

Lexical marking of discourse relations - some experimental findings

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Abstract

Both in written and in spoken language, discourse relations may or may not be signalled by lexical material. In this paper we present the results of two experiments which were intended to answer some questions concerning the relationship between discourse relations and their lexical markers. Assuming that, in any case, discourse relations are inferred by the addressee/interpreter, the question arises about what suggests to the speaker/writer the strategical decision of using rather than not using explicit signals, such as connectives or cue phrases. In order to answer this main question, the following subquestions need to be answered: first, which role do discourse markers play in the task of reconstructing the discourse relation which was originally intended by the speaker/writer. Second, to what extent the lexical signalling of the relation is essential for the relation to be inferred. Third, whether there are coherence relations that are always lexically signalled and whether there are any that are never lexically signalled. Finally, if the different access that addressees have to the linguistic context in spoken and written language affects the kind of relations employed in the construction of text and/or in the realization of the relations.

1 Discourse Relations

Discourse relations have been addressed by a number of different approaches for the purposes of text understanding, text analysis and text planning. This results not only in a difference in the theoretical interpretations of the concept, but also in a heterogeneity among the actual sets of relations which are assumed to be psychologically and/or descrip-

tively adequate. On the other hand, the various approaches show a considerable overlap in the individual relations adopted, thus suggesting a "common ground" shared by all approaches. For the aims of our research, rather than committing to one or another interpretation of discourse relations, we have abstracted from the various taxonomies three broad classes or types of relations, namely an *additive* type, a *consequential* type, and a *contrastive* type. These three classes are identified on the ground of the basic cognitive operation which is implied in the instantiation of a connection between adjacent segments of discourse.

Additive relations share the common feature of implying some kind of *similarity* between the segments they relate. We conceive the notion of similarity in a broad sense, so that an additive relation is supposed to hold when

- a) $p(x)$ can be inferred from the assertion of S_1 and $p(y)$ can be inferred from the assertion of S_2 , where x and y belong to a similar class of entities. For example:

1. *The French proposal to invoke the right to self-determination of that population having been rejected (S_1), also the idea of a military intervention has been abandoned (S_2).*

- b) $p(X)$ can be inferred from the assertion of S_1 and $p(x)$ can be inferred from the assertion of S_2 , where x is a member or subset of X (as for specification or exemplification). For example:

2. *In spite of their unwelcoming appearance, the islands off Kerry have been once inhabited (S1). Skellig Michael, for instance, hosted a monastery in the VI century (S2).*
- c) $p(x)$ can be inferred from the assertion of S_1 and $p(X)$ can be inferred from the assertion of S_2 , where x is a member or subset of X (opposite case of generalization). For example:
3. *Phil is 6 feet tall (S1). All the men in my family are tall (S2).*
- d) $p(x)$ can be inferred from the assertion of S_1 and $p(x)$ can be inferred from the assertion of S_2 (that is, the "same" proposition can be inferred from the assertion of the two segments; this class concerns reformulations and corrections). For example:
4. *One of the central notions of neurophysiology is that neurons work in "frequency modulation" (S1). That is, they exchange signals by increasing or decreasing the frequency of nervous impulses (S2).*
- e) $p(x)$ can be inferred from the assertion of S_1 and $q(x)$ can be inferred from the assertion of S_2 . This class concerns those cases generally identifiable as "continuation", as in 5, as well as instances of "alternative", as in 6:
5. *In 1732 Tiepolo was in Bergamo, painting Colleoni chapel; he received, then, important commissions for the venetian churches (S1) and dedicated himself to the decoration of palaces and villas of the high venetian aristocracy (S2).*
6. *Pursuing the desire of a better feeling, one smokes (S1) or keeps swallowing drugs (S2).*
- f) $p(x)$ can be inferred from the assertion of S_1 and $q(y)$ can be inferred from the assertion of S_2 , where x and y are connected by one of the following relations (cf. van Dijk, 1977): whole-part, including-included, possessor-possession, outside-inside, Figure-ground (cf. Hobbs, 1985; 1990), as in
7. *They climbed upon the hill (S1). In the distance they could see the line of the sea (S2).*

and script-based relations, as in the two following examples:

8. *Paul is a doctor (S1). The children are three and five years old (S2).*
9. *The effect is guaranteed (S1) and the pureness increases the risks of overdose (S2).*

Generally speaking, the additive class of relations covers Hobbs' **Parallel**, **Elaboration**, **Exemplification** and **Generalization** relations (cf. Hobbs 1985; 1990), Mann and Thompson's **Sequence**, **Elaboration**, **Joint**, **Summary**, **Restatement** and **Interpretation** relations (cf. Mann and Thompson, 1986; 1988); it also embraces the relations **List** and **Enumeration** of (Sanders et al., 1993).

Typical markers of the additive type are *and*, *or*, *or else*, *in other words*, *that is*, *or better*, *I mean*, *in addition*, *also*, *alternatively*, *for example*, etc.

Consequential relations share the common feature of establishing an *implication* or a *dependence* of some kind (causal, temporal, modal, concessive, hypothetical, etc.) between the segments they relate. In all the relations belonging to this class the information (or the content) that can be inferred from S_1 implies the information (or the content) that can be inferred from S_2 (or *vice versa*). More precisely, p can be inferred from the assertion of S_1 and q can be inferred from the assertion of S_2 , and p implies q or *vice versa*, from a point of view which can be causal, temporal, modal, hypothetical, etc. Some examples, representative of the different kinds of implication, are the following:

10. *If you want to work (S1), the more you look lean and pale the more they think you're wonderful (S2).*
11. *We should reckon with the resources we dispose of, because no one would accept to go to the moon with a bicycle (S1). It is a question, thus, of attentively evaluating the appropriateness of the means in regard to the target (S2).*
12. *Preparing jams, marmalades and jellies, to be consumed in the winter and to be proudly offered to friends, can be a pleasant and relaxing pastime (S1). The operation, although beginners may think is very complex, does not present, in fact, any particular difficulty (S2).*

13. *From 1750 to 1753 he was already working out of Italy in Würzburg, at the residence of the prince-bishop (S1); finally he left to Madrid, where he spent the last eight years of his life concentrating upon the frescos of the royal palace (S2).*

Typical markers are *because, so, so that, thus, as a consequence, as a result, then, while, after, therefore, finally, consequently, it follows, for this purpose, next, etc.*

Contrastive relations share the common feature of implying a contrast of some kind between the segments they relate. The relations of this class represent the negative counterpart of the two preceding classes, thus involving a negative component. As a consequence, this type can be further specified in two subtypes, one which defines those cases implying the negation of a similarity and another which defines those cases implying the negation of an implication. More precisely, a contrastive relation holds when

- a) $p(x)$ can be inferred from the assertion of S_1 and $\neg p(y)$ can be inferred from the assertion of S_2 (negation of the additive type). For example:

14. *John is good-looking (S1). Frank is ugly (S2).*

15. *Cork county is characterized by luxuriant valleys and gorgeous coasts (S1), whereas the territory of Kerry county is wilder and hilly (S2).*

- b) p can be inferred from the assertion of S_1 and q can be inferred from the assertion of S_2 , where p implies $\neg q$ (negation of the consequential type). For example:

16. *Tom is a lawyer (S1) but he is honest (S2).*

17. *Although its port does not have the importance it had in the past (S1), Cork is still the second town of the republic (S2).*

This type of relations covers Mann and Thompson's **Antithesis**, **Concession**, **Otherwise** and **Contrast** relations, Hobbs' **Contrast** and **Violated Expectation**, Sanders et al.'s **Contrastive Cause-Consequence**, **Contrastive Consequence-Cause**, **Contrastive Argument-Claim**, **Contrastive Claim-Argument**, **Opposition** and **Concession** relations, as well as all the

relations sharing a negative polarity value in the approach of (Knott and Mellish, 1996).

Typical markers of this class are *but, while, on the other hand, on the contrary, however, although, nevertheless, in any case, in fact, actually, otherwise, etc.*

2 Experiment 1: The role of discourse markers in comprehension

If connectives play a significant a role in directing the receiver toward the reconstruction of a discourse relation, their presence should result in a higher rate of correct recognition of relations, while their absence should determine a significant worsening in the recognition ability; also, relations different from the original ones may be inferred more easily.

2.1 Methodology and Data Collection

In Experiment 1 subjects had to label the relation perceived between two textual segments, presented in two different versions, either with or without the original connective.

The material for the experiment consisted of two sets of 72 pairs of discourse segments, embedded in a larger context. The segments were taken from a corpus of written texts, of various genres; all items were in Italian. In the "with connective" version, the segments had not been altered; in the "without connective" version, the original text was modified as little as possible. The segments had been chosen in order to form a representative set of the three classes of coherence relations (21 examples for the additive type, 27 for the consequential type, and 24 for the contrastive type; attribution of actual instances to types was made on the basis of the taxonomy in section 1), as well as to display a vast range of connectives for each type of relations.

The subjects were ten undergraduate students. Subjects were instructed to spontaneously label the relation they perceived between the two segments. A half of the subjects had to read 36 examples with the connective and 36 without; the other half had to read the same examples, in inverted order.

2.2 Results and Discussion

The data were analyzed according to the following criteria. For each type of relation, we determined the number of cases where the relation between the segments was correctly inferred, either with connective and without connective. A relation was considered to be correctly inferred when the spontaneous label chosen matched our taxonomy-based classification. Those cases where the relation was not correctly

Additive Type		
	with conn.	without conn.
correct identification	72.6	64.3
uncertain	11.9	9.5
confusions with contrastive	2.4	14.3
confusions with consequential	13.1	11.9
Consequential Type		
	with conn.	without conn.
correct identification	88.9	60.2
uncertain	2.8	3.7
confusions with contrastive	0.9	8.3
confusions with additive	7.4	27.8
Contrastive Type		
	with conn.	without conn.
correct identification	83.3	42.7
uncertain	2.1	9.4
confusions with additive	9.4	31.2
confusions with consequential	5.2	16.7

Table 1: Percentage of recognitions per type

retrieved were further classified in uncertainty instances and confusion instances (i.e., when subjects attributed the relation to a different class). Table 1 illustrates the data for each of the three classes of coherence relations.

The degree of correctness in the answers is taken to be representative of the degree of comprehension of the relations. The data confirm our hypothesis that a connective facilitates the interpreters' ability to infer the relation intended by the message sender. For all types of relations, the absence of the connective corresponds to a reduction in the number of correct answers. However, this reduction displays distinct patterns according to the type of relation involved. The contrastive type shows the highest reduction, while the additive type the lowest. The consequential type holds an intermediate position. Similarly, the different types of relations are not equally affected by the presence/absence of a connective: additive relations seem to be less comprehensible than contrastive and consequential relations; however, they are those which are best comprehended when lexical signalling is missing.

The difficulty with which a contrastive relation is inferred without a connective could be due to the

fact that lexical marking is essential for the inference of the contrastive component of meaning. According to our hypothesis, the contrastive type should be cognitively more complex than the other two, since it involves an additional negative component. If there is lack of marking, the negative or contrastive component of the relation is lost and the relation is thus interpreted as an additive or consequential relation, according to the underlying type, as it is shown by the redistribution into these other two classes.

Lexical marking seems not to have a fundamental role for guiding the inference of additive relations: in fact, there is only a slight difference between the number of correct answers in the condition with connective and those in the condition without connective. This could be due to two different, non competing factors: first, it could be that additive connectives are not particularly efficient for guiding the inference of the relation because of their intrinsic ambiguity. Second, it could also be the case that interpreters tend to instantiate whenever possible a "stronger" implicational relation between two segments. Numerous studies (cf., among others, Townsend and Bever, 1978; Trabasso and Sperry, 1985; Trabasso and van den Broek, 1987; Garnham et al., 1996; Noordman and Vonk, 1997) suggest that the various types of relations differ not only along the dimension of cognitive complexity, but also along the dimension of cognitive relevance. According to these studies, causal and temporal relations are cognitively more relevant since they promote the storage in memory of the connection between information. On the other hand, the ease with which an additive relation is inferred when there is no lexical marking to signal it could be explained by the fact that a relation of this type is inferred by default, since it signals a simple and general continuation without any other particular connotation.

Consequential relations, while showing a reduction in the number of correct answers from the condition with connective to the condition without connective, display a relative ease of comprehension. This is not plausibly explained by making reference to the basic common knowledge shared by writers and readers, since this should determine a good recognition of contrastive relations as well. It is more advantageous to hypothesise that the high degree of understanding of consequential relations is related to the well-known preference toward inferring an implicational relation between the segments (cf. for example Black and Bern, 1981). Again, the fact that this class of relations is the best comprehended one with lexical signalling is explainable in terms of semantic non-ambiguity of the connectives usually

employed for its expression.

In sum, Experiment 1 supports the hypothesis that connectives have a facilitating effect for the inference of the relations intended by the message sender. The fact that not all types of relations are equally facilitated by a connective has been interpreted as the result of three different phenomena: a) semantic ambiguity of connectives for the additive class vs. non-ambiguity of connectives for the consequential and contrastive classes; b) higher cognitive complexity of the contrastive type of relations and hence necessity of connectives for the understanding of the contrastive meaning; c) different cognitive relevance of the different classes of relations.

3 Experiment 2: The role of discourse markers in production

The aim of our second experiment consisted in verifying whether there is any significant difference between spoken and written language, in terms of the kind of relations employed and of lexical marking of the relations. We decided to compare the spoken and written narratives produced by subjects about a common topic. Our original hypothesis was that spoken language would display a lower proportion of cognitively more complex relations as well as an increase in the global marking of the relations. The first expectation was due to the hypothesis that spoken language, being constrained by the limitations imposed by short-term memory, would avoid the cognitively more complex relations and, at the same time, would contain a higher number of connectives as a trace or footsteps of the cognitive processes underlying the production process.

3.1 Methodology and Data Collection

The stimulus employed for this experiment consisted in a humorous story depicted in a set of eleven cartoons, put in order. Pictorial material was considered to be appropriate for the experiment in that it enables the analyst to have a comparable set of narratives based on the same subject; in addition, the pictorial form provides a neutral input with regard to the target form of expression (spoken or written), thus preventing from a priming effect. The subjects were 19 undergraduate students, who were instructed to look at the cartoons and tell the story they presented (the data for subject 9 had been later excluded from analysis). Once the spoken narrative was concluded, they were asked to put the story in written form. Spoken narratives were taped and transcribed according to the standard Italian orthography.

SPOKEN		
length	n. of conn.	conn/claus
131w. 21c.	10.6	1:1.6

Table 2: Length of narratives and percentage of connectives for spoken language; w = words, c = clauses

WRITTEN		
length	n. of conn.	conn/claus
95w. 16c.	7.6	1:2.5

Table 3: Length of narratives and percentage of connectives for written language

In order to compare the two versions of the narratives, each pair of narratives underwent three levels of analysis. First, the total number of connectives was measured, as well as the percentage of connectives in relation to the total number of words and the ratio connectives:clauses. Second, after translating the narratives into a propositional form, we labelled the individual relation holding between a proposition and the preceding one and we determined the relative percentage of every class of relations for both versions, spoken and written. Finally, for each class of relations we measured the proportion of relations which were signalled by a connective.

3.2 Results and Discussion

3.2.1 Length of narratives and percentage of connectives

Tables 2 and 3 illustrate, for each pair of narratives, the mean values for length, the total number of connectives, the percentage of connectives over the total number of words and the connectives:clauses ratio.

The figures show a steady tendency toward a decrease in the number of connectives from the spoken to the written version of the narratives ($M = 10,6\%$ in the spoken version, $7,6\%$ in the written version).

3.2.2 Types of relations employed in the two versions

Table 4 shows a comparison of the relations employed in the spoken and in the written versions of the narratives (where *A* means additive type, *CS* consequential, and *CT* contrastive, respectively). The data show no significant difference between the

SPOKEN			WRITTEN		
A	CS	CT	A	CS	CT
40.4	49.6	10.0	43.4	46.7	9.9

Table 4: Types of relations employed in the two versions (mean percentage values).

SPOKEN	WRITTEN
48.4	37.3

Table 5: Percentage of lexically signalled relations (mean values)

spoken and written versions: in both cases most of the relations belong to the consequential and additive types, with a relatively low percentage of contrastive relations. There is a straightforward relation between the slight preponderance of the consequential type and the nature of the task: since the narratives describe a story, it is obvious that the consequential type of relation would be the prevailing one. Another possibility, which is not in contrast with the preceding one, is that consequential type is preferred because it is cognitively "stronger" than the additive (cf. Experiment 1). Nevertheless, it is safe to assume that consequential and additive relations represent to a large extent alternative choices for the organization of the narrative content, as it is shown by the high degree of individual variation.

Regarding contrastive relations, it can be noted that they are generally little employed, both in spoken and in written language. As before, this general phenomenon could be explained by reference to the nature of the task; however, an alternative explanation could be in terms of avoidance of cognitively complex relations discussed earlier. Again, there is no difference in the percentage of use between spoken and written versions of the narratives.

3.2.3 Lexical realizations

If the data concerning the use of relations do not exhibit a significant variation explainable in terms of an influence of the spoken vs. written modality, the data regarding the lexical marking of the relations are highly indicative of some constraints imposed by the means of expression. Table 5 shows the global percentage of lexically signalled relations in the two versions of the narratives.

The figures suggest a uniform tendency toward marking the relations in the spoken versions, which drastically drops in the written form. This framework is consistent with our original hypothesis, i.e. that the spoken form would exhibit a higher number of connectives in that they represent a footstep of the cognitive processes underlying production.

At a closer inspection, however, it turns out that the reduction of lexical marking in writing displays again distinct patterns according to the type of relations involved. Table 6 illustrates for each class of relations the proportion of relations signalled by a connective.

SPOKEN			WRITTEN		
A	CS	CT	A	CS	CT
21.6	59.7	95.3	24.8	43.4	91.7

Table 6: Percentage of relations signalled by a connective for the two versions (mean values)

As it can be seen, the contrastive type holds the highest degree of marking (over 90% in the two versions); the consequential type of relations shows a relatively high degree of marking (around 60% in speaking, around 40% in writing). On the other hand, the additive type has a very low rate of lexical signalling (around 20%). In addition, the figures show that reduction in the degree of lexical signalling significantly concerns the consequential type only (- 16.3%), while the contrastive type is only slightly affected (-3.6%); more importantly, reduction does not concern the additive type, which shows an opposite tendency toward an increase in the global percentage of lexical marking (+3.2%).

The fact that a contrastive relation is almost always marked by a connective, either in speaking and in writing, indicates that connectives are obligatory for this class. This is again in accordance with the hypothesis of a higher cognitive complexity for this kind of relations. In production, thus, higher cognitive complexity imposes a constraint in the form of an obligation to lexically signal the relation (this also indicates that graphic and punctuation markers are felt as inadequate for a correct retrieval of the relation).

The relatively low degree of lexical marking of the additive type in speaking indicates a tendency against the marking of the relation which is inverted in writing. However, the data for writing (here not presented in full) show a higher individual variation than the one in speaking and as a result they suggest a less consistent tendency to mark the relation as opposed to the steady one for speaking.

For what concerns the consequential type, writing and speaking show a similar tendency to consistently and steadily signal the relation, but, again, the written language highlights a higher individual variation, and the general percentage of marking is significantly lower than in the oral versions. For the additive and consequential types, thus, the data show an influence of the means of expression in terms of an increased degree of lexical marking for the spoken versions which decreases in the written versions. This latter phenomenon could be due to the fact that writing has graphic and punctuation marks available in order to signal the relation.

In sum, with reference to our original questions, i.e. a) whether the means of expression (oral vs. written) constrains the type of relations used in the narratives; b) whether any difference could be related to the use, in spoken language, of cognitively less complex relations; c) whether spoken language manifests a tendency toward marking the cognitively more complex relations; and d) whether spoken language shows a significantly higher use of connectives, as a trace of the cognitive processes involved in production, the data from our second experiment suggest the following conclusions.

a) Discourse relations do not depend on the modality of expression, since both spoken and written narratives show a basically identical use of the three classes; this directly rules out question b). With regard to question c), this is contradicted by the data, which show that lexical marking is almost obligatory for contrastive relations both in spoken and in written language. Finally, the hypothesis underlying question d) is strongly strengthened by the data relative to the degree of signalling of the different types of relations. The spoken versions show a large use of connectives, which is globally much higher than it is for the written versions. As regards a comparison among the different types, the almost obligatory marking of contrastive relations, both in speaking and in writing, represents an unexpected finding, which is nevertheless consistent with the hypothesis of a higher cognitive complexity of the contrastive type. A further phenomenon is represented by the low degree of marking of additive relations compared to consequential relations for which we do not possess at present a convincing explanation.

4 Conclusions

The Experiments shown in the previous sections suggest that lexical marking of discourse relations is not entirely optional but is at least partially constrained by the type of relation signalled and the means of expression. Thus, contrastive relations obligatorily need a connective both in comprehension and in production, while lexical marking does not appear to be as necessary for additive and consequential relations. Although the data do not allow to conclude that there are discourse relations that are never lexically signalled, additive relations appear to be only sparsely marked; in addition, lexical marking does not significantly improve the comprehension for this class of relations. The means of expressions constrains lexical marking in that spoken discourse requires a higher number of cue phrases than it is necessary for written discourse. However, there is no evidence whatsoever of a difference between speak-

ing and writing in the marking of relations according to type.

References

- [1] Black, J. and H. Bern. 1981. "Causal coherence and memory for events in narratives." *Journal of Verbal Learning and Verbal Behavior* 20: 267-275.
- [2] Garnham, A., Traxler, M., Oakhill, J. and M.A. Gernsbacher. 1996. "The locus of implicit causality effects in comprehension." *Journal of Memory and Language* 35: 517-543.
- [3] Hobbs, J. R. 1985. "On the coherence and structure of discourse". *Technical Report No. CSLI-85-37*, Stanford, CA: Center for the Study of Language and Information, October 1985.
- [4] Hobbs, J.R. 1990. *Literature and Cognition*. CSLI Lecture Notes. Stanford, CA: CSLI.
- [5] Knott, A. and C. Mellish. 1996. "A feature-based account of the relations signalled by sentence and clause connectives." *Language and Speech* 39: 143-183.
- [6] Mann, W. C. and S. A. Thompson. 1986. "Relational propositions in discourse". *Discourse Processes* 9: 57-90.
- [7] Mann, W. C. and S. A. Thompson. 1988. "Rhetorical Structure Theory: Toward a functional theory of text organization." *Text* 8: 243-281.
- [8] Noordman, L.G.M. and W. Vonk. 1997. "The different functions of a conjunction in constructing a representation of the discourse." In J. Costermans, M. Fayol (Eds.), *Processing Interclausal Relationships*. Mahwah, NJ: Erlbaum, 75-93.
- [9] Sanders, T.J.M., Spooren, W.P.M. and L. G.M. Noordman. 1993. "Coherence relations in a theory of discourse representation." *Cognitive Linguistics* 4: 93-133.
- [10] Townsend, D.J. and T.G. Bever. 1978. "Interclause relations and clausal processing." *Journal of Verbal Learning and Verbal Behavior* 17: 509-521.
- [11] Trabasso, T. and L.L. Sperry. 1985. "Causal relatedness and importance of story events." *Journal of Memory and Language* 24: 595-611.
- [12] Trabasso, T. and P. van den Broek. 1985. "Causal thinking and representation of narrative events." *Journal of Memory and Language* 24: 612-630.
- [13] van Dijk, T. A. 1977. *Text and Context*. London: Longman.