



## **Parsimonious Or Profligate: How Many and Which Discourse Structure Relations?**

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# PARSIMONIOUS OR PROFLIGATE: HOW MANY AND WHICH DISCOURSE STRUCTURE RELATIONS?

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## Abstract

Over the past ten years, researchers studying the structure of discourse have consistently had to face questions such as the following: Given that discourses consist of segments, how do the segments relate? What intersegment relations are there? How many are needed? A fair amount of controversy exists, ranging from the parsimonious position (that two basic relations suffice) to the profligate position (that an open-ended set of semantic/rhetorical relations is required). This paper outlines the arguments and then summarizes a survey of the conclusions of approximately 30 researchers — from linguists to computational linguists to philosophers to Artificial Intelligence workers. It fuses and taxonomizes the more than 400 relations they have proposed into a hierarchy of approximately 70 increasingly semantic relations, and argues that though the taxonomy is open-ended in one dimension, it is bounded in the other and therefore does not give rise to anarchy. Some evidence is provided for the organization of the taxonomy, as well as a full listing of the sources.

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## 1 Discourse Structure and Discourse Relations

One of the first observations one makes when analyzing discourse is that it exhibits internal structure. Whether the unit of analysis is morphophonemic, a clause, a sentence, a paragraph, or the whole discourse, units cluster together in specific ways to form larger units, so that most discourses, if they are coherent, consist of a relatively small number of top-level units.

Just as a sentence can be analyzed into syntactic, semantic, thematic, focus, and other structures, a discourse can be analyzed in many ways at once. To obtain some clarification of the numerous ways, one can arrange the structural units of description along various dimensions. One dimension compares the *unit size*, on a range from morphophonemic to full discourse length. Discourse structure has been extensively studied at most unit sizes or levels, from the international patternings of spoken discourse (prosodic differences at discourse segment endings are described by [Hirschberg & Litman 87, Pierrehumbert & Hirschberg 87]), through the subclausal (for example, shifts in tense and mode [Marslen-Wilson et al. 82] or pronominalizations respecting discourse segment boundaries [Björklund & Virtanen 89, Passoneau 91, Levy 84]), through clause-level clustering (often given by cue words and phrases such as “in order to” or “then” which guide the reader’s understanding inferences by providing clues as to how the pieces of the discourse interrelate [Grimes 75, Mann & Thompson 88, Dahlgren 88]), all the way up to the overall structural skeleton of the discourse (macrostructures [Kintsch & Van Dijk 75], story grammars [Rumelhart 72], Generic Structure Potential [Hasan 78], or schemas [McKeown 85]).

Another dimension of organization compares the *function of the unit*. This dimension includes argument structure (the development and reasoning underlying the argument) [Toulmin 58, Birnbaum et al. 80, Sycara 87]; affective structure (also called plot units) [Lehnert 82]; genre-producing structure (the structural coarticulation of various presentation styles, as for example a recipe consists of a list followed by a set of imperatives) [Martin 92]; intentional structure (the goal/plan or task-related organization of the discourse) [Grosz & Sidner 86, Moore 89]; semantic structure (the expression of domain-specific and general world knowledge in generic structural patterns) [McKeown 85, Paris 87], and so on.

A discussion of this plethora of analysis levels and types, each with its own terms, rules, and idiosyncracies, requires several books. We wish to focus in this paper on a specific level of analysis — the clause level — because in the past seven or so years it has been the focus of considerable interest in the computational text planning and language generation community. Several theories of interclausal relations have been quite productive in suggesting new and powerful ways to plan coherent paragraphs of text automatically from information stored in computers in various non-linguistic ways. Although limited in this paper to the clause level, we believe the relations described here pertain as well to both the subclause and the macrostructure levels; this will in many cases be obvious to the reader. We also believe that the kinds of relations described



provide a basis for many, if not all, the functions of discourse units, whether the analysis focus on argument structure, intentional structure, affective structure, etc.

In this paper we make the following simplifying assumptions. A discourse (a spoken or written text) is a structured collection of clauses. The clauses are grouped into segments on intentional, semantic, and other grounds; the nesting of segments form to larger segments provides the discourse structure. A discourse can be represented as a tree structure, in which each node of the tree governs the segment (subtree) beneath it. At the top level, the discourse is governed by a single root node if it is coherent; at the leaves, the basic segments are single grammatical clauses. In every coherent discourse, juxtaposed segments are related depending on the underlying inter-relationships and dependencies among their contents.

Though many of these assumptions do not do justice to the complexity of real discourse — in particular, considerable evidence exists that discourse is not representable simply as a tree structure [Trabasso et al. 85, Graesser & Clark 85] — we consider them useful insofar as they enable computational experiments to be performed with text planners and generators. Such experiments, which include interactive data base question answering systems [Arens et al. 88], explainable expert systems [Moore & Swartout 90], and tutoring systems [Moore 89], can then be compared to human-human interactions and judged on the grounds of discoursal and functional adequacy, and shortcomings due to the simplifications can be identified, studied, and corrected.

### 1.1 The Problem: The Number of Relations

The study of discourse structure is severely hampered by the well-known difficulty of reliably identifying the discourse segments (but see [Passoneau & Litman 93] for some recent promising work). Any clues to segmentation, such as the cue words that indicate segment interrelations, are helpful. Since, as has been argued fairly generally, discourses are coherent by virtue of the rhetorical or semantic relationships that hold between segments [Aristotle, Grimes 75, Hobbs 79, Mann & Thompson 88], one can instead try to identify the set of interclausal relations people use, and from them try to infer something about discourse structure.

These relations, which govern the juxtaposition of clauses and clause clusters whatever the genre of the discourse and whatever task or function it fulfills, form natural building blocks of discourse structure. As such, in one way or another, the relations play a role in all the major computationally and logically oriented approaches toward the study of discourse. But even in the simplified view of discourse used in computational approaches, the nature and number of intersegment discourse relations is a serious problem, one that has become more relevant in recent years, as computational work on discourse has been attempted. This paper proposes a resolution of the problem, which can be stated in terms of two possible positions.

On the one hand, approaching the problem of discourse structure from several intellectual sub-fields, various researchers have produced lists of intersegment relations — from philosophers (e.g., [Toulmin 58]) to linguists (e.g., [Quirk & Greenbaum 73, Halliday 85]) to computational linguists (e.g., [Hobbs 79, Mann & Thompson 88, Knott & Dale 93]) to psycholinguists (e.g., [Sanders et al. 92, Redeker 91]) to logicians (e.g., [Asher 93]) to Artificial Intelligence researchers (e.g., [Schank & Abelson 88, Dahlgren 88]). Typically, their lists contain between five and thirty relations, though the more detailed the work, the more relations tend to be identified. In this paper, we call the position of these researchers, namely that (at least) tens of interclausal relations are required to describe the structure of English discourse, the *Profligate Position*.

On the other hand, some researchers, notably [Grosz & Sidner 86], prefer not to identify a specific set of such relations. They argue that trying to identify the “correct” set is a doomed enterprise, because there is no closed set; the closer you examine intersegment relationships, the more variability you encounter, until you find yourself on the slippery slope toward the full complexity of semantics proper. Thus though they do not disagree with the idea of relationships between adjacent text segments provide meaning and enforce coherence, they object to the notion that some small set of relations can describe English discourse adequately. As a counterproposal, Grosz and Sidner avoid the semantic effects on the structure of discourse by defining two basic structural relations, DOMINANCE and SATISFACTION-PRECEDENCE, which carry intentional (that is, goal-oriented, plan-based) but no semantic import. They use these relations in their theory of the structure of discourse, according to which some pieces of the text are either subordinate to or on the same “level” as other pieces with respect to the interlocutors’ intentions. We call this position, namely that two intersegment relations suffice to represent discourse structure, the *Parsimonious Position*.

Comparing the two positions, the following questions arise:

- Is there a set of relations that people use?
- If so, which relations, and how many, are there?
- How are they defined? How are they best represented?
- How can they be used in computational text planners?
- How can one manage the problem of increasing semantic complexity?

## 1.2 Comparing the Alternatives

Depending on the depth of analysis required, the Parsimonious approach may be satisfactory. Certainly one can produce a discourse structure using only the two parsimonious relations. For discourse processing, however, the two relations are not sufficient. For example, when generating the following two clauses

*"Joe's car is much admired because it is a red sports car."*

the author needs to know which semantic interrelationship to express: should the linking word be "because", "when", "unless", or none at all? It is the semantic relation of causality that provides the appropriate linking word and much of the structural/realizational information (had the interclausal relationship been temporal coincidence, the cue word would have been "when"; had it been elaboration, the second clause would have been subordinated to the first in a relative clause "Joe's car, which is...", and so on). As practical experience with text generation systems has repeatedly shown [McKeown 85, Hovy 88, Moore & Swartout 90, Paris 90, Rankin 89, Cawsey 90, Maybury 90, Dobeš & Novak 92], the two parsimonious relations alone do not provide enough information to allow the generation of appropriate cue words/phrases, syntactic forms, pronouns, etc.

Similarly, text analysis systems cannot provide adequate interpretations on parsimoniously structural considerations alone. In the following:

*"Joe bought the sports car. He came into his inheritance."*

*"Joe came into his inheritance. He bought the sports car."*

the reader knows in both sentences that the time of inheritance precedes the time of buying, regardless of clause order, because of causal knowledge and an assumption that the discourse is coherent. An account of this discourse that ignores the causal relationship simply doesn't provide very much useful information and certainly doesn't ensure successful communication.

Based on the text planning argument outlined above, we believe that one cannot provide a sufficient account of discourse structure without using semantic/rhetorical relations. In addition, [Moore & Pollack 93] argue convincingly that for an adequate description of discourse at the clause level, one needs to represent the author's intentions in relating the clauses as well as the semantic relationships between them. Apparently we are forced into the profligate position. But how many relations are there? What are they? Which of the many collections of relations is correct?

The solution we propose is to use just as many relations as are required for the task or type of analysis being done. When the analysis requires merely partitioning a discourse into segments, as used in [Grosz & Sidner 86] and [Polanyi 88], the two parsimonious relations may well suffice. Here an analogy to syntactic classes may be instructive. It is possible to represent the syntactic structure of any sentence by using only the two relations Immediate Dominance and Linear Precedence, as done in the GPSG work on the ID/LP format for grammars [Gazdar et al. 85, Shieber 84]: these relations suffice to construct a tree. On the other hand, it is also possible to represent the syntactic structure of any sentence using a much richer set of terms, in the limit as rich as the actual verb itself to govern the predicate. Such an approach is in fact advocated by

[Gross 84, Mel'čuk & Žholkovsky 70], who show that almost every verb is a class by itself, since almost every verb has in some aspect or other a unique predicate structure. Under their account, an adequate syntactic representation of any sentence requires not merely general terms such as VERB or TRANSITIVE-VERB but instead the actual verb name itself.

On the one hand, then, the parsimonious position: just two relations, and very little information about the classes involved. On the other hand, the profligate position: numerous relations, and much information about the classes involved. While the parsimonious syntax trees are easy to construct, they are not very informative; and while the profligate tree are very informative, they are difficult to construct. In practise, as with most things in life, most syntacticians compromise. They employ for syntactic descriptions a set of terms such as VERB, NOUN, ADJECTIVE, etc., that is neither as large as Gross or Mel'čuk and Žholkovsky would prefer, nor as small as used in the ID/LP format; simultaneously the terms are not as informative as those Gross or Mel'čuk and Žholkovsy provide nor as stark as those in ID/LP. Where necessary for the task at hand, people use more (or less) detailed terms, suffering the consequences of not being able to define them precisely (or losing information, respectively).

The analogy to the question of discourse structure relations is direct. While the two parsimonious relations provide as much information as one needs to build a tree, they do not convey the kind of information that a typical text generator requires, for example, to include appropriate structural cue words and phrases to guide the reader's inferences. On the other hand, as Grosz and Sidner say, if one attempts to describe the true semantic interrelationships among the various segments of the discourse, one is drawn into the quagmire of full semantic complexity, and as they show, such detail is not always pertinent in discussions of discourse structure.

We propose for general use a compromise solution of approximately 70 discourse structure relations, applicable at the clause level and higher. In the rest of the paper we provide these 70 relations, organized into a hierarchy of increasing specificity, and describe their sources and our taxonomization procedure. We believe that these relations play an important role in English discourse structure, and we have organized them to allow straightforward extension in a constrained way when more detail is required.

## 2 Collecting and Organizing Discourse Structure Relations

In a study spanning the past three years, the authors have collected intersegment clause-level discourse relations that are expressive enough to satisfy the requirements of text planning systems. In 1989, the first author collected and taxonomized over 350 such relations from approximately 30 researchers in various fields [Hovy 90b], including philosophy, linguistics, computational linguistics, psycholinguistics, and Artificial Intelligence. The collection work involved comparing names

and definitions (described in Section 2.1) and then taxonomizing relations in a single hierarchy (described in Section 2.3). Subsequently, the authors found over 50 additional relations in other sources and produced an improved taxonomization, consisting of about 70 relations, first reported in [Maier & Hovy 92]. This taxonomy is still being extended; see [Hovy et al. 92]; in particular, we are currently collecting attempts to provide precise, formal definitions of these relations, notably from [Sanders et al. 92, Martin 92, Hobbs 90, Lascarides & Asher 91, Asher 93].

In this paper, rather than attempt to define each relation (an exercise requiring too much space), we refer the reader to the various sources, particularly to [Mann & Thompson 88, Hobbs 79, Sanders et al. 92, Ivir et al. 80, Martin 92]. In order to facilitate further research, particularly comparisons of the relations and definitions we encountered, the relations, sources, and a cross-index for each relation appear in the Appendix.

## 2.1 Merging Relations from Different Sources

Deciding whether or not to merge two similar-looking relations from different sources is a task bedeviled by two factors: differences in nomenclature and the frequent lack of any explicit definition at all<sup>2</sup>. The central problem lies in comparing definitions and/or examples. Since space limitations preclude a full description of all our decisions, we illustrate our treatment and own definitions of two example relations, ELABORATION and CONCESSION.

### 2.1.1 The Relation ELABORATION

We compare several definitions and examples of relations which were labeled ELABORATION by the sources and check them for identity of meaning.

**Hobbs 90:**

**Definition:** *Infer the same proposition  $P$  from the assertions of  $S0$  and  $S1$  (where  $S0$  and  $S1$  stand for the two text segments linked by the relation).*

**Example:**

1. Go down First Street.
2. Just follow First Street down three blocks to A Street.

From the first sentence the reader can infer that he/she has to go down First Street to an unspecified goal. The second sentence allows the same inferences except that the goal ("A Street") and

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<sup>2</sup>We do not wish to cast aspersions on any source; defining semantic relations is a very difficult problem. For example, nobody has a general definition of CAUSE, though causality has been the topic of centuries of debate! Even limited definitions, as required for the purposes of Artificial Intelligence or Computational Linguistics computer programs in a particular application domain with a given ontology of terms, are difficult enough.

the distance ("three blocks") are specified. There is a certain set of inferences which coincide for both sentences. In this example the second sentence gives additional detail to the first (although for Hobbs this does not necessarily have to be the case; his definition includes exact reformulations of the first clause by the second).

**Halliday 85:**

**Definition:** *One clause expands another by elaborating on it (or some portion of it), restating it in other words, specifying in it greater detail, commenting or exemplifying.*

**Example:**

1. John didn't wait.
2. He ran away.

Halliday's definition, which is restricted to linking simple clauses, explicitly allows both for relations that simply restate and for relations that provide more detail. This way, Halliday hints that the ELABORATION relation can be subclassified into various subcategories.

**Rhetorical Structure Theory — Mann and Thompson 87:**

**Definition:** *The Satellite [the clause of less importance] presents additional detail about the situation or some element of the subject matter which is presented in the Nucleus, or is inferentially accessible from the Nucleus, in one or more of the ways listed below:*

- abstract – instance
- set – member
- whole – part
- object – attribute
- generalization – specific

Besides the fact that this relation is the most detailed we have encountered — it specializes into five subclasses — it does not, like the definitions of Hobbs and Halliday, explicitly include restatements; for this function Mann and Thompson define a separate relation RESTATEMENT.

**Dahlgren 88:**

**Definition:** *One clause gives details about or describes a part of a larger event reported in the other clause.*

Being limited to events, Dahlgren's definition is narrower, specifying under ELABORATION a subset of the phenomena included by Mann and Thompson.

The definitions reproduced here are representative of those for elaborations (and somewhat more explicit than most sources' descriptions). As is clear, the sources have a common understanding of the semantics of this relation. For ELABORATION, we base our definition on the above ones to get:

**Definition:** *One text segment expands on the other by specifying it in greater detail or specifying it in other words, according to one of the following ways:*

- *set-member*
- *process-step*
- *part-whole*
- *object-attribute*
- *abstract-instance*
- *general-specific*
- *restatement*

### 2.1.2 The Relation CONCESSION

In this subsection we merge several sources' relations, all with different labels, into one relation.

**Hobbs 90:**

**Name:** VIOLATED EXPECTATION

**Definition:** *Infer P from the assertion S0 and not-P from the assertion S1.*

**Example:**

- The paper is weak,
- but it is interesting.

From Hobbs's explanation, it becomes clear that the concessive meaning of the relation is meant: the reader makes assumptions about one of the propositions or text segments which are violated by what is said in the other segment.

**Ivir et al. 80:**

**Name:** CONTRADICTION

**Definition:** *The Relator [the discourse structure relation] implies that S2 is not [an] expected consequence of S1.*

**Example:**

1. He is not polite,
2. but I like him.

Again, both the definition and the example imply a concessive meaning. The same is the case in the definition Dahlgren gives for her QUALIFICATION relation:

**Dahlgren 88:**

**Name:** QUALIFICATION

**Definition:** *A qualification denies one of the implications of the event or state expressed by the other clause. The main clause in the relation qualifies the "though" clause.*

**Example:**

1. Though Levine pleaded for sympathy,
2. the judge was unmoved.

**Sanders et al. 92:** Sanders et al. develop four basic parameters and define all their relations in terms of the parameter values. The parameters are:

- relation type: either additive or causal;
- pragmatic: specifying whether the relation conveys some illocutionary meaning;
- basic order: indicating a preferred sequence for the text segments;
- polarity: indicating whether one of the segments is negative or not.

Their relation NEGATIVE ARGUMENT – CLAIM is defined as follows:

**Name:** NEGATIVE ARGUMENT – CLAIM

**Definition:** *causal, +basic-order, +pragmatic, -polarity*

**Example:**

1. Although it is not exactly shouted from the rooftops,
2. you will have to take into account that sharks may occur along the Yugoslavian coast.

From these and similar definitions, we create the CONCESSION relation, defined as:

**Definition:** *One of the text segments raises expectations which are contradicted / violated by the other.*



## 2.2 Correctness of the Relations

One question always asked about efforts of this type: What guarantee exists that the relations collected and merged here are indeed the "right" ones? Or the only ones? It is not difficult to come up with relations that differ in some way from those in the Appendix and that do not neatly fall under a single item in the taxonomy shown in the next section.

This is a standard objection to *any* set of terms proposed to fulfill some function. The standard response holds here too: there is no guarantee that these are the "right" relations, whatever "right" may mean<sup>3</sup>. The particular relations proposed here are certainly open to question, but their strongest support is that they are a synthesis of the terms proposed in over 30 different investigations from different fields. The possibility always exists that new interclausal relations will be needed that cannot be subsumed under existing nodes in the taxonomy, though we believe this to be unlikely, based on our experience in compiling the hierarchy: halfway through this study, the topmost tiers had essentially been established, and almost all new relations found were simply specializations of existing ones. We expect that when new domains are investigated, the hierarchy will grow primarily at the bottom, and that the ratio of the number of relations added at one level to the number of relations added at the next lower level will be low, for all levels. In addition, as has been mentioned before, there is mounting evidence from actual attempts at constructing working systems (text planners and discourse analyzers) that intersegment relations of this type are required to guide inference and planning processes.

The collected relations are listed in the Appendix. We next turn to the question of taxonomizing them.

## 2.3 Organizing the Relations

Given the semantic overlaps of many of the relations, it was soon clear that they could be taxonomized somehow. The most informative taxonomization was a traditional two-dimensional hierarchic organization of increasing semantic specificity, with one dimension constrained in the number of relations and the other unconstrained (thus the more general a relation is, the higher it is in the hierarchy, while the more a relation is specified to distinguish it from others, the more its semantics are enhanced, and the lower it appears in the hierarchy).

Here an objection raised by the Parsimonious Position applies: The taxonomy, being unbounded toward the bottom, places one on the slippery slope toward having to deal with the full

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<sup>3</sup>Similarly, there is no guarantee that the terms VERB, NOUN, ADJECTIVE, ADVERB, etc. are the "right" and "only" labels for types of words; they have simply been canonized by long use and much experience. Other terms may appear more natural in other languages, such as in languages that make no syntactic or morphological distinction between nouns and adjectives.

complexity of semantics. Simply working on the structure of discourse is difficult enough without bringing in the complexity of semantic knowledge. The response: There is no reason to fear the complexity of an unbounded set of terms, whether semantic or not, as long as the terms are well-behaved and subject to a pattern of organization which makes them manageable. A taxonomization of the terms in which all the pertinent information about discursal behavior is captured near the top (which is maximally general, bounded, and well-understood) and not at the bottom (which permits unboundedness and redundancy) presents no threat to computational processing. Each discourse relation simply inherits from its ancestors all necessary processing information, such as cue words and realization constraints, and adds its unique peculiarities, to be used for inference (in parsing) or for planning out a discourse (in generation). Increasing differentiation of relations, continued until the very finest nuances of meaning are separately represented, need be pursued only to the extent required for any given application. Thus "unbounded" growth of semantic relations is not a problem, as long as they can be subsumed under existing nodes in the taxonomy.

The top tier of the hierarchy presented the most serious problems. A top-level organization ideally should satisfactorily reconcile the Parsimonious and Profligate positions and make possible the most constrained and yet predictive theory of discourse structure relations, thereby enabling the clearest generalizations. However, attempts to taxonomize all the relations under DOMINATES and SATISFACTIONPRECEDES or under Halliday's three top-level relations ELABORATION, ENHANCEMENT, and EXTENSION both failed, proving either unworkable or not informative enough (see [Hovy 90b]).

Recent work in computational discourse analysis and generation increasingly suggests that several parallel and non-isomorphic structural analyses should be given for a discourse at the clause level and upward: [Moore & Pollack 93] argue for the differentiation of semantic and intentional information into two distinct discourse structures, [Redeker 93] and [Lambert & Carberry 91] each propose different triple parallel analyses of discourse structure, and [Hovy 93] names four different perspectives at the clause level and above that require a distinct structure.

In line with such arguments, and following our text planning experience with relations from Rhetorical Structure Theory [Mann & Thompson 88, Mann & Thompson 86], as reported among others in [Hovy 88, Hovy 90a, Maier & Brown 90, Hovy et al. 92], we decided that a functional perspective is the most illuminating to take. We therefore partitioned the relations into three broad groups according to which primary function they perform in text. (A similar subcategorization strategy was discussed in [Mann & Thompson 88]). The three functions themselves are motivated by Halliday's subcategorization of linguistic phenomena into three so-called metafunctions *ideational* (i.e., semantic), *interpersonal* (i.e., author- and/or addressee-related), and *textual* (i.e., presentational) [Halliday 85]. As described below, semantic information such as causality, generalization, class membership, temporal sequentiality, etc., is expressed by ideational relations;

interpersonal relations express the author's communicative goals such as to describe, motivate, explain, etc.; and textual relations are used to form the discourse into a coherent whole, determining pronouns and other anaphora usage or linearizing sequences of topics.

The taxonomy under this three-way subcategorization is given in Figure 1. The number associated with each relation indicates the number of different researchers who have listed the relation and may be interpreted as a vote of confidence in it.

In this section we motivate the top-level classification into three parts by appealing to factors central to text planning: the types of information required to define and use the relations and the resulting types of illocutionary and perlocutionary effects that the relations have in the discourse.

### 2.3.1 Ideational Relations

We define ideational (i.e., semantic) relations between adjacent segments of material as those relations that express some experience of the world about us and within our imagination. This knowledge is of course shared by but not limited to the discourse interlocutors.

We have classified the ideational relations, such as ELABORATION and its various subtypes, SEQUENCE, CIRCUMSTANCE, CONTRAST, etc. (see Figure 1), together, since they are all defined with respect to their semantic properties. For example:

*"Ben poured coffee into the cup. When next he looked, he saw that it had been drunk."*

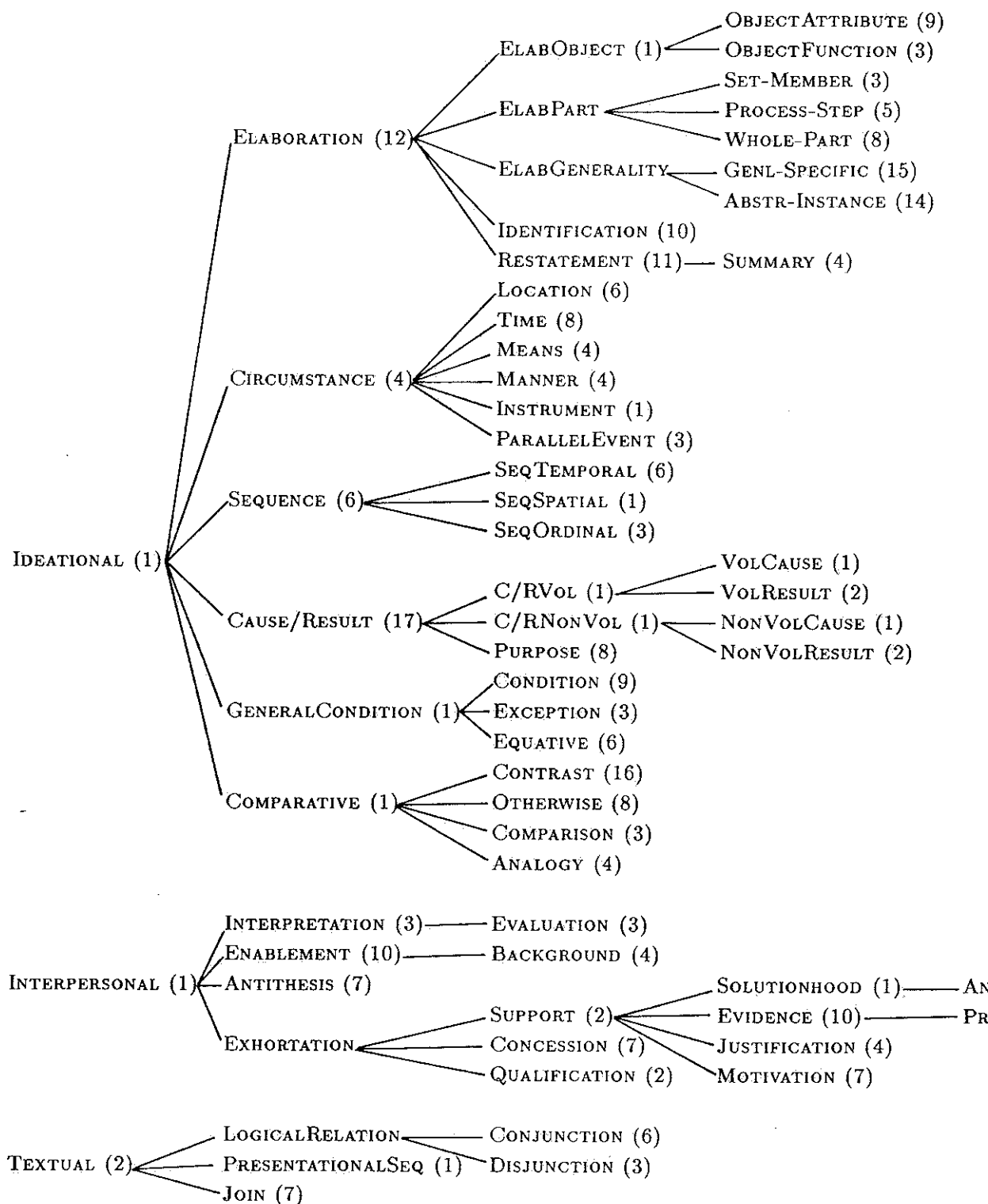
The sequential relationship between the two clauses is cued by the word "when" and by the referential identification of "Ben" with "he" and "coffee" with "it". The temporal (semantic) sequentiality of the second clause after the first is given by the fact that Ben's discovery could only occur *after* he poured the coffee into the cup. The interclausal relation SEQUENCE must be specified in terms of the underlying temporal relationship between the events mentioned in the two clauses — a semantic fact about the world.

Given their semantic nature, the use of ideational relations can be determined by means of operations on a knowledge base in a computer. In many instances, relations can be mapped onto knowledge base constructs; for example, the GENERAL-SPECIFIC subtype of ELABORATION can be mapped onto IS-A or CONCEPT-INSTANCE links in conventional knowledge representation formalisms. No explicit reference to a user model or any other external source of knowledge is generally required.

### 2.3.2 Interpersonal Relations

We define interpersonal relations as holding between adjacent segments of textual material by which the author attempts to affect the addressee's beliefs, attitudes, desires, etc., by means

Figure 1: A taxonomy of discourse segment relations. The number associated with each relation indicates the number of different researchers who listed the relation and may be interpreted as a vote of confidence in it.



of language. The perlocutionary effects achieved by these relations are convincing, enabling, motivating, giving evidence, interpreting and evaluating.

We found that relations such as MOTIVATION, JUSTIFICATION, ANTITHESIS, all necessarily involve in their definitions the addressee's knowledge, beliefs, or attitudes toward the propositional content of the text. For example,

*"The new Tech Report abstracts are now in the journal area of the library near the abridged dictionary. Please sign your name by any that you would be interested in seeing."* (from [Mann & Thompson 88])

The enabling relation that holds between the two sentences concerns the addressee's knowledge and desire to express his or her interests in certain Tech Reports. It is not possible to define the interclausal relationship used without reference to the addressee. This essential aspect of interpersonal relations is reflected in the Mann and Thompson's definitions (*ibid.*) of, say,

- EVIDENCE:

*The reader's comprehending the satellite increases his belief of the nucleus.*

- MOTIVATION:

*Comprehending the satellite increases the reader's desire to perform the action presented in the nucleus.*

Other interpersonal relations, such as INTERPRETATION and EVALUATION, must be defined in terms of the goals and intentions of the author.

Since the use of interpersonal relations is predicated mainly on the interests, beliefs, and attitudes of the addressee and/or author, relations of this type are usually defined in a computer system with respect to a user model.

### 2.3.3 Textual Relations

We define textual (i.e., presentational) relations as holding between adjacent segments of text that are not meant to be directly related ideationally or interpersonally, but whose relationship exists solely due to the juxtaposition imposed by the nature of the presentation medium.

Typically, the "linear" nature of language enforces the use of relations for presentational purposes; examples are CONJUNCTION and PRESENTATIONALSEQ. For example, the latter is used as follows:

*"There are a number of criteria for distinguishing Ranges from Goals: First, the Range cannot be probed by do to or do with, whereas the Goal can. Second, since nothing is being 'done to' it, a Range element never can have a resultative Attribute*

*added within the clause, as a Goal can... Next, the Range cannot be a personal pronoun, and it cannot normally be modified by a possessive. Finally, a range element (other than one with an 'empty' verb like have or do) can often be realized as a prepositional phrase and under certain conditions it has to be...*

(from [Martin 92], with text formatting removed. The semantics of text formatting instructions and their relationship to intersegment relations is discussed in [Hovy & Arens 90].)

The text makes no claim about the semantic orderedness of the sentences enumerated; these clauses could have appeared in any order.

Most collections of intersegment discourse relations indiscriminately intermix explicitly presentational relations with ideational and interpersonal ones. This, we believe, is due to the fact that *all* intersegment relations play some presentational role in text, which causes a certain amount of confusion. However, for most relations the presentational function is not primary, and when one is aware of this distinction, the problem is greatly reduced. One major remaining source of difficulty is the SEQUENCE family, since in English the same cue words and other textual markers are used to signal presentational sequence as semantic sequence. We solve the problem by creating the purely textual relation PRESENTATIONALSEQ.

A further reason for distinguishing the three classes is their difference in illocutionary force. All the ideational relations are expressed by the single illocutionary act DESCRIBE, while the interpersonal relations are expressed by various perlocutionary acts, including CONVINCE, MOTIVATE, and JUSTIFY. The consequences of this difference on the design of text planning systems are outlined in [Maier & Hovy 92].

## 2.4 Suggestive Evidence for the Structure of Lower Levels of the Taxonomy

Some nonconclusive evidence supports our organization of the lower portions of the hierarchy, though further study must be done to examine all the relations. This evidence is based on a sensitivity to generalization evinced by many cue words and phrases and syntactic realizations. For example, the cue word "then" is associated with SEQUENCE, and can be used appropriately to indicate its subordinates SEQTEMPORAL and SEQSPATIAL, as in:

SEQTEMPORAL: *"First you play the long note, then the short ones"*

SEQSPATIAL: *"On the wall I have a red picture, then a blue one"*

In contrast, the cue words for the two subrelations are specific and cannot be interchanged without introducing the associated connotation:

SEQTEMPORAL: *"After the long note you play the short ones"*

SEQSPATIAL: *"Beside the red picture is the blue one"*

Thus the relation associated with “then” subsumes the relations associated with “after” and “beside”, mirroring the structure of the taxonomy. Similar observations hold for a number of the relations, including SOLUTIONHOOD and RESTATEMENT.

Preliminary investigation indicates possible additional evidence in the syntactic realization of some relations: When a relation typically gives rise to a dependent clause, then its subrelations tend to do so as well. This surmise requires study by linguists and is given here as a suggestion. (As is illustrated by the work of [Martin 92], syntactic commonalities between relations typically occur toward the fringes of our taxonomization rather than toward the top.)

### 3 Conclusion

A rather gratifying result of the synthesis presented here is that a relatively small number of core relations, organized into three principal types, suffice to cover essentially all types of clause-level intersegment relations proposed by the sources. This suggests that other relations not yet in the hierarchy are likely to be subtypes of relations already in it, preserving the boundedness of the number of relation types.

While we do not claim that discourse structure relations of the type presented in this paper suffice to capture all aspects of discourse structure, we believe that the relations are a necessary part of any structural description of coherent discourse. The author’s intentions, decomposed into the purpose of each discourse segment and related using interpersonal relations, co-direct the formation of the discourse together with the semantic material and their ideational relations. The surface form of the discourse is captured in a presentationally oriented discourse structure in which textual relations figure. Any account of discourse structure that ignores these types of intersegment relations is incomplete in an important way.

While some evidence is provided for the structure of the hierarchy, we make no claim that this taxonomy is complete or correct in all details. It is certainly open to elaboration, enhancement, and extension! Our hope is that it will serve the community by providing a common starting point and straw man for future work on discourse structure.

### 4 Acknowledgments

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sent us their relations. We are still collecting relations and continuing to update the taxonomy...a task like this is never completed.



## 5 Appendix

The discourse structure relations taxonomized in Figure 1 was drawn from the following sources (the researchers, identified by initials, are listed after the table. In the parenthesized comments, *A* stands for author and *R* for reader):

<b>Ideational</b>	MH
Elaboration	MT, JH, JG, MP, GH, BF, KD, DSN, QG, MH, IMM, LA
Elab-Object	IMM
Object-Attribute	MT, HI, HL, KM, LP, JG, MP, MM, MH
Object-Function	HL, KM, MP
ElabPart	
Set-Member	MT, KM, JG
Process-Step	MT, HP, HI, MP, DL
Whole-Part	MT, HI, HL, KM, JG, MP, AC, DL
Elab-Generality	
General-Specific	MT, HP, JH, KM, JG, TNR, HS, MP, KD, AC, NS, RC, QG, MH, IMM
Abstract-Instance	MT, HP, JH, KM, LP, TNR, JG, HS, MP, MM, RC, QG, MH, IMM
Identification	KM, JG, HS, MP, KD, AC, MM, QG, ST, RJ
Restatement	MT, KM, KD, DSN, NS, RR, RC, QG, MH, WL, IMM
Conclusion (interp at end)	KM, JG, HS, KD, RR, RC, QG
Summary (short restatement)	MT, DSN, RC, QG
Circumstance	MT, JG, DSN, QG
Location	HI, HL, KD, QG, RJ, MH
Time	HI, HL, TNR, KD, QG, RJ, MH, IMM
Means	MP, QG, ST, MH
Manner	QG, MH, IMM, SSN
Instrument	QG
Parallel-Event	KD, QG, RJ
Sequence	MT, JH, LP, KD, DSN, RC
Seq-Temporal	HI, HP, LP, DL, NS, MH
Seq-Spatial	NS
Seq-Ordinal	LP, DSN, QG
Cause/Result	JH, KM, TNR, JG, GH, KD, LP, RL, RR, RC, QG, RJ, SA, MH, LA, IMM, SSN
C/RVol (volitional)	IMM
Vol-Cause	MT
Vol-Result	MT, WL
C/RNonvol (nonvolitional)	IMM
NonVol-Cause	MT
NonVol-Result	MT, MP
Purpose	MT, HP, KD, QG, SA, MH, IMM, SSN
General-Condition	IMM
Condition	MT, JG, LP, RL, DL, RC, MH, IMM, SSN
Exception	RL, MH, SSN
Comparative	IMM

Equative (like, while)	JG, TNR, DL, QG, MH, IMM
Contrast	MT, JH, LP, IR, TNR, MP, RL, GH, BF, KD, NS, DSN, RC, QG, WL, IMM
Otherwise (if then else)	MT, LP, NS, RL, RC, QG, MH, IMM
Comparison	KM, HS, MH
Analogy	KM, JG, MP, RR
<b>Interpersonal</b>	MH
Interpretation	MT, KD, IMM
Evaluation (A opinion)	MT, KD, JH
Enablement	MT, JH, HL, TNR, MP, KD, DSN, DL, SA, LA
Background	MT, JH, HL, MP
Antithesis	MT, DSN, JG, HS, KM, QG, SSN
Exhortation	
Support	RR, RC
Solutionhood (general prob)	MT
Answer (numeric prob)	KM
Evidence (support claim)	MT, KM, JG, MP, BF, KD, ST, WL, IMM, SSN
Proof	MP
Justification (for A act)	MT, IR, DL, WL
Motivation (for R act)	MT, MP, DSN, DL, MM, IMM, SSN
Concession	MT, DSN, KD, RR, IMM, QG, MH
Qualification	ST, IMM
<b>Textual</b>	MH, IMM
Logical-Relation	
Conjunction	MT, DSN, RC, QG, MH, IMM
Disjunction	QG, MH, IMM
Pres-Sequence	IMM
Joint	KM, RC, KD, GH, JH, MT, IMM

(Note: Not all relations of QG and RJ are interclausal; some are intraclausal.)

In order to facilitate further investigations of relation definitions, we provide here our cross-classification of our sources' relations (in the left-hand column) and the corresponding relation from our taxonomization (Figure 1).

AC: [Cawsey 90]		HI: Circumstance	Time, Location
AC: HowItWorks	(script)	HI: Attribute	ObjctAttrib, Wholepart
AC: WhatItDoes	(script)	HI: Details	ProcessStep
AC: Identification	Identificatio	HL: Description	(script)
AC: Constituency	WholePart	HL: Access	(script)
AC: ComponentIdentfctn	WholePart, Identification	HL: Features	(script)
AC: ParticularBehaviour	GeneralSpecific	HL: Open	Enablement (sub)
		HL: Cost	Enablement (sub)
		HL: IntFeature	ObjectAttribute
		HL: History	Background (sub)
		HL: ElabPartWhole	Wholepart
		HL: ElabDetails	ObjctAttrib, ObjctFnctn
		HL: CircumstanceLoc	Location
		HL: CircumstanceTime	Time
		HP: Sequence	SeqTemporal
		HP: Purpose	Purpose
		HP: Elaboration	GeneralSpecific, AbstractInstance, ProcessStep
BF: [Fox 84]		HS: [Shepherd 26]	
BF: Issue	Elaboration	HS: Comparison	Comparison
BF: Contrast	Contrast	HS: IllustrationGeneral	AbstractInstance
BF: Evidence	Evidence	HS: Amplification	GeneralSpecific
BF: Elaboration	Elaboration	HS: Conclusion	Conclusion
		HS: Topic	Identification
		HS: IllustrationPartlr	AbstractInstance
		HS: Contrasting	Antithesis
DL: [Litman 85]		IMM: [Ivir et al. 80]	
DL: Step	ProcessStep	IMM: Conjunction	Conjunction
DL: After	SeqTemporal	IMM: Additive	
DL: Next	SeqTemporal	IMM: Additive-smpl	Conjunction (sub)
DL: Contains	WholePart, ProcessStep	IMM: Additive-emph	Conjunction (sub)
DL: Motivates	Motivation, Justification	IMM: Converse	Contrast (sub)
DL: Enables	Enablement	IMM: Disjunction	Disjunction
DL: Equal	Comparison	IMM: Simple-Disjunctn	Disjunction
DL: Parameter	WholePart (sub)	IMM: Replacive	Otherwise
DL: Condition	Condition	IMM: Reformulation	Elaboration
		IMM: Illustrative	GeneralSpecific
		IMM: I.e.	AbstractInstance
		IMM: Concise-refmltn	Equative
		IMM: Preferred-rfmltn	Restatement (sub)
		IMM: Contradictn-Contrst	Comparative
		IMM: Contradiction	Concession
		IMM: Opposing-factors	Contrast
DSN: [De Souza et al. 89]			
DSN: Antithesis	Antithesis		
DSN: Summary	Summary		
DSN: Restatement	Restatement		
DSN: List	SeqOrdinal (sub)		
DSN: Concession	Concession		
DSN: Circumstance	Circumstance		
DSN: Elaboration	Elaboration		
DSN: Contrast	Contrast		
DSN: Joint	Joint		
DSN: Sequence	Sequence		
DSN: MotivatnEnablmt	Motivation, Enablement		
GH: [Hirst 81]			
GH: Cause	Cause		
GH: Parallel	Parallel (other)		
GH: Contrast	Contrast		
GH: Elaboration	Elaboration		
HI, HL, HP: [Hovy 90a, Hovy 89, Hovy 88]			
HI: Sequence	SeqTemporal		

IMM:Concessive	Concession	IMM:Degree-Manner	Comparative
IMM:Contradict-rlty	Concession (sub)	IMM:Degree	Comparative (sub)
IMM:Contrary	Evidence	IMM:Manner	Comparative (sub)
IMM:Contrast	Contrast	IMM:Temporal	Time
IMM:Contrastive-neg	Contrast	IMM:Simultaneity	Time (sub)
IMM:Rhetorical-Links	Textual	IMM:Non-Simultnty	Time (sub)
IMM:Serial-Order	Pres-Sequence	IMM:Precedence	Time
IMM:Instncs-1-gnlzn	Joint	IMM:Subsequence	Time
IMM:Continuity	Next Topic		
IMM:Resmptn-theme	Previous Topic	IR: [Rankin 89]	
IMM:Breach	(dialogue)	IR:Justify	Justification
IMM:Attitude	Interpretation?	IR:Alternative	Contrast
IMM:Focus-Directing	?		
IMM:Gratis-Addition	Evidence	JG: [Grimes 75]	
IMM:Specific-Shift	General-Specific	JG:Paratactic	Satisfaction Preceding
IMM:General-Shift	General-Specific	JG:Hypotactic	Dominating
IMM:Retrospective-Ref	Elab-Object	JG:Supporting	? Dominating
IMM:Adverbs-as-Reltrs		JG:Setting	Circumstance
IMM:Causation	Cause-Result	JG:Identification	Identification
IMM:Inference	Evidence	JG:Specifically	Elaboration
IMM:Reason-Simple	C/RVol, Nonvol	JG:Attributive	Object Attribute
IMM:Reason-Emph	C/RVol, Nonvol	JG:Equivalent	Restatement
IMM:Exceptional	C/RVol, Nonvol	JG:Specification	General Specific
IMM:Purpose	Purpose	JG:Explanation	Cause/Result
IMM:Purpose-pos	Purpose	JG:Evidence	Evidence
IMM:Purpose-neg	Purpose	JG:Analogy	Analogy
IMM:Result-Cause	Cause-Result	JG:Representative	Abstract Instance
IMM:Result	Cause-Result	JG:Constituency	Whole Part, Set Member
IMM:Cause	Cause-Result	JG:Covariance	Condition (sub)
IMM:Obvious-Cause	Cause-Result (sub)	JG:Alternatives	Antithesis
IMM:Non-Real-Cause	Cause-Result (sub)	JG:Cause Effect	Cause/Result
IMM:Contradcty-Cse	Cause-Result (sub)	JG:Adversative	Antithesis (sub)
IMM:Hypoth-Cause	Cause-Result (sub)	JG:Inference	Conclusion, Cause/Result
IMM:Manner-Causation	Manner		
IMM:Conditionality	General-Condition	JH: [Hobbs 78, Hobbs 79, Hobbs 82, Hobbs 90]	
IMM:Concomitant-Var	General-Condition (sub)	JH:Occasion	Sequence (sub)
IMM:Eventlty-Cnsid	Condition	JH:Enablement	Enablement
IMM:Considerative	Qualification	JH:Cause	Cause
IMM:Condition-Met	Condition	JH:Evaluation	Evaluation
IMM:Comparative-Deg	Condition (sub)	JH:Background-Fcntrl	Background (sub)
IMM:Temp-Spat-Cond	Condition (sub)	JH:Background-Visual	Background (sub)
IMM:Condition-Neg	Qualification	JH:Explanation	Cause/Result (sub)
IMM:Condition-Irrl	Condition (sub)	JH:Parallel	Parallel (other)
IMM:Conditn-Impsd	Condition (sub)	JH:Elaboration	Elaboration
IMM:Conditn-Imagnd	Condition (sub)	JH:Generalization	General Specific
IMM:Cond-Flmmt-Ad	Condition (sub)	JH:Example	Abstract Instance

JH:Contrast	Contrast	KM:CauseEffect	Cause/Result
JH:ViolatedExpctatn	Contrast (sub)	KM:IdentifctnDpth	ObjectAttribute (sub)
		KM:IdentifctnAttr	ObjectAttribute
KD: [Dahlgren 88]		KM:Positing	Identification (sub)
KD:Sequence	Sequence	KM:Generalization	GeneralSpecific
KD:Reported-Event	Elaboration, Interpretation		
KD:Enablement	Enablement	LA: [Lascarides & Asher 91]	
KD:Cause	Cause	LA:Cause	Cause/Result
KD:Goal	Purpose	LA:Elaboration	Elaboration
KD:Parallel	Parallel (other)	LA:Background	Background
KD:Contrast	Contrast	LA:Result	Cause/Result
KD:Evidence	Evidence		
KD:Generalization	GeneralSpecific	LP: [Polanyi 88]	
KD:Elaboration	Elaboration	LP:Sequential	SatisfactionPreceding
KD:Restatement	Restatement	LP:Expansion	Dominating
KD:Qualification	Concession	LP:Interruption	(dialogue)
KD:Evaluation	Evaluation	LP:Binary	Cause/Result, Otherwise,
KD:Description	Identification		Condition
KD:Situation	Circumstance	LP:Expansion	ObjectAttribute
KD:Situation-Acty	Circumstance (sub)	LP:Sequence	Sequence
KD:Situation-Time	Time	LP:Sequence-List	SeqOrdinal
KD:Situation-Place	Location	LP:Seqnce-TopicChain	NextTopic (other)
KD:Import	Interprettn, Conclsn (sub)	LP:Seqnce-Narrative	SeqTemporal
KD:UnbiasedCmnt	Interpretation	LP:Instance	Instance
KD:BiasedCmnt	Evaluation	LP:Elaboration	ObjectAttribute
		LP:EvaluativeCmnt	Evaluation
		LP:Contrast	Contrast
KM: [McKeown 85]			
KM:Identification	(script)		
KM:Constituency	(script)	MH: [Halliday 85]	
KM:Attributive	(script)	MH:Elaboration	
KM:CompareContrast	(script)	MH:Exposition	Restatement
KM:Attributive	ObjectAttribute	MH:Exemplification	GenlSpec, AbstInstnce
KM:Amplification	ObjectAttribute (sub)	MH:Clarification	ObjectAttribute (sub)
KM:IllustratnPrtr	AbstractInstance	MH:Extension	
KM:Representative	AbstractInstance (sub)	MH:Addition	
KM:Answer	Answer	MH:Additive	Conjunction
KM:Comparison	Comparison	MH:Adversative	Conjunction (sub, neg)
KM:Adversative	Antithesis	MH:Variation	
KM:Explanation	Cause/Result (sub)	MH:Replative	Otherwise
KM:Inference	Conclsn, Cause/Rslt (sub)	MH:Subtractive	Exception
KM:Identificatn-Class	Identification	MH:Alternative	Disjunction
KM:Identificatn-Functn	ObjectFunction	MH:Enhancement	
KM:Analogy	Analogy	MH:Temporal	
KM:Constituency	WholePart, SetMember	MH:SameTime	Equative (sub)
KM:Renaming	Restatement (sub)	MH:DiffntTime	SeqTemporal
KM:Evidence	Evidence	MH:Spatial	Location

MH:Manner		MP:Process-Step	ProcessStep
MH:Means	Means, Manner	MP:Object-Attr	ObjectAttribute
MH:Comparison	Comparison	MP:Concept-Ex	AbstractInstance
MH:Causal		MP:WholePart	WholePart
MH:Reason	Cause/Result	MP:Background	Background
MH:Purpose	Purpose	MP:Backgrnd-Def	Background (sub)
MH:ConditionPos	Condition	MP:Backgrnd-Sub	Background (sub)
MH:ConditionNeg	Condition (sub: neg)	MP:Evidence	Evidence
MH:Concessive	Concession	MP:Contrast	Contrast
MM: [Maybury 90]		MP:Abstraction	GeneralSpecific
MM:Identification	Identification	MP:Consequence	NonVolResult
MM:SupptCharstic	ObjectAttribute		
MM:SupportClassify	AbstractInstance	MT: [Mann & Thompson 88, Mann & Thompson 86]	
MM:Recommend	Motivation	MT:Sequence	Sequence
MP: [Moore 89, Moore & Swartout 90, Paris 90]		MT:Cause/Result	Cause/Result
MP:RcmndEnablMtv	(script)	MT:VolCause	VolitionalCause
MP:MakeComptnt	Enablement	MT:VolResult	VolitionalResult
MP:Persuade	Motivation	MT:Non VolCause	Non VolitionalCause
MP:PrsByMot	Motivation	MT:Non VolResult	Non VolitionalResult
MP:ElbPrcStp	ProcessStep	MT:Purpose	Purpose
MP:PrsInstOf	AbstractInstance	MT:Enablement	Enablement
MP:EvdInstOf	AbstractInst, Evidnce	MT:Solutionhood	Solutionhood
MP:ProveResult	Proof	MT:Restatement	Restatement
MP:ElabGenSpStp	GeneralSpecific	MT:Summary	Summary
MP:InfmAndPersde	(script)	MT:Contrast	Contrast
MP:Contrast	Contrast	MT:Antithesis	Antithesis
MP:Differences	Contrast	MT:Otherwise	Otherwise
MP:Difference	Contrast	MT:Condition	Condition
MP:Describe	(script)	MT:Joint	Conjunction
MP:ClsAsc&Rls	Identification	MT:Circumstance	Circumstance
MP:Generalize	GeneralSpecific	MT:Elaboration	Elaboration
MP:Instance	AbstractInstance	MT:Elab-ObjAttr	ObjectAttribute
MP:Analogy	Analogy	MT:Elab-SetMemb	SetMember
MP:Part	WholePart	MT:Elab-WhlePrt	WholePart
MP:Use	ObjectFunction	MT:Elab-ProcStep	ProcessStep
MP:Proof	Proof	MT:Elab-GenlSpec	GeneralSpecific
MP:PrfModusPns	Proof (sub)	MT:Elab-AbstInst	AbstractInstance
MP:ProofByMeans	Proof (sub)	MT:Evidence	Evidence
MP:Motivation	Motivation	MT:Justification	Justification
MP:MotReplAct	Motivation (sub)	MT:Motivation	Motivation
MP:MotAct	Motivation	MT:Concession	Concession
MP:MotActByMns	Motivation (sub)	MT:Interpretation	Interpretation
MP:Means	Means	MT:Evaluation	Evaluation
MP:Elaboration	Elaboration	MT:Background	Background
MP:General-Spec	GeneralSpecific	NS: [Simonin 88]	

NS:Contrast	Contrast	QG:Identification	Identification
NS:Restatement	Restatement	QG:Reformulation	Restatement
NS:Restriction	Otherwise	QG:Attribution	Elaboration
NS:SpatialOrder	SeqSpatial	QG:Inclusion	GenlSpec, AbstInst
NS:TemporalOrder	SeqTemporal	3: - some types of adjuncts -	
NS:GeneralSpecific	GeneralSpecific	QG:Place	Location
		QG:Position	Location (sub)
		QG:Direction	Location (sub)
QG: [Quirk & Greenbaum 73]		QG:Time	Time
Note — not all these are interclausal		QG:When	Time (sub)
1: - interclausal relations -		QG:Duration	Time (sub)
QG:Time	Time	QG:Frequency	Time (sub)
QG:Ordinals	SeqOrdinal	QG:Relational	Equative (sub)
QG:Place	Location	QG:Process	Circumstance
QG:And	Conjunction	QG:Means	Means
QG:Enumeration	SeqOrdinal	QG:Instrument	Instrument
QG:Addition	Conjunction	QG:Manner	Manner
QG:Transition	NextTopic (other)	QG:Other	
QG:Summation	Summary	QG:Purpose	Purpose
QG:Apposition	Restatement	QG:Result, Cause	Cause/Result
QG:Result	Cause/Result		
QG:Inference	Conclusion, Cause/Result		
QG:OrRefmlnRplmnt	Disjunction, Restatement	RC: [Cohen 83]	
QG:But	Otherwise	RC:Parallel	Sequence, Condition, Conjunction, Parallel
QG:Contrast	Contrast		
QG:Concession	Concession	RC:Summary	Summary
QG:ConcessionNml	Concession	RC:Reformulation	Restatement
QG:ConcessionPrt	Concession	RC:Detail	GenlSpec, AbstInst
QG:ConcessionNom	Concession	RC:Inference	Cause/Result, Concl
QG:For	Cause/Result, Conclusion	RC:Contrast	Contrast, Otherwise
2: - intraclausal conjuncts -		RC:EvidenceSupport	Support
QG:Enumerative	SeqOrdinal	RC:Claim	Identification (sub)
QG:Reinforcing	Conjunction (sub)		
QG:Equative	Conjunction (sub)	RJ: [Jackendoff 83]	
QG:Transitional	NextTopic (other)	Note — Not all of these are interclausal	
QG:Summative	Conclusion	RJ:SpatialLocMotion	Circumstance
QG:Apposition	Restatement	RJ:SpatialLocation	Location
QG:Result	Cause/Result	RJ:Causative	Cause/Result
QG:Inferential	Conclusion, Cause/Result	RJ:Temporal	Time
QG:Reformulatory	Restatement (sub)	RJ:Possessive	? (not interclausal)
QG:Replative	Otherwise	RJ:Identificational	Identification
QG:Antithetic	Antithesis	RJ:Circumstantial	ParallelEvent
QG:Concessive	Concession	RJ:Existential	? (not interclausal)
QG:TemporalTrnsitn	Circumstance (sub)		
QG: - apposition in noun phrases -		RL: [Longacre 76]	
QG:Appellation	Identification (sub)	RL:Exception	Exception
QG:Designation	Ident (sub), Restmnt	RL:BinaryParagraph	Cause/Result, Otherwise,

	Condition	ST:PossibleRebuttals	Qualification (sub)
RR: [Reichman 78]		TNR: [Tucker et al. 86]	
RR:Support	Support, Cause/Result	TNR:Temporal	Time
RR:RestmntCnclsn	Restatement, Conclusion	TNR:Condition	Cause/Result, Enablement (sub)
RR:Concession	Concession		Contrast
RR:Analogy	Analogy	TNR:Contrastive	Restatement (sub)
RR:TextDevelopment	NextTopic (other)	TNR:Equivalent	AbstractInstance
RR:Interruption	(dialogue)	TNR:Expansion	GeneralSpecific
RR:RetnToPrevTopic	PreviousTopic (other)	TNR:Generalization	Restatement
RR:IndrectChallnge	(dialogue)	TNR:Similar	(dialogue)
RR:DirectChallenge	(dialogue)	TNR:Digression	
RR:PriorLgclAbstrn	PrevTopic (other) (sub)		
SA: [Schank & Abelson 77]		WL: [Wu & Lytinen 90]	
SA:Result	Cause/Result	WL:Evidence	Evidence
SA:Enable	Enablement	WL:Justification	Justification
SA:Initiate	Cause/Result (sub)	WL:Elaboration	Elaboration
SA:ReasonFor	Purpose	WL:Contrast	Contrast
SA:Disable	?	WL:Restatement	Restatement
		WL:Volitional-Result	VolitionalResult
SSN: [Sanders et al. 92]			
SSN:Cause-Conseq	Cause/Result		
SSN:Contr-Cse-Consq	Exception, Antithesis ?		
SSN:Conseq-Cause	Cause/Result		
SSN:Contr-Consq-Cse	Exception, Antithesis ?		
SSN:Argument-Claim	Evidence		
SSN:Instrument-Goal	Purpose, Manner		
SSN:Condition-Consq	Condition		
SSN:Contr-Arg-Claim	Concession (sub)		
SSN:Claim-Argument	Evidence		
SSN:Goal-Instrument	Purpose		
SSN:Conseq-Conditi	Condition		
SSN:Contr-Clm-Arg	Concession, Antithesis ?		
SSN:List	Joint		
SSN:Exception	Exception		
SSN:Opposition	Antithesis		
SSN:Enumeration	Joint, Pres-Sequence		
SSN:Concession	Concession		
ST: [Toulmin 58]			
ST:Claim	Identification (sub)		
ST:Data	Evidence (sub)		
ST:Warrant	Means		
ST:Backing	Evidence (sub)		
ST:ModalQualification	Qualification		



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