russell.]
 - [I have not read this book,] [which was written by Bertrand Russell.]
 - [I have not read this book written by Bertrand Russell.]
 - [I have not read this Bertrand Russell book.]
- Rhetorical relations are ambiguous
 - [He caught a bad fever] [while he was in Africa.]
 - Circumstance > Temporal-Same-Time
 - [With its distant orbit, Mars experiences frigid weather conditions.] [Surface temperatures typically average about -60 degrees Celsius at the equator and can dip to -123 degrees C near the poles.]
 - Evidence > Elaboration

Adapted from slide by Daniel Marcu

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A final problem with RST: overkill? 'Schemas' are simpler

- Observations:
 - people generally follow standard patterns of organization when producing texts.
- Hypothesis:
 - people have preconceived ideas about what resources to use to achieve particular goals;
 - people have preconceived ideas about how these resources can be integrated to form a text.
- So
 - if these patterns are captured formally, they can guide a generation system in its decisions about what to say next.

Adapted from slide by Robert Dale

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McKeown's TEXT

- Developed to provide paragraph-length responses to meta-level questions about the structure of a database.
- Could generate responses to three classes of questions corresponding to three communicative goals:
 - Request for definition
 - What is a <concept>?
 - Request for available information
 - What do you know about <concept>?
 - Requests to compare two objects
 - What the difference between <concept1> and <concept2>?

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McKeown's TEXT: The Basic Ideas

- Each utterance in a discourse plays some role in that discourse characterised by a **rhetorical predicate**.
- Examples:
 - making an analogy, or comparing
 - describing sub-parts or sub-types
 - providing detail about something.
- Rhetorical predicates can be combined into standard patterns of discourse represented by **schemas**.
- When many options available, constraints on **focus of attention** can be used to break ties

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McKeown's TEXT: Rhetorical Predicates

- **Attributive:**
 - Mary has a pink coat.
- **Equivalent:**
 - Wines described as "great" are fine wines from an especially good village.
- **Specification:**
 - [Mary is quite heavy.] She weighs 200 pounds.
- **Constituency:**
 - [This is an octopus.] There is his eye, these are his legs, and he has these suction cups.
- **Evidence:**
 - [The audience recognized the difference.] They started laughing right from the very first frames of that film ...
- **Adversative:**
 - It was a case of sink or swim.
- **Inference:**
 - So people form a low self-image of themselves.

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McKeown's Observation

- Study of naturally occurring descriptions indicated:
 - certain combinations were more likely to occur than others
 - certain predicates are more appropriate in certain discourse contexts (i.e., discourse goals influence predicates used)

Schemas of Rhetorical Predicates

- McKeown encoded these standard patterns into **schemas**
- Characterize "means" (strategies) speakers have for achieving discourse goals (purposes)

| Purpose | Strategy |
|----------------|--------------------------------|
| Define | IDENTIFICATION CONSTITUENCY |
| Compare | COMPARE AND CONTRAST |
| Describe | ATTRIBUTIVE CONSTITUENCY |

Example: Describe by Identification

To define objects, people:

1. Identify object as member of a generic class
2. Describe an object's function, constituency or attributes
3. Give examples
4. Optionally give analogies to familiar concepts, or examples, or further evidence

The Identification Schema

Identification (class and attribute/function)

{Analogy/Constituency/Attributive/
Renaming/Amplification}*
Particular-illustration/Evidence +

{Amplification/Analogy/Attributive}

{Particular-illustration/Evidence}

Example Identification Text

Identification (class and attribute/function)

{Analogy/Constituency/Attributive/Renaming/Amplification}*
Particular-illustration/Evidence +

{Amplification/Analogy/Attributive}
{Particular-illustration/Evidence}

Eltville (Germany):

Identification: *An important wine village of the Rheingau region.*

Attributive: *The vineyards make wines that are emphatically of the Rheingau style*

Amplification: *with a considerable weight for a white wine.*

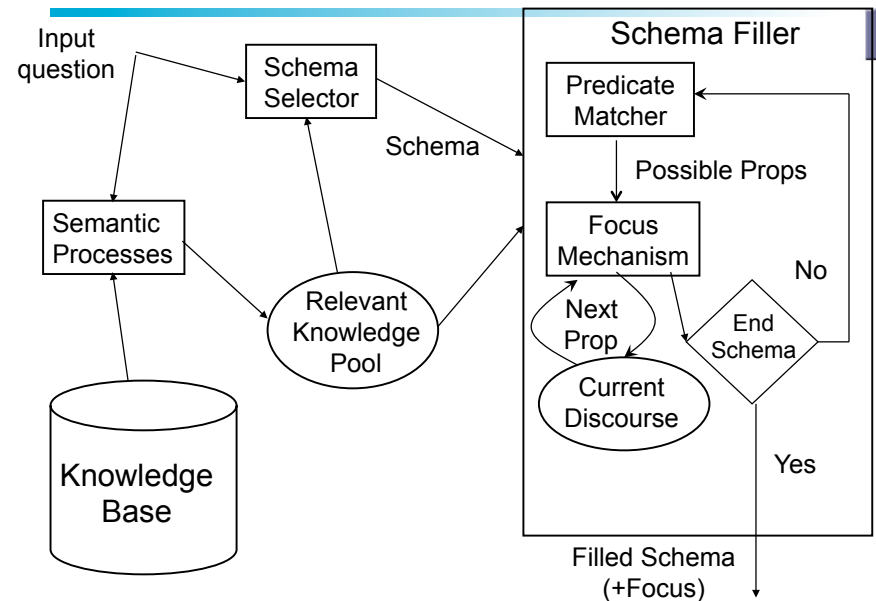
Particular-illustration: *Taubenberg, Sonnenberg and Langenstuck are among the vineyards of note.*

Example: Describe by constituency

To describe objects, people:

1. Identify subtypes of the object
2. Provide information about each subtype in turn, or further describe object's attributes or function
3. Optionally, provide attributive, analogical, explanation or amplification about original object

TEXT: Overall Structure



McKeown's TEXT: How it Works

- Based on the type of question:
 - Choose set of schemata that can be used to respond
 - Select relevant knowledge pool (RKP)
- Based on type of information in RKP, select the schema to be used to produce response
- Fill the schema via the semantics of the rhetorical predicates.
- Where there are alternatives in the schema, use focus of attention to select the best alternative
- Realize utterances via a functional unification grammar

Choosing a (set of) Schemas

| Goal | Strategy |
|----------|--------------------------------|
| Define | IDENTIFICATION CONSTITUENCY |
| Compare | COMPARE AND CONTRAST |
| Describe | ATTRIBUTIVE CONSTITUENCY |

Determining the Relevant Knowledge

Requests for information or definitions:

- section off area around the questioned object
 - varies depending on question type
- preserve all links
- include siblings and descendents of questioned object

Comparisons:

- If the two entities are similar, need to provide detail
- if they are very different, need discussion of generic class

Determining the Relevant Knowledge

Comparisons:

- (1) Q: What is the difference between a part-time and a full-time student?
A: A part-time student takes 2 or 3 courses per semester while a full-time student takes 3 or 4.
- (2) Q: What is the difference between a raven and a writing desk?
A: A writing desk has 4 legs while a raven has only 2.

Selecting One Schema

Requests for information or definitions:

- If RKP contains a rich description of the object's sub-classes, use
 - Constituency schema
- Else if there is more information about the object itself, use
 - Identification schema for definitions
 - Attributive schema for information questions

Note: The higher an entity occurs in the hierarchy, the less descriptive information about instances in the class

Filling the Schema

- Step through schema matching each predicate against relevant knowledge pool (RKP)
- Each predicate type has associated semantics which dictates the kind of information it can match
- In general, more than one predicate will match at a time due to:
 - more than one predicate being possible at one time according to the schema
 - more than one piece of information in the RKP matching a particular predicate

The Attributive Predicate

Attributive Predicate:

Given Argument: entity

Type: DB-attributes

Subtype: attributes-only

(attributive db <entity> <naming-attr> <topic-attr>
<duplicate-attrs> <db-attrs>)

Example:

(attributive db SHIP (name OFFICIAL-NAME)
(topics SPEED-DEPENDENT-RANGE DIMENSIONS)
(duplicates
(FUEL (FUEL-TYPE FUEL-CAPACITY)))
(attrs PROPULSION MAXIMUM-SPEED))

Attributive Cont'd

Subtype: attributes and values

(attributive db <entity> (<attr-1> <value-1>)...
(<attr-n> <value-n>))

Example:

(attributive db AIRCRAFT-CARRIER
(PROPULSION STMTURGRD)
(ENDURANCE-SPEED 30)(ECONOMIC-SPEED 12)
(ENDURANCE-RANGE 30)(BEAM 252)
(FLAG BLBL)(FUEL-TYPE BNKR) (REMARKS 0))

Using Focus

- Where there are alternatives in the schema, focus of attention is used to select the best alternative.
- Focus: that item in a proposition the writer is emphasizing, or that item the proposition is about
- Sidner (1979) used focus constraints to resolve anaphoric references in NLU
- McKeown ordered Sidner's focusing constraints for NLG
- An indication of current focus is also passed to the tactical component to assist in realization decisions

Adding Focus [Sidner 79]

Focusing Preferences:

1. Switch to something just introduced
2. Continue talking about the same thing
3. Return to an old topic
4. Switch to that item with the most ties to the previous proposition.

The Constituency Schema

Constituency
Cause-effect*/Attributive*
 {Depth-identification/Depth-attributive
 {Particular-illustration/Evidence}
 {Comparison/Analogy} } +
{Amplification/Explanation/Attributive/Analogy}

Example: *Steam and electric torpedoes:*
Constituency: *Modern torpedoes are of two general types.*
Depth-attr: *Steam-propelled models have speeds of 27 to 45 knots and ranges of 4000 to 25000 yards.*
Comparison: *The electric powered models are similar*
Depth-attr: *but do not leave the telltale wake created by the exhaust of a steam torpedo.*

TEXT Example

| | |
|----------------|--|
| identification | 1. A guided missile is a projectile that is self-propelled. |
| constituency | 2. There are two types of guided projectiles in the ONR database torpedoes and missiles. |
| attributive | 3. The missile has a target location in the air or on the earth's surface. |
| attributive | 4. The torpedo has an underwater target location. |
| evidence | 5. The missile's target location is indicated by the DB attribute DESCRIPTION and the missile's flight capabilities are provided by the DB attribute ALTITUDE. |
| evidence | 6. The torpedo's underwater capabilities are provided by the DB attributes under DEPTH (for example, MAXIMUM OPERATING DEPTH). |
| attributive | 7. The guided projectile has DB attributes TIME TO TARGET & UNITS, HORZ RANGE & UNITS and NAME. |

Summary

- Discourse sticks together thanks to both cohesion and coherence
- Rhetorical structure theory has been an influential theory of coherence
- But it has some significant problems
- Schemas are a simpler but less general approach

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References

- Asher, N. and Lascarides, A. (2003) *Logics of Conversation*, Cambridge University Press
- Grosz, B. and Sidner, C. (1986) *Attention, Intentions, and the Structure of Discourse*. *Computational Linguistics*, 12, 175-204.
- Halliday, M.A.K. and Hasan, R. (1976) *Cohesion in English*. Longmans.
- Hearst, M. (1997) *TextTiling: Segmenting Text into Multi-Paragraph Subtopic Passages*, *Computational Linguistics*, 23, 33-64.
- Hobbs, J. R. (1978), *Why is discourse coherent?* SRI Tech Report 176.
- Knott, A., Oberlander, J., O'Donnell, M. and Mellish, C. (2001) *Beyond elaboration: the interaction of relations and focus in coherent text*. In T. Sanders, J. Schilperoord and W. Spooren (eds.) *Text representation: linguistic and psycholinguistic aspects*, pp181-196. Amsterdam: Benjamins.
- McKeown, K. R. (1985), *Text Generation: Using Discourse Strategies and Focus Constraints to Generate Natural Language Text*, Cambridge University Press.
- Mann, W. C. and Thompson, S. A. (1988). *Rhetorical Structure Theory: Toward a functional theory of text organization*. *Text*, 8 (3), 243-281.
- Marcu, D. (1999). *A decision-based approach to rhetorical parsing*. *ACL'99*, pp. 365-372
- Moore, J. and M. Pollack (1992) "A Problem for RST: The Need for Multi-Level Discourse Analysis", *Computational Linguistics*, 18, 537-544.
- Morris, J. and Hirst, G.,. 1991. *Lexical cohesion computed by thesaural relations as an indicator of the structure of text*. *Computational Linguistics*, 17:21-48.
- Taboada, M. and Renkema, J. (2008) *Discourse Relations Reference Corpus [Corpus]*. Simon Fraser University and Tilburg University. Available from http://www.sfu.ca/rst/06tools/discourse_relations_corpus.html.

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