Särtryck/Offprint: Henrik Rosenkvist
On connectives in natural language
Vol. 2: Sida/Page 275-282

Grammatik i fokus

Festskrift till Christer Platzack den 18 november 2003

Volym 1

Grammar in focus

Festschrift for Christer Platzack 18 November 2003

Volume 1

Redaktörer/Editors
Lars-Olof Delsing, Cecilia Falk, Gunlög Josefsson & Halldór Á. Sigurðsson

Institutionen för nordiska språk, Lunds universitet
Department of Scandinavian Languages, Lund University

Grammatik i fokus/Grammar in focus
Redaktörer/Editors: Lars-Olof Delsing, Cecilia Falk, Gunlög Josefsson & Halldór Á. Sigurðsson
Omslag/Cover: Lars Emilsson, Malmö
Översättning av förord/Translation of foreword: Alan Crozier, Skatteberga
Foto/Photo: Kennet Ruona, Lund
Porträtt/Portrait: Siri Ekberg, Lund

ISBN 91-631-4570-7
Institutionen för nordiska språk, Lunds universitet, Lund
http://www.nordlund.lu.se

Wallin & Dalholm, Lund 2003

On connectives in natural language

Henrik Rosenkvist

1. Introduction

In propositional logic, only three basic sentential connectives are generally reckoned with: conjunction, disjunction and implication (Allwood et al. 1986:26ff.). As Jackson (1987:1) puts it: "The three most common and easiest to use dyadic sentential connectives are 'and', 'or' and 'if, then'." However, in natural language we find a large number of different connectives that all seem to contribute to the logical structure of sentences: *and*, *but*, *or*, *unless*, *because*, *since*, *although*, *if*, *even if* etc. (cf. Thompson and Longacre 1985:177, 185ff.; SAG 2:729-731, 734f). The nature of the relation between these two kinds of connectives has been debated frequently and intensively, above all in studies of conditional sentences and of causality in general (cf. Hempel 1942, Goodman 1947, Mackie 1965, Haiman 1986, König 1986, Jackson 1987, Sweetser 1990, van der Auwera 1997, Dancygier 1998, Declerck and Reed 2001 etc). This article is an attempt to show that natural language subordinators and coordinators may be categorized into eight distinct categories with the aid of three basic semantic parameters: hypotheticality, causality and contrast (Rudolph 1996). Such a categorization will furthermore reveal both the links to the logic connectives and those features in natural language that cannot be fathomed by mere logic. Yet another aspect of natural language will also be commented upon: the negation that is inherent in *unless* and in *neither nor*-constructions.

In the following section causality is discussed, and then short discussions about the concepts of hypotheticality and contrast follow in sections 3 and 4. Section 5 is dedicated to the negative connectives *unless* and *neither nor*, while section 6 contains some conclusions.

As the primary goal of this article is to establish a link between logic connectives and connectives in natural language, purely linguistic features such as tense, mood, aspect etc, and the possible interactions and implications of these features,[1] will not be taken into consideration. Neither will the connectives' respective truth values be discussed, since they are not really relevant for the purposes of the present article (cf. Sweetser 1990:117).

[1] For instance, Comrie (1986) argues that counterfactual conditional sentences are epiphenomenal, on the ground that a hypothetical situation in the past always will be interpreted as counterfactual.

2. Causality

Logic connectives do not reflect natural language in any systematic fashion. The implication (→) is generally considered to express a causal relation (Allwood et al. 1986:37 ff.), and in natural language an implication is always supposed to be matched by a conditional sentence. Thus a vital semantic feature of conditional subordinators is causality (cf. Comrie 1986, Dancygier 1998:80ff.). But causal sentences are at least as causal as conditional sentences, of course, and therefore one would assume that an implication might just as well be represented with a causal sentence as a conditional sentence. This is not the case, however; the reason is probably that causal subordinators, just as coordinators (even when the context allows causal interpretations), are quite useless in deductive reasoning. Using causals in deductive reasoning does not lead to any conclusions, just uninteresting asserted statements,[2] as a causal sentence can not be used when a general rule is formulated. Johnson-Laird (1986:56) points out that deductions of this kind are "obviously trivial":

(1) TRIVIAL DEDUCTION

"rule":	Since you hit your thumb with a hammer, it is painful.	(p → q)
case:	You hit your thumb with a hammer.	(p)
"conclusion":	It is painful.	(q)

Hence, I think that it might be necessary to include, in the definition of implication, a feature of hypotheticality.[3] Or, one can at least can suggest that the representation of the implication in natural language must include hypotheticality.

Looking at connectives in natural language, we find, then, that both conditionals (*if*) and causals (*because*) express causality. To this group also concessive causals (*although*) and concessive conditionals (*even if*), as well as negative conditionals (or anticonditionals) such as *unless,* may be added (cf. Thompson and Longacre 1985). On the other hand, it is clear that neither *and*

[2] Logical consequences (which must be formalized as implications) can naturally be expressed with causals: *Since Hengist is fatter than Horsa (then) Horsa is thinner than Hengist* (cf. Allwood et al. 1986:37). Again, this does not express a general rule; the "consequence" is nothing but a mere restatement of the "cause", and as such the construction is irrelevant for deductive reasoning. Neither Allwood et al. (ibid.) nor Jackson (1987) do explicitly address the question whether implications must be hypothetical, but take it for granted that they are.

[3] It is commonly assumed that conditionals are hypothetical (cf. Comrie 1986, Athanasiadou and Dirven 1997). Some linguists do however avoid this term (like Declerck and Reed 2001:4ff), due to a fear of terminological confusion. Here the term is used in the general meaning 'suggested, possible, non-certain'.

nor *or* convey causal meaning, although they may be interpreted as causal in some contexts (cf. Sweetser 1990:98).

A simple and fairly uncontroversial division of the relevant connectives in the categories causal and non-causal is found below:

CAUSAL	
causal subordinators	*because, since*
conditional subordinators	*if*
concessive causal subordinators	*although*
concessive conditional subordinators	*even if*
NON-CAUSAL	
additive coordinators	*and*
disjunctive coordinators	*or*
adversative coordinators	*but*

As is apparent, causal relations in English are generally expressed by subordination; this seems to be quite common in the languages of the world (cf. Thompson and Longacre 1985:185ff.).

3. Hypotheticality

From the statement *If John is ill, he will stay in bed*, we can not decide whether John actually is ill or not, or whether he will stay in bed or not; John's illness is hypothetical. Comrie (1986) points out that in a typical conditional sentence, both the protasis and the apodosis are hypothetical. Thus a conditional subordinator can be said to convey a feature of hypotheticality.

Another connective in natural language that seems to share this quality is the disjunction. Just as the conditional sentence above, the sentence *John is ill or he will go to work* does not tell us anything about John's health or his intentions to go to work or not. The disjunctive *or* signals two possibilities, two hypothetical situations, and in uttering a disjunctive sentence, the speaker asserts that one of the propositions is true, without specifying which one. In some cases, the alternatives will exclude each other (2a), but in other cases they might, in principle, both be true (2b).

(2) a. John is a vegetarian **or** he eats meat.
b. John is a vegetarian **or** Mary is.

As Sweetser (1990:94) remarks, Grice's conversational maxims implies that (2b) will be interpreted as a case where only one of the propositions is supposed to be true; had the speaker known that both were true an *and* had been more informative, and therefore more appropriate. Still, by using *or* the speaker does not actually assert that any of the propositions is true. Rather, the speaker

presents two more or less plausible possible alternatives, just as a speaker using a conditional presents an possible cause (*If...*) and a possible effect (*..., then...*).

On the other hand, the sentences *John is ill and he will not go to work* and *John will stay in bed, because he is ill* clearly tell us that John is in a poor condition; the speaker asserts us that this is the case. Extending this line of thought will yield the following division in hypothetical and non-hypothetical connectives in English:

HYPOTHETICAL	
disjunctive coordinators	*or*
conditional subordinators	*if*
concessive conditional subordinators	*even if*
NON- HYPOTHETICAL	
additive coordinators	*and*
causal subordinators	*because, since*
concessive causal subordinators	*although*
adversative coordinators	*but*

Interestingly, this split does not follow the division in lexical categories (subordinators versus coordinators).

4. Contrast

Payne (1985:5) points out that adversative connectives signal that "a contrast exists between the conjuncts, or between the implications of the conjuncts", and Sweetser (1990:100) states that "*But* presents two conjuncts that clash with each other in some way". SAG (4:926ff.) presents a similar view on adversativity.

Rudolph (1996) extensively investigates the properties of connectives that convey a feature of contrast, and she claims that this quality is shared by adversative coordinators (*but*) and concessive connectives (*even if, although*). Her idea is that speakers and listeners have expectations about the world; an expected state of affairs will be reported in a neutral fashion, whereas an unexpected situation will be marked with the contrastive connectives. Such an expectation may be that youth and health co-occur:

(3) a. John is young **and** healthy.
b. John is young **but** unhealthy.

(4) a. **Since** John is young, he is in good health.
b. **Although** John is young, he is in poor health.

(5) a. **If** John is young, then he is healthy.
b. **Even if** John is young, he is in poor health.

The pairs above are semantic minimal pairs; the only difference is John's physical state. Still, the use of *and* in (3b) would be quite inappropriate, and in (3b) and (4b) *since* and *if*, respectively, would convey an odd image of the world around us. [4]

Rudolph (1996) thus finds that *and*, *because* and *if* have the contrastive counterparts *but*, *although* and *even if*. A natural question is: what about *or*? Is there a contrastive version of the disjunction? Payne (1985:3) explicitly doubts the existence of adversative disjunctions: "The feature [+/-Adversative], which specifies whether or not the conjuncts are to be contrasted, subdivides all the basic types [of conjunctions, my remark] except disjunction, with which it appears to be incompatible". The reason for absence of contrastive disjunctions[5] is perhaps that disjunctions, being non-causal and hypothetical, do not allow speakers to have any expectations. The connective *or* juxtaposes things and qualities that exclude each other, and it is very hard to have any expectations about which things and qualities that normally exclude other things and qualities; the number of qualities that youth, for example, does not generally co-occur with is of course endless.

A division of connectives based on the parameter of contrast is offered below:

CONTRASTIVE	
adversative coordinators	*but*
concessive causal subordinators	*although*
concessive conditional subordinators	*even if*
NON-CONTRASTIVE	
conditional subordinators	*if*
disjunctive coordinators	*or*
additive coordinators	*and*
causal subordinators	*because, since*

As can be seen, the split is yet again different from the previous ones (+/- causal and +/- hypothetical). In the final section a sketch of the paradigm that can be constructed by utilizing these contrasting features is offered.

[4] The attempts to explain concessive conditionals within some form of logical model (like e.g. König 1986, Haspelmath and König 1998) must by necessity remain inadequate, I think, since contrastive connectives reflect human expectations rather than logical relations. A formalization like "Whether p or ¬p, q" (König 1986:234) may be logically correct, but it does not capture the essential feature of concessive conditionals.

[5] A possible candidate is however *or else*, but the meaning of this connective is too complex to be dealt with here; I intend to return to this matter in future work.

5. Inherently negative connectives: *unless* and *neither/nor*

Geis (1973:231) noted that English *unless* and *if not* have different meanings; how *unless* should be formalized in propositional logic is however still unclear. Traugott (1997:145f) lists a number of suggestions concerning the understanding of the anticonditional *unless*, and *unless* is also extensively discussed by Dancygier (1998:167-178) and Declerck and Reed (2001, chapter 13). The ongoing debate seems to be centered around the questions whether *unless* is biconditional (like *if and only if*) or not, and whether the first conjunct (the protasis) or the second (the apodosis) should be negated in a formalization of *unless*. The fact that negative polarity items cannot appear in the protasis of *unless*-sentences (Geis 1973) suggests that the protasis actually is not negated, although the protasis contains the seemingly inherently negative connective *unless*.

A possible solution to this problem is to assume that *unless* signals an externally negated implication. In that case, a sentence like *Unless it rains, we will have a picnic* could be formalized: $\neg (p \rightarrow q)$. This formula can be paraphrased as *It is not the case that if it rains, then we will have a picnic*, a paraphrase that I think captures the actual meaning of *unless* accurately. It also sheds some light on why negative polarity items are disallowed in the protasis.

Another negative connective, *neither/nor*, should perhaps be understood as yet another instance of an external negation. If so, the sentence *He is neither young nor healthy* could be paraphrased as *It is not the case that he is young or healthy*, and the proper formalization would be: $\neg (p \vee q)$. This is a piece of circumstantial evidence for the possibility that external negations are inherent in some natural language connectives.

6. Conclusion

The semantic parameters of causality, hypotheticality and contrast divide the connectives that are discussed here into eight distinct types:

causal	**hypothetical**	**contrastive**	**connective**
+	+	+	*even if*
+	+	-	*if*
+	-	+	*although*
+	-	-	*because, since*
-	+	+	*Ø*
-	+	-	*or*
-	-	+	*but*
-	-	-	*and*

If one adopts the perspective on connectives that is illustrated in the table above, then it is not meaningful to assign specific logical formulations for contrastive connectives – *and* and *but* must be dealt with as one logic connective ($\wedge$), and the same applies for the pairs *if*/*even if* and *since*/*although*. The gap in the paradigm may be explained by the fact that disjunctions do not allow speakers to construct expectations, and hence disjunctions cannot be contrastive.

Furthermore, I have introduced the idea that both *unless* and *neither*/*nor* can be seen as instances of externally negated logical connectives; this hypothesis might lead to new insights regarding these complex connectives.

Geis and Zwicky (1971:562) remark that "In many cases [...], there is a quasi-regular association between the logical form of a sentence and the form of inference it invites". I think that one of the complicating factors in assigning logical meaning to connectives in natural language has been the feature of contrast; contrast is however a pure natural language feature with no formal meaning, and thus the contrastive connectives should not be formalized in any other way than their non-contrastive counterparts. What remains is then four basic connectives (*if*, *and*, *or* and *because*), of which the causal *because* is of little importance in deductive reasoning. The other three connectives are matched by $\rightarrow$, $\wedge$ and $\vee$.

References

Allwood, J., L.-G. Andersson, and Ö. Dahl. 1986. *Logic in linguistics*. Cambridge: CUP.

Andersen, H. 1973. Abductive and deductive change. *Language* 49:4.

Athanasidou, A. and R. Dirven. 1997. Conditionality, hypotheticality, counterfactuality. In *On conditionals again*, ed. A. Athanasiadou and R. Dirven, 61-96. Amsterdam: John Benjamins.

van der Auwera, J. 1997. Conditional perfection. In *On conditionals again*, ed. A. Athanasiadou and R. Dirven, 169-190. Amsterdam: John Benjamins.

Comrie, B. 1986. Conditionals: a typology. In *On conditionals*, ed. E. Traugott, A. ter Meulen, J. Snitzer Reilly, and C. Ferguson, 77-102. Cambridge: CUP.

Dancygier, B. 1998. *Conditionals and predication*. Cambridge: CUP.

Declerck, R. and S. Reed. 2001. *Conditionals. A comprehensive empirical analysis*. Berlin, New York: Mouton de Gruyter.

Goodman, N. 1947. The problem of counter-factual conditionals. *Journal of Philosophy* 44:113-120. Lancaster, PA: Lancaster Press.

Haiman, J. 1986. Constraints on the form and meaning of the protasis. In *On conditionals*, ed. E. Traugott, A. ter Meulen, J. Snitzer Reilly, and C. Ferguson, 215-228. Cambridge: CUP.

Hempel, C. 1942. The function of general law in history. *Journal of Philosophy* 39.

Hempel, C. 1966. *Philosophy of natural science*. Englewood Cliffs: Prentice-Hall.

Jackson, F. 1987. *Conditionals*. Oxford: Basil Blackwell.

Johnson-Laird, P. 1970. Linguistic complexity and insight into a deductive problem. *Advances in psycholinguistics*, 334-343. Amsterdam, London: North Holland.

Johnson-Laird, P. 1986. Conditionals and mental models. In *On conditionals*, ed. E. Traugott, A. ter Meulen, J. Snitzer Reilly, and C. Ferguson, 55-76. Cambridge: CUP.

Kotcheva, K. Om konjunktionerna *ok* och *än* i fornsvenska. In *Studier i svensk språkhistoria* 6 :145-156. Ed. G. Harling-Kranck and H. Lehti-Eklund. Helsingfors: Universitets-tryckeriet.

König, E. 1986. Conditionals, concessive conditionals and concessives: areas of contrast, overlap and neutralization. In *On conditionals*, ed. E. Traugott, A. ter Meulen, J. Snitzer Reilly, and C. Ferguson, 229-246. Cambridge: CUP.

Lakoff, R. 1971. If's, and's, and but's about conjunction. In *Studies in linguistic semantics*, ed. C. Fillmore and T. Langendoen, 114-149. New York: Holt, Rhinehart and Winston.

Lang, E. 1984. *The semantics of coordination*. Amsterdam: John Benjamins.

Legrenzi, P. 1970. Relations between language and reasoning about deductive rules. *Advances in psycholinguistics*:233-333. Amsterdam, London: North Holland.

Mackie, J. 1965. Causes and conditions. *American Philosophical Quarterly* 2 (4).

Payne, J. 1985. Complex phrases and complex sentences. In *Language typology and syntactic description* II, 3-41. Ed. T. Shopen. Cambridge: CUP.

Peirce, C. 1931. *Collected papers*. Ed. C. Hartshorne and P Weiss. Cambridge, MA: Harvard University Press.

Rudolph, E. 1996. *Contrast. Adversative and concessive relations and their expressions in English, German, Spanish, Portuguese on sentence and text level*. Berlin: De Gruyter.

SAG (*Svenska Akademiens grammatik*), I-IV. 1999. U. Teleman, S. Hellberg and E. Andersson. Stockholm: Svenska Akademien.

Sweetser, E. 1990. *From etymology to pragmatics*. Cambridge: CUP.

Thompson, S. and R. Longacre. 1985. Adverbial clauses. *Language typology and syntactic description* II, 171-234. Ed. T. Shopen. Cambridge: CUP.

Henrik Rosenkvist
Department of Scandinavian Languages
Lund University
Helgonabacken 14
SE-223 62 Lund
Henrik.Rosenkvist@nordlund.lu.se