

# ON LEXICALLY BIASED DISCOURSE ORGANIZATION IN TEXT GENERATION

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## Summary

In this paper, we show that *Reiteration* and *Collocation* relations as introduced by Halliday and Hasan may function as lexically biased discourse structure relations and that these relations are well represented by sequences of Mel'čuk's *Lexical Functions* (LFs). We propose to use LF sequences for the final determination and realization of discourse organization during lexical choice in text generation.

## 1 LEXICAL PHENOMENA IN DISCOURSE

### 1.1 The Problem

In text generation, the task of content selection and discourse organization, i.e. text planning, has often been opposed to the task of linguistic realization of the information selected and organized by the text planning process (cf., e.g., McKeown and Swartout, 1987). However, discourse organization is not possible without taking into account linguistic means that are available to express a particular meaning (cf., e.g., Meter, 1992; Rubino, 1992). Especially the failure to integrate lexical choice into the planning process may lead to monotonous, awkward, or even ungrammatical text (note that when used separately, the clauses in (1a) and (2a) are fully acceptable):<sup>1</sup>

- (1) a. <sup>?</sup> *Alle bewahrten Ruhe; nur Hans konnte keine Ruhe/(sie nicht) bewahren*  
lit. 'All kept calmness; only Hans could not keep calmness/ it'.  
vs.  
b. *Alle bewahrten Ruhe; nur Hans konnte nicht ruhig bleiben*  
lit. 'All kept calmness; only Hans could not keep calm'.
- (2) a. <sup>?</sup> *Der langgeplante Ausflug fand am Sonntag statt; wir unternahmen ihn mit der ganzen Familie*  
lit. 'The long-planned trip took place on Sunday; we undertook it with the entire family'.  
vs.  
b. *Der langgeplante Ausflug fand am Sonntag statt; die ganze Familie nahm daran teil*  
lit. 'The long-planned trip took place on Sunday; the entire family took part in it'.

<sup>1</sup>In the following examples, the inappropriate lexical expression in the (a) sentences and its more appropriate alternative in the (b) sentences are underlined.

- (3) a. *\*Hans machte eine Entdeckung; diese Entdeckung war wirklich*  
lit. 'Hans made a discovery; this discovery was real'.  
vs.  
b. *Hans machte eine Entdeckung; diese Entdeckung war eine Entdeckung im wahrsten Sinne des Wortes*  
lit. 'Hans made a discovery; this discovery was a discovery in the real sense of the word'.

These examples show that lexical constraints are of a special relevance to discourse organization if related discourse segments communicate information on the same or related object, event, process, etc. While in the past, considerable work has been done on the realization of anaphoric links between related entities via referring expressions (cf., e.g., Tutin and Kittredge, 1992; Dale, 1989; Reiter, 1991), only a few proposals emphasize the relevance of lexical means for the realization of discourse structure relations such as CONTRAST in (1b) and ELABORATION in (2b) and (3b).<sup>2</sup> It is important to note that the actual realization of a discourse relation may vary with the semantics of the lexemes involved. For example, in (4), the second clause is an INTERPRETATION or CONSEQUENCE of the first; despite the analogous syntactic construction in (5), the second clause is a JUSTIFICATION or an EXPLANATION of the first rather than an INTERPRETATION or CONSEQUENCE.

- (4) *He travels a lot — he is a 'professional' traveller.*  
(5) *He flies a lot — he is a professional flier.*

### 1.2 The Proposal

Such relations as those between *Ruhe bewahren* '[to] keep calmness' and *ruhig bleiben* '[to] keep calm' (in 1); between *Ausflug findet statt* 'trip takes place' and *am Ausflug teilnehmen* '[to] take part in the trip' (in 2); and between *eine Entdeckung* 'discovery' and *im wahrsten Sinne des Wortes* 'in the real sense of the word' (in 3) have been introduced by (Halliday and Hasan, 1976) as *Reiteration* and *Collocation* relations.<sup>3</sup>

<sup>2</sup>In this paper, we use the names of discourse structure relations as they are known from the *Rhetorical Structure Theory* (Mann and Thompson, 1987).

<sup>3</sup>Although preferably used so far to describe discourse links between information segments realized by nouns, *Reiteration* and *Collocation* relations may well hold between segments which are realized by other parts of speech and even by multiple word expressions.

Reiteration stands for a strict repetition of a lexical expression in related discourse segments; for a substitution of a lexical expression by a synonym, or for a substitution by a superordinate. Consider the following examples, which illustrate the three different reiteration relations (strict repetition in (7a), synonymy in (7b), and superordination in (7c)):

- (6) *Last summer, Monica flew to Italy,*  
 (7) a. *while Daniela flew to Norway.*  
 b. *while Daniela took the plane to Norway.*  
 c. *while Daniela travelled to Norway.*

Further substitution relations such as metaphoric repetition (7d), negated antonymy (7e), etc. can be added:

- (7) d. *while Daniela wafled away to Norway.*  
 e. *Daniela also did not stay at home.*

Collocation stands for ‘any recognizable lexicosemantic relation’ between lexical expressions in related discourse segments. Examples of collocation relations are attribution (7f), partition (7g), means (7h), etc.:

- (7) f. *it was a very pleasant journey.*  
 g. *making a stop over in Munich.*  
 h. *it was one of those big aircrafts.*

As our examples show, reiteration and collocation relations help to ensure not only cohesion, but also coherence in texts. Therefore, a text generator has to provide an organization of lexical resources that tailors discourse structure relations to reiteration and collocation relations. This presupposes, on the one hand, a precise picture of which reiteration and collocation relations are available in language and how they are realizable; and, on the other hand, a fine-grained discourse model that contains these relations.

To make allowance for the global discourse organization, which is performed independently from lexical resources, we suggest a two level text planning task implementation, with the first level realized by a *Rhetorical Structure Theory* (RST) (Mann and Thompson, 1987) style text planner and the second level — by a separate lexical choice module. Then, the discourse organization of a text is done in two steps: in the first step, the text planner predetermines the discourse structure relations; in the second step, the lexical choice module provides, in accordance with linguistic constraints, the final determination and the realization of these discourse structure relations.

The present paper reports an attempt to define lexically biased discourse structure relations used in a partially implemented lexical choice module. Due to the lack of space, we do not discuss the module itself; it is described in detail in (Wanner, 1992, 1994). Here, we demonstrate how discourse organization for text generation can be refined by lexically biased discourse structure relations and how these relations are related to global discourse relations specified in the output of an RST style text planner.

In contrast to the most discourse models (cf., e.g., McKeown, 1985; Grosz and Sidner, 1986; Mann and Thompson, 1987), which take the clause as the minimal discourse segment, we consider as discourse segments ‘perspectives’ (cf. McCoy, 1989) — specific views taken on a semantic entity (an object, an event, etc.). A perspective is a wording which is tailored to the lexical repertoire of an entity; it is realizable as a clause, a phrase, or as a single lexeme. Each of the clauses in the examples above can be considered as a realization of a single perspective; and the reiteration and collocation relations that hold between the clauses — as well-defined perspective pairs.

In our model, a single perspective is represented as a composition of Mel’čuk’s *Lexical Functions* (hereafter LFs) (Mel’čuk and Polguère, 1987); perspective pairs are represented as LF sequences.

The following distinctive features characterize our model:

- it makes sure that all relations defined are expressible in language,
- it allows for a realization of lexical relations as subclausal relations between discourse segments,
- it is sensitive to lexical and syntactic variations for the realization of discourse structure relations.

## 2 LEXICAL FUNCTIONS IN DISCOURSE

### 2.1 The Basics

Formally speaking, an LF *f* is a standard semantico-lexical relation which holds between a lexeme *l*<sub>1</sub> (the keyword of *f*) and a set of lexemes *f*(*l*) (the value of *f*). Examples of LFs are:

Syn: ‘synonym’	Syn( <i>bible</i> ) = <i>God’s Book</i>
Anti: ‘antonym’	Anti( <i>victory</i> ) = <i>defeat</i>
Gener: ‘hyperonym’	Gener( <i>lamb</i> ) = <i>meat</i>
Figur: ‘metaph. rep.’	Figur( <i>fog</i> ) = <i>wall [of fog]</i>
Conv <sub>21</sub> : ‘conversion’	Conv <sub>21</sub> ( <i>to include</i> ) = [ <i>to</i> ] <i>belong</i>
S <sub>0</sub> : ‘situation’	S <sub>0</sub> ( <i>to teach</i> ) = <i>teaching</i>
S <sub>1</sub> : ‘actor’	S <sub>1</sub> ( <i>lie</i> ) = <i>liar</i>
A <sub>0</sub> : ‘situational adj.’	A <sub>0</sub> ( <i>sun</i> ) = <i>solar</i>
V <sub>0</sub> : ‘action’	V <sub>0</sub> ( <i>deal</i> ) = [ <i>to</i> ] <i>deal</i>
Magn: ‘intense(ly)’	Magn( <i>beauty</i> ) = <i>real, stunning</i>
Oper <sub>1</sub> : ‘perform’	Oper <sub>1</sub> ( <i>cry</i> ) = [ <i>to</i> ] <i>let out (a cry)</i>
Incep: ‘beginning’	Incep( <i>to sleep</i> ) = [ <i>to</i> ] <i>fall asleep</i>
Fin: ‘end’	Fin( <i>to sleep</i> ) = [ <i>to</i> ] <i>wake up</i>
Caus: ‘causation’	Caus( <i>to sleep</i> ) = [ <i>to</i> ] <i>put to sleep</i>
Manif: ‘manifestation’	Manif( <i>happy</i> ) = [ <i>to</i> ] <i>beam with joy</i>

Mel’čuk distinguishes about sixty *simple* LFs of the above kind. Simple LFs can further be combined with

$\text{Oper}_1 \wedge \text{Oper}_1$	strict repetition ( $[to]$ <i>have a look</i> $\wedge$ $[to]$ <i>have a look</i> )
$V_0 \wedge \text{Syn}V_0$	synonymy ( $[to]$ <i>disappear</i> $\wedge$ $[to]$ <i>vanish</i> )
$V_0 \wedge \text{Gener}S_0$	superordination ( $[to]$ <i>search (a flat)</i> $\wedge$ <i>reprisal</i> )
$S_0 \wedge \text{Figur}S_0$	metaph. repetition ( <i>fog</i> $\wedge$ <i>wall of fog</i> )
$V_0 \wedge \text{NOT Anti}V_0$	neg. antonymy ( <i>close</i> $\wedge$ <i>not far away</i> )
$V_0 \wedge \text{Conv}_{21}V_0$	conversion ( $[to]$ <i>sell</i> $\wedge$ $[to]$ <i>buy</i> )
$V_0 \wedge S_1$	process-actor ( $[to]$ <i>lie</i> $\wedge$ <i>liar</i> )
$\text{Caus} \wedge V_0$	cause-process ( $[to]$ <i>put to sleep</i> $\wedge$ $[to]$ <i>sleep</i> )
$\text{Incep} \wedge V_0$	initialization-process ( $[to]$ <i>fall asleep</i> $\wedge$ $[to]$ <i>sleep</i> )
$A_0 \wedge \text{Magn} \circ S_0$	attribution ( <i>beautiful</i> $\wedge$ <i>real beauty</i> )
$V_0 \wedge \text{Manif}$	manifestation ( $[to]$ <i>be happy</i> $\wedge$ $[to]$ <i>beam with joy</i> )

Table 1: The realization of reiteration and collocation relations by LF sequences

each other; the meaning of such *complex* LFs is, as a rule, a combination of the meanings of the participating LFs. Thus, *AntiMagn* means ‘slightly’ (e.g., *AntiMagn(injury) = minor*); and *IncepOper* ‘start performing’ (e.g., *IncepOper(debate) = [to] start (a debate)*).<sup>4</sup>

In text generation, the benefits from LFs are threefold: (i) they provide subclausal collocational constraints between the keywords and the values (cf. Iordanskaja *et al.*, 1991) as, e.g., between *narrow* and *majority* (with *AntiMagn(majority) = narrow*) in *Houdini won with a narrow majority*; (ii) they provide interclausal cooccurrence links (cf. Tutin and Kittredge, 1992) between the keywords and the values as, e.g., between *spaghetti* and *pasta* (with *Gener(spaghetti) = pasta*) in *Let’s take spaghetti; pasta is not bad here*; and (iii) they allow for explicit statements on the cooccurrence between values of various LFs in related discourse segments, as, e.g., between the values of  $V_0(\textit{sleep}) = [to] \textit{sleep}$  and  $\textit{Incep}(\textit{sleep}) = [to] \textit{sink into sleep}$  in *Hardly in bed, Tony sank into sleep and slept all the night till the morning*.

In our work, we use (i) for single perspective realizations (cf. Wanner and Bateman, 1990); (ii) and (iii) serve for the representation of perspective sequences, i.e. reiteration and collocation relations in discourse. One such relation is given by all pairs  $\text{LF}_1 \wedge \text{LF}_2$  (‘LF sequences’) which show the same cooccurrence behavior (e.g., the sequences  $\text{Oper}_1 \wedge \text{Oper}_1$  and  $V_0 \wedge V_0$  show the same cooccurrence behavior; both stand for **strict repetition**). Consider Table 1.

LF sequences are directed, i.e.  $\text{LF}_1 \wedge \text{LF}_2 \neq \text{LF}_2 \wedge \text{LF}_1$ .

<sup>4</sup>If several (simple or complex) LFs compose a phrase or a clause (as, e.g., *AntiMagn* and  $S_0$  compose *minor injury*), we separate these LFs by a ‘o’ sign. For the theoretical background and further details of how LFs can be composed with each other, see the literature on *Meaning Text Theory*; e.g., (Mel’čuk and Polguère, 1987).

$\text{LF}_1$ . Moreover, the existence of  $\text{LF}_1 \wedge \text{LF}_2$  in a language does not mean that  $\text{LF}_2 \wedge \text{LF}_1$  is also available. Therefore, in LF sequences, one argument is the ‘hub’ – the point of departure (or the expanded LF) and the other argument is the ‘hub expander’. How a specific LF can be expanded, i.e. which LF sequences are possible, depends individually on this LF, and on which LFs are further available for the entity the LFs are applied to. Compare, e.g., the LF sequences that instantiate the **negated antonymy** reiteration for  $V_0(\textit{forgetting})$  and the two, which instantiate the same relation for  $V_0(\textit{lie})$ :

**Forgetting** (the  $V_0$  clause is in all examples realized as *I forgot*; to abbreviate, we write ‘...’ instead):

$V_0 \wedge \text{NOT Conv}_{21} \text{Anti}V_0$	...; <i>it does not remind me of anything.</i>
$V_0 \wedge (\text{Magn} \circ \text{NOT Anti}V_0)$	...; <i>can (absolutely) not think of it (now).</i>
$V_0 \wedge (\text{Magn} \circ \text{FinOper}_1 \circ \text{Anti}S_0)$	...; <i>it (totally) has slipped my mind.</i>
$V_0 \wedge (\text{Magn} \circ \text{NOT AntiSyn}S_0)$	...; <i>(absolutely) no idea.</i>

**Lie** (‘...’ stands here for *He is lying*):

$V_0 \wedge \text{NOT Oper}_1 \circ S_0 \text{Anti}V_0$	...; <i>(simply) does not tell the truth.</i>
$V_0 \wedge \text{Gener}V_0 \circ \text{NOT Anti}A_0$	...; <i>what he says is not true.</i>

Apart from the reiteration or collocation relation it stands for, an LF sequence is further characterized by its possible syntactic realizations and its functional content.

## 2.2 Syntactic Realizations of LF Sequences

As a rule, an LF sequence is realizable by several different syntactic constructions. How these constructions can look like is predetermined by each LF sequence individually (and by the information to be communicated). For example,  $\text{Oper}_1 \wedge \text{Oper}_1$  (more precisely, **strict repetition**) is in general realizable only as a *paratactic complex clause*; cf. *Have a look at it; please have a look*. In contrast, for example,  $\text{Oper}_1 \wedge \text{Magn} \circ S_0$  is realizable – when applied to, e.g., *decision* – by all syntactic constructions possible, cf.:

- (8) a. *John made a decision; this decision was important to him* (paratactic complex clause);
- b. *John made a decision, which was important to him* (hypotactic complex clause);
- c. *The decision, which John made, was important to him* (embedded clause);
- d. *John made an important decision* (simple clause);
- e. *John’s recently made important decision* (phrase).

The relevance of syntactic variations for the realization of discourse structure relations is well known, cf., e.g., (Hovy, 1993).

### 2.3 Functional Content of LF Sequences

Semantics, lexis, and syntax of LF sequences do not provide sufficient criteria for the choice of one sequence over all other comparable ones. These criteria must be provided by the *functional content* we associate with each sequence (or reiteration and collocation relation, respectively). The functional content of the reiteration and collocation relations listed in Table 1 is presented in Table 2.<sup>5</sup>

strict repetition	insisting restatement
synonymy	clarifying restatement
superordination	generalizing restatement, clarifying restatement, class-referencing
metaphor, repetition	illustrative restatement, pictoresque restatement, intensifying restatement
negated antonymy	contrastive restatement
conversion	clarifying restatement, constituent enhancement, perspective shifting
process-actor	identification, actor-introduction
cause-process	processual enhancement, causal enhancement, causer introduction
initialization-process	processual extension, beginning extension
attribution	attributive refinement
manifestation	predicative refinement, manifestation enhancement

Table 2: Functional content of some reiteration and collocation relations

## 3 TOWARDS LEXICALLY BIASED DISCOURSE RELATIONS

Due to their functional content, LF sequences serve as instantiations of individual discourse structure relations. In our work, we suggest that these individual discourse structure relations can be organized coherently in terms of the functions and semantic distinctions they represent. In accordance with the claim that the availability of specific LF sequences is dependent on the entities the LFs are applied to, we further suggest that this organization must be done individually for each predicative entity (cf. Wanner, 1994).

Based on this, we define taxonomies (one for each predicative entity) which have been inspired by Halliday's proposal for grouping interclausal logico-semantic relations (cf. Halliday, 1985). How such an organization can be realized efficiently using inheritance techniques is described in (Wanner, 1992).

<sup>5</sup>This is not to say that these functions are the only ones that are possible

Although our model is not restricted to interclausal relations, two features of Halliday's proposal are valuable to us: (i) that a logico-semantic relation 'expands' one wording by another one rather than connecting two given wordings and (ii) that a logico-semantic relation can be further decomposed with respect to its: 1. semantics, 2. syntactic realization, 3. communicative structure, and 4. with respect to the speaker's intention, which motivates the selection of this relation during the text production process.

In what follows, we discuss first the general taxonomy of our 'expanding' discourse structure relations for processes and then the decomposition of the relations along these four dimensions. Following the conventions in RST, we call the expanded part 'nucleus' and the expanding one 'satellite'.

### 3.1 Taxonomy of Lexical Discourse Relations

A taxonomy of lexical discourse structure relations is to be understood as a hierarchy of alternative choices of increasingly delicate relations. The most delicate relations are LF sequences represented by their functional content. The top level of the taxonomy represents, thus, the most global types of expansion. In accordance with (Halliday, 1985), these are ELABORATION, EXTENSION, and ENHANCEMENT. ELABORATION subsumes all those expansions which ensure a deeper understanding of the meaning communicated by the nucleus wording. A deeper understanding of the nucleus wording is ensured by *repeating*, *refining*, or *clarifying* it (the next level of ELABORATION in the taxonomy). For example, all reiteration relations are of the ELABORATION type.

The EXTENSION expansions extend the meaning communicated by the nucleus wording. This can be done by introducing a new constituent that is related to what has been said in the nucleus, by adding a new action of the known constituents, etc. **Beginning extension** is, e.g., an EXTENSION.

The ENHANCEMENT expansions qualify the meaning communicated by the nucleus wording by adding a reference of causation, time, location, manner, mode, etc. An example of ENHANCEMENT is **causal enhancement**.

Figure 1 shows in more detail the ELABORATION fragment of the taxonomy in network form. According to this figure, RESTATEMENT can be realized as a *contrastive*, a *generalized*, or as a *repeating restatement*, respectively. As shown in Table 2, CONTRASTIVE RESTATEMENT corresponds to the reiteration **negated antonymy**, GENERALIZING RESTATEMENT to **superordination**, respectively. REPEATING RESTATEMENT is further *insisting*, *clarifying*, *illustrative*, *pictoresque*, etc. (see again Table 2 for corresponding reiteration relations).

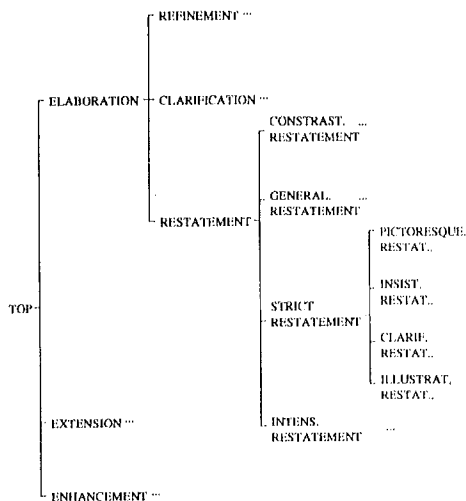


Figure 1: A fragment of a lexical discourse structure relation taxonomy

### 3.2 Decomposition of Lexical Discourse Structure Relations

As presented in Figure 1, the relations are still too global to be useful for lexical choice. Consider, e.g. *ATTRIBUTION* — a subtype of the *REFINEMENT* relation; it allows for various decompositions with respect to all four dimensions mentioned above:

- **Semantics**; thus, *ATTRIBUTION* can mean *ATTRIBUTION*, e.g., of a process, of one of the participants of this process, or of one of the circumstances of this process; if *ATTRIBUTION* of a participant (let's say the *ACTOR*) is meant, it is still undetermined what kind of attribution this is (e.g., a one which enables the actor to engage in the process, a one which prevents him from engaging in this process, etc.).
- **Syntactic realization**; how the various *ATTRIBUTIONS* can be realized syntactically depends on the semantic and lexical properties of the information to be communicated. For example, *Monica flew to Italy; it was a very pleasant journey* is also realizable as a subordinated clause (*Monica flew to Italy, which was very pleasant*); as a simple clause (*Monica had a very pleasant journey to Italy*); and as a phrase (*Monica's pleasant journey to Italy*).
- **Communicative structure**; the communicative structure of *ATTRIBUTION* varies depending on the order in which nucleus and satellite are realized. Cf., e.g.: *Monica flew to Italy; it was a very pleasant journey* vs. *It was very pleasant, Monica's journey to Italy*.
- **Speaker's intention**; selecting the *ATTRIBUTION* relation the speaker is assumed to intend,

```
(R1/CONSEQUENCE
  :action (LYING/ SITUATION
    :actor (PERSON
      :in-focus +
      :sex male
      :name #unknown#)
    :obligatory-roles (:actor,
      :situation))
  :consequence (LYING/ CLASS-DESCRIPTION
    :domain (PERSON
      :in-focus +
      :sex male
      :name #unknown#)
    :range (:actor
      :situation LYING)
    :obligatory-roles (:domain,
      :range)))
```

Figure 2: The text plan for the text with the meaning 'The man is lying; the consequence of this is that this man is a liar'

e.g., a justification of what has been communicated in the nucleus as in *John failed the exam; it was very difficult*; a consequence of it *John has been shot -- he is dead*, etc.

The increasingly delicate specifications achieved by decomposition are also represented hierarchically in network form; one network for each dimension.

## 4 GETTING THE RELATIONS ACROSS

The lexical choice process, which makes use of the discussed discourse structure relation taxonomies, and the representation of lexical resources are described in detail in (Wanner, 1992, 1994). Here we focus on the interface between the first level text planning and the lexical choice module; and on the output as produced by the lexical choice module.

The computational framework in which our model has partially been implemented, is the systemic text generator *KOMET* (Bateman *et al.*, 1991). One source of constraints for the first level text organization comes in *KOMET* from an *RST*-based planner.<sup>6</sup> The output of this planner is a collection of case frames with *RST* relations holding between them as shown in Figure 2.

Starting from a text plan of this kind, the lexical choice module traverses a multilayered collection of networks (one of these layers is given by a taxonomy of lexical discourse structure relations discussed). During the traversal, the text plan is transformed into a lexicalized *Partial Grammatical Structure* (PGS);<sup>7</sup> it is called 'partial' because it contains precisely that amount of grammatical information which is necessary

<sup>6</sup>Recent developments of this planner are described in (Hovy *et al.*, 1992).

<sup>7</sup>A PGS corresponds, roughly speaking, to the *Partial Surface Functional Description* (PSFD) specification in the *COMET* system (McKeown *et al.*, 1990).

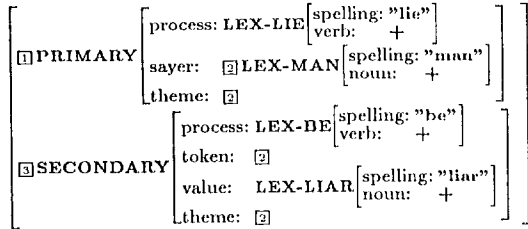


Figure 3: PGS structure for the sentence *The man is lying; he is a liar*

for lexical choice. The PGS is passed to the grammar (a systemic grammar of German; cf. Teich, 1992) for final syntactic realization. Figure 3 shows a sample PGS encoded as a *Typed Features Structure* (cf. Bateman *et al.*, 1992).

The first and the most important task in tailoring the text plan to linguistic resources is to find a lexically biased discourse structure relation for the RST relation specified in the text plan. The search is done in accordance with the functional content, the intention of the speaker, and the contents of the arguments of the RST relation. If the RST relation connects unrelated case frames<sup>8</sup> (as, e.g., EVIDENCE in *In winter, the days are short. It is getting light late and early dark.*) these case frames are realized independently without being connected by a lexical discourse structure relation. If the case frames are related, the following three variations are possible:

(i) An RST relation instantiation coincides with a lexical discourse structure relation; as, e.g., the instantiation of RESTATEMENT in the following rudimentary text plan coincides with our RESTATEMENT:

```
(R2/RESTATEMENT
:statement1 (SAYING/ SITUATION
:sayer Sveta/ person
:verbiage #unknown#
:manner (quiet
:scale #minimal#)
:obligatory-roles (:sayer,
:verbiage, :manner,
:situation))
:statement2 (SAYING/ SITUATION
:sayer Sveta/ person
:manner (quiet
:scale #minimal#)
:obligatory-roles (:sayer,
:verbiage, :manner,
:situation)))
```

If so, the subclassification of the lexical discourse structure relation determines its final realization. For example, the above text plan could be realized as a GENERALIZED RESTATEMENT: *Sveta flüsterte; sie sagte etwas ganz leise* lit. 'Sveta whispered; she said something very quietly'; an INTENSIFYING RESTATEMENT: *Sveta sagte etwas sehr leise; sie hauchte es kaum hörbar hin* lit. 'Sveta said something very quietly; she breathed it hardly audible', etc.

(ii) An RST relation instantiation subsumes several dis-

<sup>8</sup>Case frames are considered to be unrelated if between them or one of their roles no *identity, is-a, causer, location*, etc. relation holds.

inct classes of lexical discourse structure relations; as, e.g., the instantiation of the RST relation CONTRAST in (this plan is also highly simplified):

```
(R2/CONTRAST
:action1 (OCCUPATION/ SITUATION
:actor Roman/ nation
:actee Gaul/ state
:obligatory-roles (:actor,
actee, :situation))
:action2 (OCCUPATION/ SITUATION
:actor Roman/ nation
:actee (village /location
:part-of: Gaul)
:negation +
:obligatory-roles (:actor,
actee, :situation)))
```

may be realized either as CONTRASTIVE CLARIFICATION (9a) or as CONTRASTIVE ENHANCEMENT (9b):

- (9) a. *Gaul is entirely occupied by the Romans; well, not entirely ... one small village still holds out.*  
b. *Gaul is almost entirely occupied by the Romans; but one small village still holds out.*

In this case, the taxonomy of lexical discourse structure relations is entered at a relatively general level (in the worst case at TOP).

(iii) An RST relation is not captured by our taxonomy (as, e.g., CONCESSION). Then, the corresponding case frames are treated as unrelated (see above).

## 5 RELATED WORK

Our proposal for the description of lexically biased discourse structure relations resembles Danlos' work (Danlos, 1987), who presented acceptable clause pattern sequences explicitly in a *Discourse Grammar*. The basic difference between Danlos' work and ours is that in the *Discourse Grammar*, clause pattern sequences are represented as concrete valency schemata while in our model they are represented as functional distinctions that encode sequences of LFs. As a result, we do not face the problem of being restricted to a concrete small domain as Danlos does.

Meteer's text planner (Meteer, 1992) is another proposal for the realization of lexically biased discourse structure relations. But while we argue that lexically biased discourse structure relations are to be realized by a functionally motivated lexical choice model, Meteer suggests a single structurally motivated model for text planning, which also subsumes lexical choice. This is different from, e.g., (Rubinoff, 1992), who ensures the expressibility of discourse structure relations provided by a conventional text planner by annotating linguistic structures.

Elhadad's proposal (Elhadad, 1992) to use *Topoi* (inference rules that encode relations between propositions incorporating lexical material) as discourse structure relations is aimed at exploiting lexical phenomena for discourse organization. Elhadad focuses, however, on the 'argumentative potential' of lexical items rather than on lexically biased discourse structure relations.

## 6 CONCLUSIONS AND FUTURE WORK

In this paper, we argued that it is useful to distinguish between two levels of discourse organization: a global discourse organization, which is not affected by linguistic means; and a finer discourse organization, which is built up in accordance with the linguistic material that is available for the meaning communicated.

We have shown that reiteration and collocation relations may function as discourse structure relations and that these relations are well represented by *Lexical Function* sequences. We presented a taxonomy of lexically biased discourse structure relations, which is related to Halliday's proposal for grouping inter-clausal logico-semantic relations and suggested to use this taxonomy in a lexical choice module.

One of the open problems we face is how sufficiently detailed contextual constraints can be acquired in order to guide the choice of one discourse structure relation over others. This will certainly be one of the topics we will have to address in the future.

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# Parsing

