TEXT PLANNING METHODS

Aims of text planning

Text planning with schemata

Text planning with rhetorical relations

Evaluation and comparison

TEXT PLANNING

Subtasks

1. Building "messages"

from information sources

2. Choosing those "messages"

which contribute to fulfilling the communicative intention

3. Structuring the document

to obtain coherent and fluent text

Organisation of the process

Subtasks intervowen in various ways

1. & 2. Application-dependent (knowledge sources, domain conventions)

Methodological part focuses on 3.

Motivation

Aim

Early approaches restrict their coverage to the generation of sentences

Task: Generation of (specifications for) paragraph-length text

Input: A set of assertions (facts and relations)

Output: A sequence or a tree consisting of connected assertions

Phenomena involved

Central notion of "coherence":

A discourse is coherent if the hearer knows the communicative role of each portion of it; that is, if the hearer knows how the speaker intends each clause to relate to each other clause.

The order of sentences is not arbitrary (fluency, different meanings)

Signalling of rhetorical relations often implicit (e.g., causality),

hence, relations between sentences potentially ambiguous

A crucial problem

There is *no general theory* of parts of speech of discourse and inference

Theories about discourse

The formalist approaches

Discourse exhibits internal structure, encapsulate closely related semantic units
Theories used to explain pronominalizations and quantifier scoping effects
Weak on actual contents (precise interrelationship, communicative purpose)
Prominent representative: *Discourse Representation Theory* (DRT)

The functionalist approaches

Discourse segments are defined by communicative purposes
Theories focus on interrelationships between segments (how they fulfil goals)
Complementary to formalist approaches in terms of strenghts and weaknesses
Prominent representative: *Rhetorical Structure Theory* (RST)

A (combined) theory of discourse (Grosz amd Sidner 1986)

Segmentation of the utterances (formalist view)
Structure of the interlocutor intentions (functionalist view)
Attentional state (record of referentially available objects)

Text schemata (McKeown 1985)

The approach

First approach that takes into account discourse structure explicitly
Predefined representations of stereotypical paragraph structures
Templates to mandate the content and order of clauses
Coherence achieved by correct nesting and filling-in of a schema

Schema components

Rhetorical predicate specifies the suitable material (semantic attributes)
Variability obtain through optionality, repetitions and nesting of schemata
Later developments include dependencies on hearer knowledge in selections

Categories of schemas (originally developed for describing naval objects)

Identify
Describe
Compare & Contrast
Attributive

An example of a text schema

IDENTIFICATION

1. Identification (class & attribute/function)
2. {Analogy / Constituency / Attributive / Renaming} +
3. Particular-illustration/Evidence +
4. {Amplification / Analogy / Atributive}
5. {Particular-illustration / Evidence}

Example text:

Eltville (Germany) 1) An important wine village of the Rheingau region. 2) The vineyards make wines that are emphatically of the Rheingau region style, 3) with a considerable weight for the white wine. 4) Taubenberg, Sonnenberg and Langenstuck are among wineyards of note.

Using text schemata

Instantiation

Access functions associated with rhetorical predicates

to select information from the knowlegde base

Example: *Identify* -> superordinate concept + defining property

Instantiation is done stepwise, according to the schema definition

Choosing information

Based on focus of attention (most salient object in a sentence)

Preferences among available choices:

1. shift focus to newly introduced object

2. maintain focus

3. shift focus back to some previously introduced object

Focus also used in verbalization (word choice, topicalisation, …)

Options also compared according to other demands (domain-specific ones)

Example of using text schemata – path description

Entire path

attributive(path)
define(path-segment)+
identify(goal)

Path segment

define(direction) |
define(move)
attributive(landmark)

Rhetorical elements

attributive(path)
define(direction)
attributive(landmark)
define(move)
attributive(landmark)
identify(goal)

Instantiated schema

short(path(A,B))
go(User,from(A),to(church))
–
turn(User,at(church),direction(left))
pass(User,by(big&building&town-hall))
be(User,at(B))

This is a short path. You go to the church. There you turn left. Then you pass by a big bulding, the town hall. Then you will arrive at B.

Assessing text schemata

What makes them work

- **Based on analysis of text corpus**
- **Closely tied to domain semantics (data base predicates)**
- **Relatively easy to develop and use**

Limitations

- **Lack of representation of purpose of each part**
- **No replanning possible**
- **Later developments include dependencies on hearer knowledge in selections**

Application areas

- **Schematic descriptions (e.g., of data base content – schema)**
- **Conventionalized components of documents (e.g., business letters)**
- **Not suitable for dynamically assembled text (explanations, documentation)**

Planning with discourse relations

The approach

- **Discourse relations are elementary components in a text plan**
- **Planning process based on formal description of discourse relations**
- **Incrementally building a text plan by composing related text segments**
- **Coherence achieved by correct formalizations of discourse relations and by their consitent composition**

Some examples of discourse relations

- **Sequence – a temporal or local relation**
- **Elaboration – detailed information about a discourse object**
- **Result – a consequence of a situation**
- **Background – Contextual material to increase understanding**

Issues in defining the planning space

- **Taxonomy of discourse relations (many linguistic theories)**
- **Formalizations needed**

Rhetorical Structure Theory (RST) (Mann, Thompson 1988)

Rhetorical relations – connect text segments

Subordinate relations – *Nucleus* expanded by *Satellite*

the majority of all relations, e.g., BACKGROUND, CAUSE, EVIDENCE

Coordinate relations – Several *Nuclei*

a few relations only, e.g., JOIN, SEQUENCE

Ideational (i.e., semantic), interpersonal, and relations

Formalizations of discourse relations

Constraints on nucleus and satellite, and both

Effect of understanding relation

Exploring the planning space

A discourse is recursively built by successive compositions of relations

Various methods to organize the text structure building process

An example relation – Elaboration

Relation name

Elaboration

Constraints on Nucleus

none

Constraints on Satellite

none

Constraints on Nucleus and Satellite combination

The Satellite clause presents additional detail about the situation or some element of subject matter which is presented or inferable from the Nucleus clause in one of the following ways:

set - member, abstract - instance, whole - part, process - step, object - attribute, generalization - specific

Effect

The reader recognizes the situation presented in the Satellite as providing additional detail of the Nucleus

An example – structuring a set of facts (1)

The communicative goal

(GOAL (BMB SPEAKER HEARER (SEQUENCE-OF E1 ?NEXT)))

Facts form the database

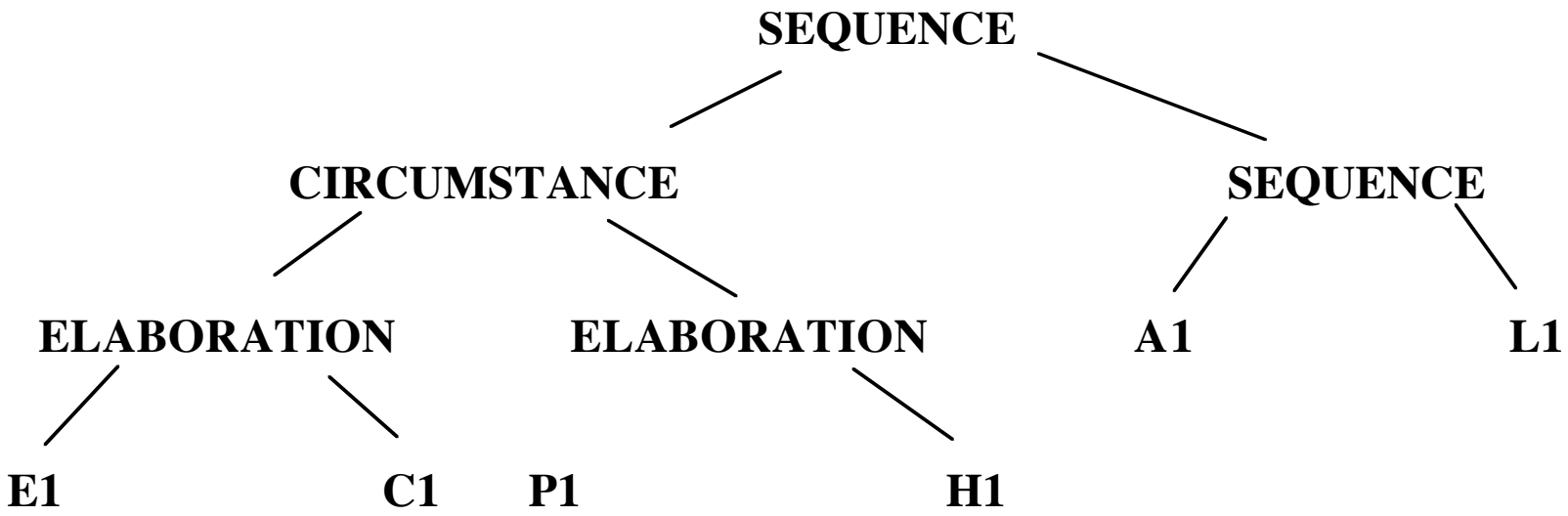
((ENROUTE E1)
(ACTOR E1 K1)
(DESTINATION E1 S1)
(NEXT-ACTION E1 A1)
(LOCATION E1 P1))
((ARRIVE A1)
(ACTOR A1 K1)
(TIME A1 T1)
(NEXT-ACTION A1 L1))
((READINESS-STATUS C1)
(NAME C1 C4))

((POSITION P1)
(HEADING P1 H1)
(LATITUDE P1 79)
(LONGITUDE P1 18))
((HEADING H1)
(COURSE H1 195))
((LOAD L1)
(ACTOR L1 K1)
(STARTTIME L1 T2)
(ENDTIME L1 T3))

((SHIP K1)
(NAME K1 KNOX)
(READINESS K1 C1))
((PORT S1)
(NAME S1 SASEBO))
((DATE T1)
(DAY T1 24)
(MONTH T1 4))
((DATE T2)
(DAY T2 25)
(MONTH T2 4))
((DATE T3)
(DAY T3 28)
(MONTH T3 4))

An example – structuring a set of facts (2)

Resulting paragraph structure tree



Corresponding text

Knox, which is C4, is en route to Sasebo. It is at 79 N 18 E heading SSW. It will arive on 4/24, and will load for four days.

Top-down planning with intentions (EES system)

Text plan operators

NAME:	**PERSUADE-BY-MOTIVATION**
EFFECT:	**(PERSUADED H (GOAL H (DO H ?act)))**
CONSTRAINTS:	**(AND (GOAL S ?g)** **(GOAL H ?g)** **(STEP ?act ?g))**
NUCLEUS:	**(FORALL ?g (MOTIVATION ?act ?g))**
SATELLITES:	**()**

NAME:	**MOTIVATION-ACT-BY-MEANS**
EFFECT:	**(MOTIVATION H ?act ?g)**
CONSTRAINTS:	**(AND (GOAL S ?g)** **(GOAL H ?g)** **(STEP ?act ?g))**
NUCLEUS:	**(INFORM S H (GOAL S ?g))**
SATELLITES:	**(MEANS ?g ?act)**

Top-down Planning with intentions (EES system)

Discourse structure fragment

(PERSUADED USER (GOAL USER (DO USER REPLACE-1)))

(MOTIVATION REPLACE-1 ENHANCE-READABILITY))

(INFORM SYSTEM USER ENHANCE-READABILITY)
"I'm trying to enhance the readability of the program"

"by"
(MEANS REPLACE-1 ENHANCE-READABILITY)

(INFORM SYSTEM USER APPLY-1)
"applying transformations that enhance readability"

(BEL USER (STEP REPLACE-1 APPLY-1))

Heuristics for sentence formation (Scott, de Souza 1990)

1. **A Satellite can only be embedded in its Nucleus.**
2. **Embedding can be realized as an adjective, appositive NP, PP, or relative clause (in this order of preference)**
3. **Embedding can occur in the leftmost nuclear clause with the same focus value**
4. **Satellites in a JOIN within an ELABORATION should be embedded, provided there are no, or no more than one, remaining clause.**
5. **Coordination occurs only between elements of JOIN, SEQUENCE, and CONTRAST relations**
6. **The more shared parameters between clauses, the more they should be coordinated.**
7. **Prefer coordinating NPs over PPs over Vs or VPs**
8. **Sentences should contain no more than 3 clauses**
9. **Sentences should contain at most one level of embedding**
10. **Embedding should occur before coordination and before focus transformations**

Assumptions in text planning with discourse relations

Text segments are always clauses

- **Simplification to make analysis simpler (RST originally an empirical analysis)**
- **NPs or PPs can carry the same information**
- **Some systems can flexibly generate several variants**

Only one prominent relation between two text segments

- **Frequently interpersonal and ideational relations**
- **Mostly a problem of view or precision**
- **In a few cases structural differences**

All specifications are expressed explicitly in the text structure

- **May lead to redundancy**
- **Occasional inconsistencies in constraints when associated with surface (inferable information must be included to meet constraints)**

Examples where assumptions fail

Multiple relations with different structural patterns

(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.

Interpersonal view: (b) *Motivation* for (a), (c) *Motivation* for (b)

Ideational view: (a) *Condition* for (b), (b) *Condition* for (c)

Both representations necessary, but not built explicitly in a system

All specifications are expressed explicitly in the text structure

(d) Some extra copies of the Spring 1984 issue of AI magazine are available in the library.

(e) This issue includes a report on AI research at ISI.

(e) intended as *Motivation* for (d), but addressee not mentioned in (d) and (e)

In analysis, that relation would not be recognized (no inferences considered)

In generation from more explicit data, a redundancy would result