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Causal Connectives Have Presuppositions

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Volume 10

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Effects on Coherence and Discourse Structure

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Published by
Holland Academic Graphics
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The Netherlands

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e-mail: mail@hag.nl
http: www.hag.nl

Cover illustration:
Greta Garbo, in *Ninotchka* (© Warner Brothers)

ISBN 90-5569-53-8
NUGI 941

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Printed in The Netherlands.

Contents

Voorwoord

Dit boek is het resultaat van een onderzoeksproject dat in 1992 startte, toen ik bij de afdeling Tekstwetenschap werd aangenomen als Assistent in Opleiding (AiO). Een AiO wordt begeleid, en de verhouding tussen begeleider en AiO wordt wel gekenschetst als een meester-gezelverhouding. Mijn dank gaat in eerste instantie uit naar Leo Noordman en Leonoor Oversteegen, die zich ware meesters hebben betoond, en enorm veel tijd en toewijding in mijn begeleiding hebben gestoken. De rol van gezel was mij niet op het lijf geschreven. Ik hoop dat het meesterstuk er niet al te zeer onder geleden heeft.

Ik denk met warme gevoelens terug aan de tijd die ik mocht doorbrengen bij Tekstwetenschap. De cultuur van goede samenwerking en persoonlijke belangstelling is me zeer goed bevallen. Wilbert Spooren, Birgit Bekker, Carel van Wijk, Hans Hoeken, Leonoor Oversteegen, Leo Noordman, Fons Maes, Gisela Redeker, Rein Cozijn, Gerard Steen, Erica Huls, Jan Renkema en Jürgen Bohnemeyer worden bedankt voor hun betrokkenheid en hulp bij mijn welzijn en werkzaamheden.

Eerdere versies van delen van het proefschrift werden gelezen en becommentarieerd door David Beaver, Claire Gardent, Reinhard Muskens en Henk Zeevat. Hun bemoedigende commentaar (op soms ondermaats werk) heeft me veel steun gegeven. Met Nicholas Asher, Harry Bunt, Eduard Hovy en Jon Oberlander heb ik bij gelegenheid kunnen discussiëren over plannen voor hoofdstukken. Hun reacties waren voor mij een aanmoediging om door te gaan op de ingeslagen weg, wat niet wil zeggen dat ze het met me eens waren.

Andrée Tingloo, Pieter Niewint en Hans Verhulst stonden altijd klaar om een helpende hand te bieden met de Engelse tekst of de Engelse voorbeelden. Ze zijn niet verantwoordelijk voor het resultaat. Jan en Dini Lagerwerf, en Barend van Soest hebben logistieke problemen opgelost toen de tijd begon te dringen. Jozef Pijnenburg heeft voor mij onoverkomelijke problemen opgelost bij het persklaar maken van het manuscript.

Het proefschrift was er waarschijnlijk niet gekomen als ik niet een deeltijdbaan had gekregen bij Toegepaste Taalkunde in Twente. Willem Bulter, Thea van der Geest, Lisette van Gemert, Menno de Jong, Alard Joosten, Rob Klaassen, Peter Jan Schellens, Jan van der Staak, Michaël Steehouder en Egbert Woudstra zorgden voor een ontspannen sfeer, en boden zo een goed tegenwicht voor de zorgen over het manuscript.

Marja van Soest heeft me er gedurende het hele project aan herinnerd dat ik nog een leven naast het proefschrift had. Gerda de Kruyff maakte dat leven mogelijk met semi-permanente kinderopvang.

Van alle anderen die belangstelling hebben getoond voor het welslagen van het project wil ik met name noemen Frank Jansen, die mij een hart onder de riem stak toen ik hem vertelde over mijn eerste herschrijfervaringen: *aha, de hersenspoeling is begonnen*.

Rijsenburg, juli 1998.

Chapter 1

Introduction

1.1 The effects of causal and contrastive connectives

Before he was three years old, Jefta Lagerwerf discovered the exciting use of the phrase *toch wel!* ('but it is!'). On bicycle rides with his parents, he often approaches a guarded level crossing. Shortly before they get to it, the tension starts to rise: are the crossing barriers going to come down, are the red lights going to flash, and are the alarm bells going to ring, because there is a train approaching the level crossing? His parents warn him that there may not be a train coming at all. When, at last, a train does come, Jefta calls out: *toch wel!* ('but there is!'). This use of *toch wel* is called a denial of expectation. Jefta denies his parents' expectation that nothing will happen.

The starting point of this thesis is an analysis of the denial of expectation, expressed by the Dutch connectives *hoewel* and *maar*, and their English counterparts *although* and *but*. The expectation, and Jefta's reaction, can be expressed in one sentence by using *although* or *but*, as the example in (1) shows.

(1) Although the level crossing is empty, a train is coming.

An interesting difference between the sketched situation and this sentence, is that the warning 'there may not be a train coming' has disappeared from the sentence in (1). Nevertheless, the phrase *a train is coming* still denies the expectation that there may not be a train coming. Apparently, this expectation can be derived from the utterance in (1). From the utterance, an implication can be derived: 'normally, if a level crossing is empty, no train is coming'. The implication underlying the sentence in (1), makes the relation between the main clause and the *although* clause a causal relation. A denial of expectation is a coherence relation that expresses contrast as well as causality.

Causality, or rather, what is expressed by causal connectives, will be one of the central topics of this thesis. As a philosophical notion, it

was studied by philosophers like Locke (1632) and Hume (1739). An overview of more recent philosophical thoughts about causation and conditionals can be found in Sosa (1975). In this thesis, causality will be studied because causal relations are central to the understanding of discourse. Linguistic recognition as well as recognition of real world knowledge will be analyzed, in order to explain how causality is expressed in a coherence relation.

Coherence relations may be divided in two groups, according to Kehler (1994): common topic and coherent situation relations. Asher (1993) makes a distinction between structural and non-structural relations. Sanders, Spooren and Noordman (1992) distinguish additive from causal relations. These distinctions are very similar: coherent situation, non-structural and causal relations are the same kind of coherence relations. In this thesis, it will be assumed that this group is characterized by the property of expressing causality (below, the other group will be characterized). By making a detailed analysis of how causality in coherence relations is recognized, this thesis contributes to the study of discourse coherence.

This thesis will give a detailed analysis of connectives that express causality. In the example treated above, using *toch wel* gave rise to the same coherence relation as using *although* in (1). The expectation that was denied can be regarded as a causal relation between a proposition derived from the *although* clause and the negation of a proposition derived from the main clause. *Although* is thus regarded as expressing both causality and contrast. Besides *although*, causal connectives like *because* will be analyzed.

The Dutch *toch wel* in the example above, needed a translation in English with a connective: *but there is*. In studies of discourse coherence or intentions in discourse, adverbs and connectives are often regarded as markers of coherence: they are called cue phrases (e.g. Grosz and Sidner, 1986) or discourse markers (e.g. Schiffrin, 1987). Redeker (1990, p. 372) claims that discourse markers need to be defined functionally: *a discourse marker is a linguistic expression that is used to signal the relation of an utterance to the immediate context.* In this thesis, the choice is made to select one grammatical class, namely connectives. The relation of utterances containing these connectives with the immediate context will be analyzed linguistically. This relation is characterized by the lexical meaning of connectives. The analysis of connectives might have consequences for the lexical meaning of adverbs, but it will not be a topic of this thesis. More descriptive analyzes of connectives and adverbs can be found in Knott (1995); Degand (1996).

In order to define lexical meaning of connectives, formal semantic approaches will be studied. In the end, definitions will be proposed that make use of several developments in discourse theory and logic. It has been claimed that *but* has a conventional implicature (e.g. Grice, 1975; Gamut, 1982b). Here, the claim will be made that connectives like *although* bear presuppositions in the form of an implication. In the

past years, theories of presupposition have been developed into more discourse oriented theories (Gazdar, 1979; Heim, 1982; Van der Sandt, 1982; Geurts, 1995; Beaver, 1995). The definitions proposed here will profit from this development. These definitions could be formulated thanks to the development of a theory of non-monotonic logic (Asher and Morreau, 1991).

If a detailed analysis of lexical meaning of connectives is possible, the relation between connectives and coherence needs to be well-defined. The meaning of causal and contrastive connectives has been analyzed by, amongst others, Lakoff (1971), Van Dijk (1977), König (1986), Sidiropoulou (1992) and Kehler (1994). They did not relate their analysis to analyzes of coherence relations that were inferred on other grounds than the presence of a connective. Hobbs (1985), Mann and Thompson (1988) and Sanders et al. (1992) do not use connectives in their definitions of coherence relations. It is correct to leave connectives out of the definitions of coherence relations, for most coherence relations can be inferred without lexical marking. There is an omission in both the study of connectives and the study of coherence: it has not been investigated whether or not the use of a connective makes a difference in the way the inference of a coherence relation is made. A formal and restricted approach of inferring coherence relations is defined in the work of Lascarides and Asher (e.g., Lacarides & Asher, 1991; Asher, 1993; Lascarides, Copestake & Briscoe, 1996). They pay special attention to the relations between the inference of coherence, and relations between lexical items in the lexicon. But in these publications, lexical meaning of connectives is not defined. By defining lexical meaning of connectives, it will become possible to define the difference between coherence with and without explicit lexical marking by connectives. The procedure of inferring a relation between associated lexical items in the lexicon by using connectives is different from the procedure that is proposed for inferring a relation between associated lexical items without using connectives.

In studies of the creation of discourse structure, the group of additive, common topic, or structural relations is characterized by the systematic way a topic of discourse is enriched with new information every time a new sentence enters the discourse. This group of relations is studied especially by researchers trying to give a formal and restrictive account of the incremental update of information in small pieces of discourse (Prüst, 1992; Asher, 1993; Sanders and van Wijk, 1996; Schilperoord, 1996). The causal, coherent situation or non-structural group is analyzed by researchers studying representations of narrative discourse (e.g. Trabasso and Van den Broek, 1985; Van den Broek, 1994). The main differences between both approaches is that the former tries to come to a linguistic analysis of discourse representation, while the latter tries to give a psycholinguistic analysis of a mental representation of the discourse. In this thesis, insights from the psycholinguistic study of causality in discourse will be added to the linguistic study of discourse

representation.

In this thesis, causal relations will be studied in the framework of a formal and restrictive discourse structure theory (namely, Prüst, 1992). Non-causal relations are often characterized by updating a topic with every new sentence; causal relations do not seem to be strictly following a topic update strategy. What effect causal relations do have on discourse structure, has not been established yet. The effect of causal relations on discourse structure will be investigated with the help of so called propositional anaphors. Since discourse structure determines possible antecedents for anaphors that refer to propositions in their context, this phenomenon can be used as an instrument for detecting discourse structure.

In sum, it is the purpose of this thesis to give an analysis of the lexical meaning of causal or contrastive connectives in terms of presuppositions, resulting in a definition of the inference of coherence using causal connectives, and an analysis of the effect of causal coherence on discourse structure, appearing from the reference of propositional anaphors. The central question in this thesis will be:

how does lexical meaning of causal connectives affect discourse coherence and structure?

The answer consists of several steps. First, an analysis is given of causal and contrastive interpretation of connectives, in terms of the coherence relations they express. Secondly, lexical meaning of a causal or contrastive connective is analyzed as invoking a presupposition in the form of an implication. Thirdly, causal coherence is derived differently using causal connectives: causal connectives check lexical knowledge, in order to derive a coherence relation. Fourthly, causal coherence relations have a different effect on discourse structure than additive relations.

1.2 Research questions

In this section, four questions will be formulated concerning the analysis of lexical meaning of connectives, coherence and discourse structure.

The first question concerns the description of causal coherence relations. A systematic account of a naturally defined group of causal connectives seems to be difficult. Hovy (1990) estimates that approximately 350 coherence relations have been defined in the literature. There are a lot of coherence relations that may be identified with each other, because they cover the same phenomena (for instance, Purpose and Goal-Instrument refer to the same relations). But also different coherence relations may share a property, for instance the property of causality. A study of the interpretation of causal connectives may

give the possibility to find shared properties of coherence relations. Sweetser (1990) identifies a group of connectives that might be considered causal, but within this group, different interpretations of causal connectives arise. Causal connectives can be interpreted as content, epistemic or speech act. These interpretations can be connected with a theory of properties shared between relations, namely Sanders, Spooren and Noordman (1992,1993). They define a classification, or taxonomy, of coherence relations. Four properties, called cognitive primitives, characterize coherence relations. One of those primitives is the Basic Operation: the coherence relation is either causal or additive. Another primitive is the Source of Coherence: the relation is either semantic or pragmatic. Semantic interpretation is identified with content; pragmatic interpretation is identified with both epistemic and speech act interpretation (Sanders et al., 1993). The primitive of Polarity defines either a contrast or a positive relation. The primitive Order (non-basic or basic) is only applied to causal relations. As a result, 12 classes are distinguished by four two valued primitives. This makes it possible to refer to a class of 'causal relations', including contrastive causal relations (like the one in (1)), consisting of well-defined sub-classes.

Given the taxonomy of Sanders et al. (1992), it is possible to generalize over groups of coherence relations in a systematic way. One might, however, question the accuracy of some of the distinctions. Is the cognitive primitive Source of Coherence specific enough, or should epistemic and speech act interpretations be distinguished? A second question concerns the precise classification of some coherence relations: is a contrastive relation like Concessive opposition pragmatic? Is it causal or additive? A third question relates to the criteria used for the assignment of some relational property to the mental representation. A relation is causal if the mental representation contains a causal relation. This is determined by knowledge of the world. How is this knowledge of the world characterized? These questions may be summarized as: what interpretations of causal or contrastive relations should be distinguished?

The second question zooms in on a detailed analysis of the linguistic properties of the interpretation of connectives, in order to explain their different interpretations distinguished in the answer of the first question. A detailed linguistic analysis of the interpretation of causal connectives explains how causal coherence is realized by causal connectives. The second question is: how is lexical meaning of causal connectives represented?

The third question is based on the fact that causal connectives are not needed to infer a causal relation. The reason why it is generally assumed that a causal coherence relation is only indicated, instead of fully determined, by connectives like *because*, is that coherence relations may be inferred without connectives. In (2), a causal relation is expressed.

(2) Theo was exhausted. He had run to the university.

Sanders et al. (1992) define a coherence relation between two utterances as follows. The term 'coherence relation' is taken from Hobbs (1979).

> A coherence relation is an aspect of meaning of two or more discourse segments that cannot be described in terms of the meaning of the segments in isolation. In other words, it is because of this coherence relation that the meaning of two discourse segments is more than the sum of the parts (Sanders et al., 1992, p. 2)

It is generally assumed that the coherence relation in (1) is indicated by *although*. On the other hand, a coherence relation is defined as being *more than the sum of the parts*. This 'extra' meaning is derived from the contents of two related sentences, or it is indicated by a connective. Is there a difference between these two ways of obtaining the extra meaning?

The inference of coherence relations without linguistic indication has been studied in a formal and restrictive way in the approach initiated in Lascarides and Asher (1991). They try to show that a coherence relation, whether or not expressed by a connective, comes forth systematically out of the propositional meaning in two related clauses. Some combinations of words lead to causal relations, other combinations do not. In (2), the meaning of the word *exhausted* may be associated causally with the meaning of *run*. This way of inferring coherence is quite complex, and it needs a lexicon in which those relations can be specified. It would be easier if the causal relation were given. In that case, the meanings of the words can be adjusted to the causal relation. This is possible using a connective. The third research question is thus defined as: how is lexical knowledge exploited when a causal connective is used to indicate causal coherence?

The fourth question concerns discourse structure. A central problem in the study of discourse structure is how anaphors find their antecedents in context. Much attention has been paid, in formal theories, to anaphors with a nominal antecedent (Kamp and Reyle, 1993; Muskens, 1996). The presupposition theory of Van der Sandt (1982) is also a theory of the nominal antecedents of definite descriptions.

In Maes (1991) and Givón (1992), very detailed analyzes of sorts of nominal anaphors are given. Less attention has been paid to anaphors that have a concept, proposition, event, situation or state as an antecedent. Deictic pronouns (Webber, 1991), some VP anaphors (Prüst, 1992), abstract object anaphors (Asher, 1993) and situation anaphors (Fraurud, 1992) have in common the property that their antecedent is not a specific linguistic element in the context, but some representation of a part of the information that is gathered by the context. Discourse theories like the Linguistic Discourse Model (Polanyi, 1988;

Prüst, Scha & Van den Berg, 1994) try to explain the construction of the antecedent representations. Relational coherence plays a role in this construction. The role of additive relations has been described, but the role of causal and contrastive relations has not received much attention (except for the analysis of Contrast in Asher, 1993). By studying the effect of causal relations on the formation of representations of antecedents, discourse structure will be better understood. The fourth research question is: how do causal relations affect discourse structure?

In sum, the research questions are:

1. what interpretations of causal or contrastive relations should be distinguished?
2. how is lexical meaning of causal connectives represented?
3. how is lexical knowledge exploited when a causal connective is used to indicate causal coherence?
4. how do causal relations affect discourse structure?

To give a first impression of the type of answers the reader may expect in this thesis, a rough outline will be given of the answers and the way they connect to the central question.

The answer to the first question defines the types of interpretations causal connectives express. The interpretations of the connectives discussed in chapter 2 are, in general, recognized as coherence relations indicated by connectives. These interpretations need to be reflected in the answer to the second question, where an analysis in terms of presuppositions will represent the lexical meaning of causal connectives. Given the lexical meaning of connectives, the answer to the third question will be that there is a difference in inference of coherence relations when connectives are present or absent. This difference did not play a role in the answer to the first question, but the answer to the second question predicts that the relation between causal connectives and coherence relations is more specific than just assuming that connectives indicate coherence. The difference is especially found in the interaction between the propositional contents of an utterance and the way in which lexical meanings from the utterance are combined in the lexicon. Without connectives, causality must be derived from the way lexical items are used in the sentences, and by application of world knowledge; using causal connectives, the causal relation is already indicated, and interpretations of lexical items are selected according to the causal relation. The answer to the fourth question is that a causal relation changes the possibilities for propositional anaphors to refer to an antecedent that has been constructed in the context. Having answered these questions, the central question can be answered: lexical meaning of causal connectives affects discourse coherence using presuppositions, and causal coherence relations affect discourse structure, by

having another effect on antecedents of propositional anaphors than additive coherence relations.

An approach of discourse analysis that did not receive attention in this chapter, but will return in several chapters as complementary, is discourse analysis on the basis of argumentation (e.g. Ducrot, 1980; Van Eemeren and Grootendorst, 1992). Argumentation takes standpoints of speakers (or argumentative orientation) as a starting point of the analysis. In the analyses performed in the chapters 3 and 5, argumentative orientation will be taken as pragmatic manipulations of the proposed representations. For a good understanding of discourse processes, the analysis of argumentative orientation is indispensable. It did not fit in the scope of this thesis, however.

Question 1 is answered in chapter 2, where the linguistic description of connectives in Sweetser (1990) will be taken as a starting point in the description of different relations, in order to compare them with the distinctions made in the classification of Sanders et al. (1992). Question 2 is answered in chapter 3, which gives an analysis of the lexical semantics of causal connectives. This chapter is an extension of the analysis in Lagerwerf and Oversteegen (1994). Question 3 is answered in chapter 4, where the lexical theory of Lascarides, Copestake & Briscoe (1996) is used to analyze the effect of causal connectives on the inference of coherence relations using the lexicon. Question 4 is answered in chapter 5, where the Linguistic Discourse Model (Polanyi, 1988; Prüst et al., 1994) will be used to show the effect of causal coherence in discourse structure. This chapter is an extension of Lagerwerf (1996).

Chapter 2

Causal and contrastive relations

2.1 Introduction

In *De Volkskrant*, a Dutch newspaper, the example in (1) was found in an obituary of Greta Garbo.[1] First, the preceding context is given, accompanied by a glossed translation. The sentence under discussion is presented next, accompanied by a word by word translation.

(1) Zij was al een legende tijdens haar leven en haar mythe groeide door haar volstrekt geïsoleerde bestaan in een flat te New York. In 1951 werd zij Amerikaans staatsburger, drie jaar later kreeg zij een ere-Oscar.
'She was already a legend during her life and her myth grew by her completely isolated existence in a New York apartment. In 1951 she became an American citizen, three years later she received an Oscar of honour.'

Hoewel	Greta	Garbo	de	maatstaf	werd	genoemd	van
Although	Greta	Garbo	the	yardstick	was	called	of
schoonheid,	is	zij	nooit	getrouwd	geweest.		
beauty,	has	she	never	married	(been.)		

The sentence of the film critic who wrote the obituary did not just express an assertion, according to some readers. Several letters were sent in, blaming him for implying that beautiful women will always marry. Peculiarly, none of them allowed for the possibility that this was just their interpretation, although it is not explicitly stated in the text.

The reason why readers noticed that implicit information was conveyed in (1), was the unacceptability of this information. An implicit

[1] The image of the newspaper might be compared to *The Guardian* and/or *The New York Times*, and the Spanish *El Pais*. This example was found in the edition of April 17th, 1990 (taken from Sanders et al., 1993).

statement like 'if a woman is beautiful, she will marry', is not unanimously shared among readers of the newspaper. With respect to the sentence in (1), however, readers should accept this implicit statement together with the understanding of the assertion itself. Reversely, readers assumed that the writer was inviting them to accept the implicit statement as common knowledge. This made them angry enough to send in letters to the newspaper.

Another connective capable of conveying implicit information in the same way, is *maar* ('but'). In a television news programme, (2) was uttered.[2]

(2) The Artist Formerly Known as Prince is gisteren in zijn woonplaats getrouwd.
The Artist Formerly Known as Prince was married yesterday at his residence.

Prince	heeft	vele	liefdes	gehad,	maar	is	nog
Prince	has	many	love-affairs	had,	but	has	yet
nooit	getrouwd	geweest.					
never	married	(been.)					

The implicit information conveyed in (2b) is: 'if a man has had many love-affairs, he will have been married.' Also in this case, the implicit information is noticed because it is not widely accepted that having many love-affaires leads to marriage.[3]

The fact that the use of *hoewel* in (1) or *maar* in (2) is annoying people, gives reason to believe that something went wrong in the cooperation between writer and reader. In other words, the Cooperative Principle (Grice, 1975) seems to be violated. This principle consists of maxims of good conversation. Whenever a maxim is violated, a conversational implicature might repair it. When conversational implicatures do not work, the Cooperative Principle allows for a reinterpretation of what has been said: it might have been irony or metaphor.[4] This is not the case here. Still, it should be possible to identify a violation of one of Grice's maxims, and explain why it has not been repaired in some way or another.

Maxims of the Cooperative Principle are applied to what has been stated in the utterance, according to Grice's (1975) definition of 'saying'.[5] Given this definition, no information is missing in what has been

[2] *Veronica Nieuwslijn Variety*, February 15th, 1996.

[3] In (2), a concessive interpretation is possible too. This interpretation will be discussed in section 2.3.

[4] In chapter 3, Grice's theory will be treated in more detail. The Cooperative Principle and its maxims are given in chapter 3, section (3.1).

[5] Cf. Grice (1975, p. 44-45): what someone has said is closely related to the conventional meaning of the words (the sentence) that have been uttered. In his example: *He is an Englishman; he is, therefore, brave*, the speaker has committed himself, by virtue of the meaning of the words, that his being brave follows from his being an Englishman.

said in(1), the writer is not saying what he believes to be false, nor does he lack evidence for what he has said (Greta Garbo was beautiful, and she did not marry - cf. footnote 5). What was said in (1) is not obscure, ambiguous, prolix or disorderly. This means that the maxims appear to have been obeyed. Consequently, no conversational implicature has been invoked. So, it is unexplained why the Cooperative Principle is violated.

A speculative answer to this problem might be the following. Annoyance is caused by the circumstance that the statement 'beautiful women will marry' is treated as if it were old information: information that is part of the knowledge shared between writer and reader. This implicit information is necessarily part of this shared knowledge, since it has to have been accepted in order to accept the assertion made in the utterance. Readers will notice that information has become available, for which the writer does not present evidence (namely, 'beautiful women marry'). However, they can not dismiss this information by applying some conversational implicature, because it is treated as if it were already old (or: given). So, the dubious prejudice will be noticed, and readers will be affronted by it, but they can not change it.

Following Grice's (1975) line of reasoning, the acceptance of the implicit information in (1) and (2) has been realized by conventional implicature. *Although* and *but*, and their Dutch counterparts *hoewel* and *maar*, have a conventional implicature, that takes the implicit information from the connected clauses, and turns it into shared knowledge. It is interesting to know that Grice indeed assumes the existence of a conventional implicature for *but*, although this specific analysis is not his.

In chapter 3 of this thesis, the idea of a conventional implicature (or, as will be argued: presupposition) for *but* and *although* will be worked out and extended to a restricted set of connectives. Before the motivation for this idea can be given, the interpretations of causal or contrastive relations should be described specifically, in answer to the first research question given in chapter 1. Meaning aspects of connectives are analyzed in order to prepare for a detailed proposal in the next chapter. In recent literature, the meaning of connectives, and their discourse functions, have been described in detail. The analyses of Sweetser (1990) and Sanders, Spooren and Noordman (1992,1993) will be taken as a starting point.

Sweetser (1990) has argued for an analysis of connectives as polysemous lexical items. She distinguishes three domains of interpretation, when a connective is used: a content domain, an epistemic domain, and a speech act domain. The application of these distinctions will be discussed below.

But the speaker only said that he is an Englishman, and he is brave. In other words, the conventional implicature of *therefore* does not belong to what has been SAID (while conventional meaning does). In chapter 3, sections 3.5 and 3.9, analyzes of *because* and *so* are given, from which the analysis of *therefore* can easily be derived.

A connective often gives expression to a coherence relation. Sanders, Spooren & Noordman (1992), already introduced in chapter 1, define four specific features of coherence relations in such a way that a taxonomy of relations can be made systematically, by assigning each feature a positive or negative value. Thus, sets of coherence relations, sharing specific feature values can be created. Sanders et al. (1992) have called the features 'cognitive primitives'. In determining a coherence relation between two text segments, this relation is either:

1. additive or causal,
2. negative or positive,
3. representing its segments in basic order or not,
4. semantic or pragmatic.

When all four choices have been made, a coherence relation is identified. The combination of all possible feature values results in the definition of twelve coherence relations.[6] These systematic definitions can express coherence relations easily. For instance, it follows from the definition that there should be contrastive additive, as well as contrastive causal relations, and not just a set of independently defined contrastive relations. Familiarity between coherence relations is now represented in a well-defined taxonomy.

Sweetser's (1990) interpretations of connectives in the content domain would correspond to coherence relations with the feature value 'semantic' in Sanders et al. (1992). Her interpretations in the epistemic and the speech act domain would both correspond to the feature value 'pragmatic'. This correspondence raises the question how epistemic, speech act and pragmatic interpretation are related. On which resemblance between epistemic and speech act domain does the definition of the pragmatic feature rely? How relevant are their differences to assignment of the pragmatic feature value? Does the difference between interpreting connectives (Sweetser, 1990) and interpreting coherence relations justify mapping of interpretations in two domains onto one feature value? These questions will lead, in section 2.2, to more specific definitions of epistemic and speech act interpretation of connectives, resulting in a clear relation between these two interpretations and a definition of the pragmatic feature.

Contrastive relations, expressed by *but* or *although*, have the value 'negative' in the framework of Sanders et al. (1992). Their taxonomy expresses that negative relations may be either additive or causal, and either semantic or pragmatic (basic order will be left out of the discussion, at this point). This means, that it should be possible to find

[6] Four features having two values should give, mathematically, sixteen possible relations. Sanders et al. (1992) define only twelve relations, since additive relations are indetermined for their order.

four different relations expressing contrast, which should correspond to the characteristics that have been given. It will not be difficult to find more than four interpretations of contrast in the literature, but an analysis of those relations in terms of Sanders et al. (1992) might be quite complicated. In section 2.3, an attempt is made to come to such an analysis

A problem, not directly related to Sanders et al. (1992), arises when the coherence relations are related to meanings of connectives. In specific contexts, the determination of the interpretations may be different. Are there differences between *although* and *but* in the kind of interpretation that they may support? A discussion of this problem will also be given in section 2.3.

How causal relations are accepted, is a difficult problem, even when they are indicated by causal connectives. To accept a causal relation, one has to refer to causal knowledge, but it is difficult to define or describe causal knowledge. And yet, language users use causal knowledge to make correct interpretations of connected clauses. Why is (3a) acceptable, but not (3b)?

(3) a. Greta never married, because she wanted to be left alone.
b. ?Greta never married, because she wanted to have children.

In sentence (3a), a causal relation is accepted between wanting to be left alone, and not marrying. In (3b), a causal relation between wanting to have children, and not marrying is not accepted. But the (non) acceptance of these relations does not seem to be well-motivated. You can be left alone within a marriage, if you want to, so that is not a complete motivation for not marrying. Reversely, you do not need to be married to have children, so that would make the inference of some other relation possible. The problem is solved when a list of 'accepted causes' and 'not-accepted causes' is made. However, this would become quite a list. Moreover, the list would be different on any occasion, depending on context and circumstances. This will be explained in section 2.4, where definitions will be formulated that make a distinction between causal and non-causal relations.

2.2 Epistemic and speech act interpretation

2.2.1 Epistemic interpretation

Sweetser (1990) analyzes connectives as polysemous lexical items.[7] In general, connectives can be interpreted in three ways, exemplified in

[7] In this section, systemic functional literature like Halliday (1985) and Martin (1992) is not discussed. Their distinction between ideational, interpersonal and textual interpretation relates to the same phenomena, however. Since the aim of the next chapter is to motivate a formal semantic proposal from a cognitive point of view, this distinction will be disregarded. See Oversteegen (1995) and Degand (1996) for an analysis of causal connectives in systemic functional terms.

(4) (taken from Sweetser, 1990, p.77).

(4) a. John came back because he loved her.
b. John loved her, because he came back.
c. What are you doing tonight, because there's a good movie on.

The example in (4a) is, according to Sweetser (1990), an interpretation in (what she calls) the content domain, which means that the relation refers to real-world causality. Her example in (4b) is interpreted in (what she calls) the epistemic domain, which means that the relation is one of observation and conclusion, rather than a real-world causality. The example in (4c) refers to (what she calls) the speech act domain, which means that the relation is between a speech act and the speaker's justification or motivation for performing this speech act.

The three domains mentioned here are conceptual domains. Sweetser (1990) claims that these domains should be regarded as metaphorical domains (like the complex conceptual metaphors in Lakoff and Johnson, 1980): use of a conjunction in a domain different from the content domain is metaphorical use of that conjunction.[8] This metaphorical use is rarely noticed, because metaphorical use of conjunction has been conventionalized, in due course. This is why Sweetser (1990) speaks of polysemous meanings of connectives.

The content domain is a mental internal model of the sociophysical world; the epistemic domain is a world of reasoning processes. The conjunction in (4b) must be interpreted with respect to reasoning processes instead of real world causality. The epistemic domain contains premisses and conclusions, and relations between them. The conjunction in (4c) must be interpreted in a domain that contains speech acts and qualifications, justifications or motivations of speech acts. This framework, presented in Sweetser (1990), is not adopted in the analysis presented below. However, the intuition that the interpretations of (4a-c) are semantically related, and that they refer to different levels of interpretation, will be shared with Sweetser (1990).

The different readings in (4) can be distinguished by means of paraphrase. Sweetser's (1990) paraphrases look like the paraphrases in (5).[9]

(5) a. The fact that he loved her caused the fact that John came back.
b. From the fact that he came back, I conclude that John loved her.
c. I ask what you are doing tonight, because I want to suggest that we go to this good movie.

[8] Sweetser's (1990) analysis may also be stated in terms of Fauconnier's (1985) mental spaces (cf. Sweetser, 1990, p. 74).

[9] Sweetser (1990) does not introduce a uniform procedural way of paraphrasing the utterances. In (5a) and (5b) the paraphrase is made conform a (simple) systematic procedure, which is completely consistent with Sweetser's paraphrases. (5c) is Sweetser's paraphrase.

In (5a), it has been made explicit that two facts are interpreted in the content domain. In (5b), a conclusion is explicitly drawn from a fact: this means that (4b) should be interpreted in the epistemic domain. In (5c), a speech act (*I ask*) has been made explicit, together with a motivation for performing that speech act, which means that (4c) should be interpreted in the speech act domain.

Sanders et al. (1992) define semantic and pragmatic interpretation in relation to locutionary and illocutionary meaning. Only a connection between two locutionary meanings can have the feature value 'semantic'. Whenever illocutionary meaning is expressed in one clause or in both clauses, the feature value is set to 'pragmatic'. The paraphrase in (5a) establishes a relation between two facts. This can be interpreted as relating two locutionary meanings. Therefore, the relation in (4a) is semantic. In (5b), a fact is related to a conclusion. This can be indicated as connecting locutionary meaning with illocutionary meaning. Therefore, the relation in (4b) is pragmatic. In (5c), a speech act (*I ask*) is connected with some inference of what has been said in the *because* clause of (4c). This may be interpreted as connecting two illocutionary meanings. Therefore, the relation in (4c)is pragmatic.

Whereas Sanders et al. (1992) assign the coherence relations in both (5b) and (5c) as pragmatic, Sweetser (1990) is interpreting the connective in (5b) epistemically and the connective in (5c) in the speech act domain. These choices are in agreement with each other: concluding from facts, as well as motivating speech acts may be seen as illocutionary meaning.

Not all cases are clear, however. For instance, it is not always obvious why connectives are interpreted as epistemic, rather than semantic. The differences in paraphrase between (5a) on the one hand, and (5b) and (5c) on the other, are quite clear. But looking back at (4a-c), the difference between (4a) and (4b) seems to be rather small. Which properties of the utterances in (4a/b) make the difference? Sweetser (1990, p.77) says:

> Example [(4b)] does *not* most naturally mean that the return caused the love in the real world; in fact, under the most reasonable interpretation, the real-world connection could still be the one in [(4a)], though not necessarily. Rather [(4b)] is normally understood as meaning that the speaker's *knowledge* of John's return (as a premise) causes the *conclusion* that John loved her.

The discriminating factor between the interpretation of (4a) and (4b) seems to be the way in which the real-world connection is established. When this connection is possible between the contents of both propositions, it is a content interpretation; When it is impossible between the contents of the propositions, it is an epistemic interpretation.

In (4b), the comma represents a difference in intonation that marks the epistemic interpretation, so the difference between content and

epistemic interpretation is marked explicitly. The relation with a real-world connection is not established between the propositions themselves.

The example in (4b) gives rise to two questions concerning epistemic interpretation:

1. Is it sufficient to make a lack of real-world connection between the propositions decisive for epistemic interpretation?

2. How are real-world connections involved in epistemic relations?

With respect to the first question: other aspects of the interpretation of the utterance play a role too. It appears to be possible to have context change the acceptance of a real-world connection, even if the utterance remains the same. Consider, for instance, (6).

(6) a. When the whole family is together, you can see how different we are. Bill is always funny. *John is shy, because he blushes very quickly.*

b. Some bodily reactions can have nasty effects on people. For example, *John is shy because he blushes very quickly.*

In (6a), context determines (especially through the presentation of *how different we are* as a conclusion) that a justification for a conclusion is presented. In that case, an interpretation like 'from the fact that John blushes very quickly, I conclude that he is shy' is more likely than an interpretation like 'The fact that John blushes very quickly causes the fact that he is shy'. So, in (6a), epistemic interpretation is preferred. In (6b), the sentence in italics is exemplifying the general statement in the preceding sentence. Here, the interpretation 'The fact that John blushes very quickly causes the fact that he is shy' is more likely. The difference in context is determining the difference in interpretation between (6a) and (6b). So, the combination of real world knowledge and influence of the context determines the interpretation of a *because*-conjunction as content or epistemic.

In (6a), a conclusion is drawn from an observation. The conclusion, *John is shy*, is warranted because the observation, *he blushes very quickly*, is relevant to the conclusion. There is some real-world connection needed between observation and conclusion: 'if you are shy, you blush very quickly'. If this real-world connection were missing, the conclusion would not be validated, and the epistemic interpretation on the basis of this real-world connection would be impossible.[10]

The real-world connection needed for the content interpretation of (6b) is: 'if you blush very quickly, you will become shy'. This is an assumption that will be commonly accepted, just as its reversal given above. The interpretation of (6b) is making use of this real-world connection, instead of switching to an epistemic interpretation using the

[10]See also section 2.4, where a detailed analysis of real-world connection is given.

other warrant. From the differences between (6a) and (6b), it can be concluded that real world knowledge about the propositions in the sentence is not directly responsible for the choice between epistemic and content interpretations. Context controls the difference between the two interpretations, rather than world knowledge related to a sentence on its own.

The second question refers to a more fundamental problem concerning epistemic interpretation. Suppose that some relation is established by recognizing an observation-conclusion pattern, or by a lack of real-world connection. Then, it still must be possible to find a causal relation that supports the observation-conclusion relation. According to Sanders et al. (1992), argument-claim or claim-argument relations are causal, and a relation can not be causal unless there is some real-world connection. In example (6a), the real-world connection appears to be reversed to the real-world connection in (6b). The epistemic paraphrase 'from the fact that John blushes very quickly, I conclude that he is shy' can be made on the basis of the real-world connection that 'if you are shy, you blush very quickly'. The inferential derivation from the real-world connection to the observation-conclusion is called 'abduction'. In (5b), the impossibility of a real-world connection when the relation is read in a cause-effect interpretation, leads to a mapping from effect to observation, and from cause to conclusion: the (unreal) cause 'John loved her' and the (unreal) effect 'John came back' are turned into an observation 'John came back' and a conclusion 'John loved her'. This abductive reasoning is invalid, but very common in normal life. It connects epistemic interpretation to causal relations systematically.

Degand (1996) makes use of this proces of abduction when she defines epistemic interpretation. The formulation P > Q refers to a defeasible implication between P and Q, the propositions between which a (causal) coherence relation is supposed to hold.[11]

> "(...) Given the fact that it is not valid to reason straightforwardly from P > Q (...) to Q > P (...), the relation expressed in ['Theo was exhausted because he was gasping for breath'] should be reinterpreted in a more restricted, subjective way." (Degand, 1996, p. 131).

The 'more restricted, subjective way' refers to an observation-conclusion relation. So, Degand (1996) argues that the process of abduction is inherent to epistemic interpretation. To account for an interpretation in a more restricted, subjective way, the speaker of the utterance is involved in the interpretation of the utterance: it is the observer's, hence the speaker's conclusion.

> "It is the speaker who draws a conclusion expressed in the main clause on the basis of a premise functioning as evi-

[11] See the chapter 3 in this thesis for an explanation of the use of >. Its definition is taken from Asher and Morreau (1991).

dence expressed in the subclause." (ibid.).

This is the observation already made with respect to (6). The way Degand (1996) defines the speaker's conclusion as a result of abductive reasoning, introduces world knowledge again as the basis for epistemic interpretation. However, this line of reasoning is only valid when all epistemic interpretations are characterized by abduction. So, the question is: is it true that only the abductive process indicates the speaker's restricted conclusion? Consider the example in (7).

(7) De straat wordt nat, want het regent.
The street is getting wet, because it is raining.
'From the fact that it is raining, I conclude that the street is getting wet.'

The paraphrase of the meaning of (7) is given after the English translation. It can be applied to the Dutch, as well as the English sentence. One important difference is that Dutch *want* invites epistemic interpretation, whereas English *because* does not have a preference for either epistemic or content interpretation. When the paraphrase is correct, it can not be related to a real-world connection by applying abduction on what is expressed by the paraphrase in (7). For this would render the real-world connection 'if the street is getting wet, it is raining.' Besides the fact that this is a standard example of a connection that does not hold in the real world, it is not the connection that has been used interpreting (7): the speaker concludes that the street is getting wet on the grounds that 'if it is raining, the street is getting wet.'

So, it is not the abduction process that yields epistemic interpretation, but the speaker's restriction on the consequence of the causal relation between the propositions connected by the coherence relation. In example (6), the restriction was indicated by context, and in the Dutch example in (7), the connective *want* was indicating restricted interpretation (also cf. Spooren and Jaspers, 1989; Oversteegen, 1995). The English example in (7) shows that an utterance (especially out of context) may be ambiguous between the two interpretations.[12] Abductive reasoning is only possible in epistemic interpretation (but not the other way around).

Spooren and Jaspers (1989) and Oversteegen (1995) claim that the difference between Dutch epistemic *want* ('because') and content *omdat* ('because') interpretation is due to different perspectives. In an epistemic interpretation, the conclusion is drawn by the speaker, on the basis of an observation that may be shared by reader and speaker. The speaker restricts the conclusion, by making himself responsible for drawing the conclusion from the observation (hence, epistemic interpretation may be called restricted interpretation: acceptance of the interpretation of an utterance is not shared among all participants of the

[12]Of course, comma intonation makes an epistemic interpretation preferred in (7).

discourse). The speaker's conclusion in an epistemic interpretation is in fact a perspectivized proposition. Its interpretation is restricted to the speaker. This supports the idea that interpretation in the epistemic domain amounts to interpretation in a part of the content domain, not equally accessible for every participant of the discourse. In a content interpretation, there is no difference in perspective of the two clauses: two facts are presented as such. Interpretation in a content domain is interpretation in a domain that is equally accessible for every participant of a discourse.[13]

There is another reason for taking restricted interpretation as a defining characteristic of epistemic interpretation. In Sweetser (1990), non-causal connectives are considered to be interpreted in the epistemic domain too. In Sanders et al. (1992), additive as well as causal relations can be pragmatic, which suggests that non-causal coherence relations can be interpreted epistemically. Abductive reasoning is not possible when two propositions are connected by a non-causal coherence relation. Restricted interpretation, however, is still defining both causal and non-causal epistemic coherence relations. This will be demonstrated in section 2.3.

In the next chapter of this thesis, the difference between epistemic and content interpretation will not be taken as a difference in kind of domain, but as a different way of structuring one domain. The introduction of a speaker's conclusion makes it possible to allow for restricting the interpretation of the conclusion to parts of a domain, and not the domain as a whole.

As epistemic interpretation identifies a speaker's conclusion, illocutionary meaning is expressed. Therefore, epistemic interpretation is pragmatic rather than semantic.

A last remark on the speaker's conclusion is that it is connected with another discourse function: epistemic interpretation corresponds to argumentative use of an utterance. Not only is the speaker restricting the scope of what he claims, he also indicates that it is his standpoint that he wants to argue for. This aspect of the use of Dutch *want* and other epistemic markers is analyzed in, among others, Houtlosser (1995).

2.2.2 Speech act interpretation

In this section, a defining characteristic for speech act interpretation will be given in such a way that assignment of the value 'pragmatic' is accounted for. A problem is that Sweetser's (1990) paraphrases expressing speech act interpretations do not seem to be connected with the utterance in a predictable way. In (8a), Sweetser's example, cited in (4c), is repeated along with her paraphrase in (8b), already cited in (5c).

[13] Both Spooren and Jaspers (1989) and Oversteegen (1995) do not claim that *omdat* may only be used in a content interpretation, nor do they claim that perspective shift may only concern the main clause.

(8) a. What are you doing tonight, because there's a good movie on.

b. I ask what you are doing tonight, because I want to suggest that we go and see this good movie.

Which parts of Sweetser's (1990) paraphrase in (8b) provide defining characteristics of interpretation in the speech act domain? The paraphrase is making the speech act interpretation explicit: (8b) is interpreted in the content domain, and the differences between paraphrase and utterance are indicative for speech act interpretation. In this case, *I ask* and *I want to suggest* are possibly characteristic for speech act interpretation.

The utterance *what are you doing tonight* in (8a) is embedded by *I ask* in the paraphrase in (8b). Notice that the question form was already given in the utterance in (8a), by means of the interrogative *what*. Marking the subclause with *I want to suggest* seems to indicate another speech act. This is, however, not an essential part of the paraphrase. Basically, it is enough to give the paraphrase the form: 'I ask P, because Q'. The explanation in *because* is now aimed at *I ask*, and not at the content of the clause embedded in it. So, *because Q* is motivating the speech act, and nothing more is needed for the recognition of a speech act interpretation. The paraphrase in (8b) is complicated, because a lot of other inferences were made explicit: that *there's a good movie on* has to be interpreted as an encouragement to go and see the movie is not essential to the speech act interpretation. In fact, a speech act interpretation will already be recognized by the paraphrase in (8c).

(8) c. I ask what you are doing tonight, because I have an alternative (for it).

In (8c), a motivation of a speech act is made explicit. This is enough to decide for an interpretation in the speech act domain.

A speech act interpretation is the only possibility in (8a). A question beginning with *what* can not be answered directly with an answer that should be interpreted as a cause in the content domain. This is illustrated in (9).

(9) A: 'What are you doing tonight?'

B: #'Because I am going out for dinner'

Speaker B gives an infelicitous answer to the question of speaker A, due to the occurrence of *because* in the answer. An interpretation of (9) as if it were said by one speaker, would be impossible too, unless an interpretation in the speech act domain were made. So, the interrogative form is a clear indication of a speech act interpretation in (8a).

Besides the occurrence of *I ask*, there is another characteristic of interpretation in the speech act domain in (8c). In the alternative paraphrase given in (8c), *for it* is easily inserted, where *it* refers to the propo-

sition expressed by the main clause. The main clause is used autonymously in the paraphrase.[14]. The autonymous use of the main clause has as an effect that the main clause is motivated as a speech act, and not as an assertion. In general, autonymy is a defining characteristic of speech act interpretation. Quite often, an anaphoric reference to the clause representing the speech act is present in the utterance itself. In other cases, like (8c), it is possible to apply it to the paraphrase. The *because*-clause is justifying the uttering of the main clause, taking the main clause autonymously.

As for (8a), speech act interpretation is linguistically marked by the question form of the main clause. In general, speech act interpretation seems to be marked explicitly by linguistic clues like interrogative or imperative form of the speech act. In her chapter 4, Sweetser (1990) presents 24 examples of a speech act interpretation of a conjunction, two of which are not explicitly marked. The marked ones are indicated by either intonation (2), quotation (2), performative predicate or phrase (3), interrogative form (7), imperative form (8). All nine examples of causal conjunction with speech act interpretation were explicitly marked.

The unmarked examples from Sweetser (1990) are presented in (10).

(10) a. King Tsin has great mu shu pork, *but* China First has good dim sum.

b. George likes mu shu pork, *but* so do all linguists.

These Chinese food examples seem to indicate speech act interpretation only implicitly. In (10a), Sweetser (1990) observes an apparent self-contradiction by the speaker, 'who seems to be simultaneously proposing two mutually exclusive options'. In (10b), Sweetser (1990) assumes a clash of conversational implicatures. 'I tell you that George likes mu shu pork' should be informative. This statement becomes uninformative if it is asserted that all linguists like mu shu pork. So, the contrast is between speech act implicatures instead of facts. Sweetser (1990) calls the proposing of mutually exclusive options, as well as the clashed conversational implicatures, 'indirect speech acts of suggestion'.

The interpretation of (10) may be analyzed in an alternative way. The utterance in (10a) might be an indirect answer to a question like: 'which restaurant should we go to?' This possibility indicates the interpretation of a Concession. Concession is characterized by an inferred proposition that serves as a direct answer to the question: 'we should go to China First'. The first part of (10a) represents an argument against, and the second an argument in favor of this proposition (cf. Abraham,

[14]A constituent is used autonymously, when it is possible to use quotation marks for the constituent, indicating that it does not have its usual grammatical function, but is an object of conversation. De Jong, Oversteegen & Verkuijl (1988) analyze autonymy as object language in a meta language expression.

1979; Dascal and Katriel, 1977). The same analysis, which will be presented in section 2.3, may be applied to (10b). Since no speech act will be identified in this analysis, (10a) and (10b) are not examples of speech act interpretation. It will be argued that Concessions always have an epistemic interpretation.

In the analysis of contrast in section 2.3, a proposition representing a conclusion might be found in 'George has a peculiar taste'. The first clause in (10b) is an argument in favour, and the second an argument against this proposition (unless all linguists share the property of having a peculiar taste).

The two examples of unmarked speech act interpretations Sweetser (1990) presents (in (10)), are not considered as speech act interpretations in the analysis adopted here. In her own analysis, they are 'indirect speech acts of suggestion', which seem to be rather weak speech act interpretations.

Given this short inventory of Sweeter's (1990) speech act examples.[15], speech act interpretation seems to be marked obligatorily by explicit linguistic markers, like quotation of the speech act clause, a question or imperative form of the speech act clause, performative predicates, or intonation. In the paraphrase it will be possible to refer to the speech act clause by means of an anaphor. In causal relations, the speech act is always represented by the claim, whereas the motivation of the speech act is always motivated by the argument.

Explicit clues do not include the 'I tell you ...' or 'I ask...' formulation itself. In (11), the interpretation is content rather than speech act.

(11) I say you are stupid, because you are.

The real-world connection that is at stake here, is one of justifying speech acts: if someone is X, I may say that he is X.' But because this justification is explicit here, it is a 'real-world justification', and not part of the speech act domain.

2.2.3 Conclusion

The definition of the pragmatic value of Sanders et al. (1992) encompasses both the definitions of epistemic interpretation and speech act interpretation. In epistemic interpretation, a speaker's conclusion is restricting the interpretation to what the speaker believes to be true. This indicates illocutionary meaning, and may thus be called pragmatic. In speech act interpretation, a speech act is justified by taking one of the clauses as the speech act, commenting on the speech act in the other

[15]The set of examples Sweetser (1990) provides is taken as canonical.

clause. This also indicates illocutionary meaning, and thus the pragmatic feature value.[16]

Despite the pragmatic value for both speech act and epistemic interpretation, they differ considerably. Epistemic interpretation amounts to the identification of the speaker's conclusion. Markers for epistemic interpretation are found in context or connective. What they mark is the speaker's position, c.q. a change of perspective. Epistemic interpretation does occur in unmarked cases too: in that case, lack of an immediate real-world connection may invoke abduction. This is only possible when a speaker's restricted conclusion is derived. Epistemic markers often indicate perspective, and their interpretation is argumentative.

Speech acts are explicitly marked. Mostly, one of the clauses is marked as a speech act, by an interrogative or imperative form, or quotation marks. In paraphrase, it is possible to embed this clause in a speech act verb, which turns it into an autonymous clause, and refer to it by means of an anaphor in the other clause. The speech act clause is justified or motivated by the other clause.

In this thesis, speech act interpretations and epistemic interpretations will be treated differently. Because the (linguistic, contextual or knowledge based) indication of these interpretations differs considerably, a detailed semantic analysis of the connectives that express these interpretations must represent these differences.

2.3 Three Kinds of Contrast

In this section, three kinds of contrast will be distinguished. In the literature on the interpretation of *but*, there are more proposals than just three. The most important proposals are listed below.[17]

- Denial of expectation (Lakoff, 1971)
- Semantic opposition (Lakoff, 1971)
- Concession (Abraham, 1975; Dascal and Katriel, 1977)
- Argumentative use (refutation) (Anscombre and Ducrot, 1977)
- Parallel contrast (Cohen, 1971; Blakemore, 1987)
- Rectification (Dascal and Katriel, 1977)

[16] On the other hand, Oversteegen (1997, p. 59) claims that from her perspective, *little can be gained by treating* belief *cases [i.e., epistemic interpretation] and* speech act *cases as equivalent*.

[17] In the bulleted list, each kind of interpretation is followed by the introductory work on this interpretation. The cited authors do not exclusively choose for the interpretation they are associated with: they introduced the interpretation next to other interpretations. The names for the interpretations are not always the same as the original ones.

- Conversational marker (Schiffrin, 1987; Redeker, 1990)

From these interpretations, only the first three will be maintained in the next chapters (following Spooren, 1989). The other interpretations can be brought down to one of the first three, or they occur in types of language use not studied in this thesis. Specifically, argumentative use of *but* boils down to concession; parallel contrast may either be concession or semantic opposition; rectification is a specific and restricted use of contrast; the functional meaning aspect of conversational markers is referring to other meaning properties than those analyzed in this chapter.

In each of the next three sections, one interpretation of *but* will be introduced, next to other interpretations, and differences and resemblances will be discussed. Besides, epistemic interpretation of contrastive connectives will be analyzed, as well as causal interpretation of some contrastive relations.

2.3.1 Denial of expectation

The utterance in (1) is what has been called a 'denial of expectation' (Lakoff, 1971). The sentence following *although* leads to an expectation: 'if a woman is beautiful, she will marry'. This expectation is denied by the second clause: 'she never married'. Using *hoewel*, this interpretation is preferred. There are occurrences of *hoewel* that support other interpretations. At the same time, there are other connectives and adverbs that may have a denial of expectation interpretation too. For instance, in (2b), the use of *maar/but* denies the expectation that 'having many love-affairs leads to marriage'.

Lakoff (1971) introduced denial of expectation by presenting different usages of *but*, and distinguishing between denial of expectation and semantic opposition. A sentence like *John is tall but he is no good at basketball*, ...is composed of an assertion plus a presupposition, and the two functioning together are what condition the use of *but*. (Lakoff, 1971, p. 133). The conjunction as a whole is asserted, and the presupposition is: *if someone is tall, then one would expect him to be good at basketball.* (ibid.). No specifications are given for a procedure to formulate the presupposition from the utterance. Lakoff (1971) presents some problematic cases too, in which it is more difficult to formulate a presupposition (e.g., in (12)).

Reactions to Lakoff's (1971) proposal concerned her problematic examples that could neither be semantic opposition, nor denial of expectation. A concessive interpretation of contrast was introduced (Abraham, 1975). For instance, instead of accepting the implication that 'having many love-affairs leads to marriage' with respect to (2b), one could also assume that *Prince has had many love-affairs* is an argument in favor of the claim 'Prince is looking for his true love', whereas 'he never married' is an argument against the claim 'Prince is looking for

his true love.' The introduction of concessive interpretation makes it possible to demarcate denial of expectation and other contrastive interpretations more precisely. Concessions will be discussed in section 2.3.3, together with some examples that seem to be difficult to classify as one or the other.

Lakoff (1971) analyzes as an apparent counterexample to her analysis, (12a) (taken from Lakoff, 1971, p.138).

(12) a. George likes Peking Duck, but all linguists are fond of Chinese food.

b. I say to you that George likes Peking Duck, but I really don't have to say this, because all linguists are fond of Chinese food.

The paraphrase of (12a) in (12b) expresses that the contrastive relation is actually between speech acts, and that the *but* clause is violating the expectation 'if one says something, then it is worthwhile to say it'. The clause *all linguists are fond of Chinese food* motivates the denial of this expectation. However, Lakoff's (1971) analysis is not in accordance with the assumptions about speech act interpretation made in this chapter. In section 2.2.2, it was argued that speech act interpretation is recognized because it is explicitly indicated, and that one clause is interpreted as a speech act, whereas the other is justifying or gainsaying it. In (12a), there is no explicit indication; in (12b), the denial is itself motivated by the contents of the clause (introducing a second coherence relation by using *because*), whereas the contents of the second clause should be gainsaying the speech act itself. In other words, the derivation of (12b) involves too much inferences that are not directly related to the utterance.

A concessive interpretation of the claim: 'George has a peculiar taste' ('George likes it, so he must have a peculiar taste'; 'all linguists do, so he does not have a peculiar taste') would provide an alternative interpretation for (12a), following quite strict interpretation schema. Again, see the section on concession for an explanation of concessive interpretation.

A reanalysis of (12a) as a concession has consequences for the analysis of denial of expectation: not only a denial of expectation and a semantic opposition need to be distinguished. The interpretation of concession accounts for some of the 'odd' examples in Lakoff (1971). Given these three interpretations, the interpretation of denial of expectation may correspond more directly to the contents of the clauses of the utterance. In (1), the expectation is an implication with an antecedent derived from the first clause (*Greta Garbo was called the yardstick of beauty* is turned into 'if a woman is beautiful'), and a consequent derived from a denial of the second clause, (*she never married* is turned into 'she will marry'). When it is not possible to derive the expectation from the two connected clauses, another interpretation has to be found. This means, that the 'problematic' examples such as (12) are

not denials of expectation. The other interpretations have not been introduced yet, so the discussion of problematic examples is postponed to the next sections.

Sanders et al. (1992) apply their cognitive primitives to the representation of propositions, derived from corresponding clauses in the utterance. The expectation is reflected in this representation. The expectation relation itself is an implication: the expectation for (1) is 'if someone is called the yardstick of beauty, she will marry.' This gives the feature value 'causal' to a denial of expectation.

A denial of expectation has the feature value negative, since the expectation is derived by negating one of the clauses in its utterance. So, a denial of expectation is a negative causal relation, in terms of Sanders et al. (1992).

Is a denial of expectation semantic or pragmatic? In (13), three denials of expectation are presented. (13a) is adapted from Noordman and Vonk (1992), (13b) is borrowed from Sweetser (1990) and (13c) is adapted from Sanders et al. (1993).[18]

(13) a. Connors didn't use Kevlar sails although he expected little wind.
b. Mary loves you very much, although you already know that.
c. Theo was not exhausted, although he was gasping for breath.

The adaptation of (13a) is the substitution of the original *because* for *although*, with a negation added to the main clause. In the sentence *Connors used Kevlar sails because he expected little wind*, the causal relationship is considered semantic. That is, even for people who do not know of the properties of Kevlar sails, it will be assumed by most readers that there is some content relation between kind of sail and type of wind. In the *although*-case, this is the same: the relationship between sails and winds will be causal as well. So, denials of expectation can be negative causal semantic relations. Can they be pragmatic too? Two cases are considered: speech act, and epistemic interpretation.

A speech act case is presented in (13b), taken from Sweetser (1990). Instead of giving a justification of the uttering of the first clause of (13b), *although* expresses the violation of such a justification. In paraphrase, the expectation is: 'if I say: "Mary loves you very much", you do not already know that'. Normally, one utters clauses to inform people; in this case, *Mary loves you very much* is uninformative (as stated in *you already know that*), but it is said anyway. So, the speech act variant of a denial of expectation is the violation of the justification of a speech act. Notice that in the paraphrase, the phrase *I say* can be found, as well as an anaphor referring to the clause that functions as speech act (namely, *that* refers to "Mary loves you very much").

(13c) is an adaptation of a *because* sentence again: *Theo was exhausted because he was gasping for breath* (taken from Sanders et al.,

[18]Similar examples and argumentation are found in Lagerwerf and Oversteegen (1994) and Oversteegen (1997).

1993). This causal relation can only be interpreted epistemically. A correct paraphrase of the *because* sentence would be: 'From the fact that someone is gasping for breath, I conclude that he is exhausted'. This is also the expectation of (13c). The conclusion: *he is exhausted* is denied in (13c). The connection in the world that has to be recognized for a correct interpretation of the expectation, has to be: 'if someone is exhausted, he is gasping for breath'.

A denial of expectation is thus interpreted as negative, causal, and either semantic or pragmatic. In the case of pragmatic interpretation, speech act, as well as epistemic interpretation occur. *Although*-clauses occur in front of the main clause or follow it, so the order of a denial of expectation may be basic or non-basic (the order of the propositions in the expectation is taken as basic). Denials of expectation expressed by *but* are always basic in order, as the (denying) *but*-clause is always the second clause. The conclusions drawn here for the English facts on *but* and *although* are similar for Dutch *maar* and *hoewel*, respectively.

In the sections on semantic opposition and concession, the distinctions between the interpretations will become more clear.

2.3.2 Semantic opposition

An example of semantic opposition is given in (14a) (in Dutch), and in (14b) (in English).

(14) a. Greta was alleen, maar Prince was getrouwd.
b. Greta was single, but Prince was married.

Semantic opposition can be separated from the other interpretations by using *although* instead of *but*, as is shown in (15).

(15) a. ?Hoewel Greta alleen was, was Prince getrouwd.
b. ?Although Greta was single, Prince was married.

Neither (15a) nor (15b) are acceptable, and it appears to be part of the semantics of *although* that it is not possible to express a semantic opposition.

The main difference in interpretation between semantic opposition and other contrastive interpretations, is that *[s]emantic oppositions are about two entities in the domain of discussion, and denials of expectation and concessive oppositions are about one entity in the domain* (Spooren, 1989, p. 56). The opposition between being *single* and *being married* is predicated over two different arguments. This restriction predicts the unacceptability of (16).

(16) #Greta was single, but she was married.

Two predicates are applied to one argument in (16), which causes a direct contradiction. However, it is not always contradiction that explains the unacceptability of a semantic opposition predicated of one entity, as (17) shows.

(17) #Greta was lonely but she was alone.

Here, it would be a tautology instead of a contradiction. But this can not be a logical tautology (analogous to the logical contradiction in (16); *Greta was lonely and she was alone* is not unacceptable. The logical meaning of *but* is a conjunction, and not a contrast. So, in a semantic opposition, there must be a contrast, but it may not be a contradiction. If two predicates are about one entity, it is difficult to meet such a condition.

Blakemore (1987) claims that semantic incompatibility of the predicates is not necessary for the contrast interpretation that is at stake here. In the appropriate circumstances, *chess* and *skiing* could express a semantic opposition, as shown in (18) (taken from Blakemore, 1987, p. 132).

(18) Mary likes skiing. Anne plays chess.

Even without the use of *but*, a contrast can be inferred between the activities of *Mary* and *Anne*. According to Blakemore (1987), a parallel intonation pattern can be recognized in (18), giving emphasis to both *skiing* and *chess*. This parallel intonation pattern is the same in the examples (14)-(17). So, semantic contrast is dependent on an intonation pattern that puts the two predicates next to each other, together with the instruction to find some contrast between the predicates. It is this instruction, that makes (16) and (17) unacceptable: because both predicates apply to the same entity, the result of the contrast is contradiction (in (16)), or it can not be found (in (17)). Because of the intonation pattern, other interpretations are excluded.

In the introduction of this section, an interpretation 'Parallel contrast' was mentioned. In Asher (1993), the effects of Parallel contrast on discourse structure are analyzed. He assumes that Contrast relations need a Parallel structure to derive contrast between discourse segments. Parallel structure, and parallel intonation are two sides of the same coin. In order to achieve parallel intonation, predicates must be parallel in constituent structure.

The properties of Parallel contrast and semantic opposition are in fact the same. When two clauses connected by *but* are parallel, the interpretation of the sentence needs to be semantic opposition. That is, between predicates, a contrast is derived, and two parallel arguments of the predicates may not refer to the same entity. Given these restrictions, the semantic oppositions in (19) can be accounted for.

(19) a. John is tall but Bill is small.

b. On Mondays Mat plays volleyball but on Thursdays he plays hockey (taken from Oversteegen, 1997).

c. It was Bill the boss fired, but it was John the boss hired.

In (19a), parallel intonation on the predicates *tall* and *small* makes them contrastive, and *John* and *Bill* are referring to different entities. In (19b), it is shown that other constituents than subjects or objects can serve as the distinct entities. The contrastive predicates are applied to the days on which Mat is performing his sport. Again, this effect is in agreement with parallel intonation. In (19c), it is the focus position of the cleft sentence that identifies the distinct entities *Bill* and *John*. Notice that this structure is submitted to parallel intonation too.

Semantic opposition is associated with parallel contrast. This explains the problem of the unacceptability of (17). There is a parallel intonation, so other interpretations are excluded, but *Greta* and *she* refer to the same entities, which make the sentence unacceptable. Parallel contrast does not explain the acceptability of (20), however.

(20) Greta was not lonely, but she was alone.

The interpretation of (20) is one of correction, rather than contrast between predicates. In the introduction, this interpretation was called 'Rectification'. Dascal and Katriel (1977) introduce this corrective variant to account for the distribution of two Hebrew connectives, *ela* and *aval*. Both connectives translate with English *but*. In (20), *but* is used in the *ela*-sense, i.e. in a corrective use.

Corrective use of *but* is a specific construction, because the predicate in the first clause needs to be denied. Normally, *but* has the truth conditional meaning of the conjunct *and*: both conjuncts need to be true. Here, both conjuncts are true, only because of the use of *not* in the first conjunct. There always has to be an explicit lexical negation in the first conjunct. The predicate *lonely* may not be applied to *Greta*, since it is not true (which is corrected in the *but* clause), according to the speaker.

Corrective use of *but* will not be analyzed in this thesis, because it does not express a genuine coherence relation. The gap that the negated predicate leaves in the interpretation of the sentence, is filled with the other predicate. Once the sentence is interpreted its propositional content is just: 'Greta is alone'. The relation is one between predicates, rather than between clauses. Dascal and Katriel (1977) state that the interpretation of *ela* is always made between the same layers of meaning. When an utterance *p ela q* has been done,

> p contains the denial of its focal element, and the focal element in q is believed by the speaker to be a replacement for the element denied in p. (Dascal and Katriel, 1977, p.171).

The replacement of one focal element (the predicate) for the other, has as a result that one proposition remains. As for the first constituents (*Greta* and *she*), Dascal & Katriel (1977) propose that a presupposition in the form of an existential statement ensures the interpretations of both entities in the same domain for both propositions. The propositions are thus structurally related. Again, this means that the sentence in (17) is, in the end, expressing one proposition rather than a relation between two propositions.

Semantic opposition is not a causal relation, for the derived propositions do not have a causal connection. The relation between the predicates *single* and *married* may have implicational properties ('If someone is single, she is not married'). This knowledge is, however, only the expression of an antonymous relation between predicates, not a causal relation between propositions. In terms of Sanders et al. (1992), lack of a causal relation between propositions means that a coherence relation is additive.

As the term already indicates, semantic opposition is considered semantic, rather than pragmatic. 'Semantic' in 'semantic opposition' refers to a relation of contrast between the predicates. Semantic opposition is not epistemic, since there is no speaker's conclusion. There are no speech act cases either. Marking a speech act through quotation marks, interrogative or imperative form would abandon the parallel intonation pattern, which is a condition for a semantic opposition. So, because a semantic opposition can not express illocutionary meaning, it is always semantic (i.e. relating two locutionary meanings, or: interpreted in the content domain).[19] This view on semantic opposition is contrary to Sweetser (1990). Arguments against Sweetser's view are given in Oversteegen (1997).

The characterization of semantic opposition is thus negative, additive and semantic (no basic order being specified in additive relations).[20]

2.3.3 Concession

Denial of expectation and semantic opposition are rather restricted in their interpretation: a causal relation between two propositions, related to the connected clauses, should be available as an expectation to be denied, and a parallel intonation pattern, applying two contrasting predicates on two different entities should be available for semantic opposition.

[19] Other interpretations of intonation patterns, e.g. Rooth (1992), are called pragmatic, in the sense that the meaning aspects of these interpretations are non-truth-conditional. The semantic/pragmatic distinction in Sanders et al. (1992) does not refer to truth-conditional properties.

[20] The fact that *but* is fixed for order in the utterance is not relevant here. What does count is the fact that the propositional contents of a semantic opposition can be interchanged, without creating an unacceptable sentence. In other words, semantic opposition is symmetric, whereas denial of expectation is asymmetric.

Do these strict definitions mean that the category of concession is taken to be the sloppy category, in which anything goes? The answer is yes and no. On the one hand, it will be possible to give an independent and clear definition; on the other hand, there are borderline cases with both denial of expectation and semantic opposition that need to be discussed. Discussion of these examples will show that the definitions are doing quite well: it will be possible to classify every example properly.

First, a definition of concession will be given with respect to the example in (21) (taken from Spooren, 1989, p. 82).

(21) A: Shall we take this room?
B: It has a beautiful view, but it is very expensive.

B's answer may be analyzed as the presentation of both an argument in favor of a claim, and an argument against it. The claim is given in the context, in this case in the question of A: 'we take this room'. The first argument, *It has a beautiful view*, leads to the claim itself; the second argument, *it is very expensive*, leads to a negation of the claim. Spooren (1989) shows in an experiment that people tend to take the *but* clause as more important: B's answer is, in the end, negative. Spooren's (1989) 'asymmetry hypothesis' agrees with the analysis of McKeown and Elhadad (1991), in which the argumentative orientation of the first clause of a *but* sentence is weaker than the second clause.[21] McKeown and Elhadad (1991) would say that the clause introduced by *but* expresses the 'directive act' of the conjunction.

The interpretation of concession is characterized by a contextually determined 'tertium comparationis': the claim for which both a positive and a negative argument is provided.[22] In a conjunction *p but q*, the tertium comparationis is a third proposition *r*. Both *p* and *q* provide an argument related to *r*, but one of the arguments leads to $\neg r$, and the other to *r*. The argument provided by *q* will always be stronger than the argument provided by *p*, according to Spooren (1989). Because two arguments are needed for this concessive interpretation, *r* can not be identified as *p* or *q*.

A concession interpretation can be found whenever a relevant yes-no question before the *but* conjunction is asked appropriately, with the propositional content of the question as tertium comparationis. This

[21] The argumentative orientations of both clauses are compared on a scale, representing the measure of what is relevant in the argument (cf. Ducrot, 1980). The first clause has a lesser degree than the second clause in a *but* sentence, if the scales are commensurable.

[22] Instead of 'concessive opposition' (cf. Spooren, 1989), the term 'concession' will be used. Concessive interpretation is originally the name for the interpretation of English *even though* and *although* or Dutch *al* and *hoewel*. In König (1986), the interpretation he assigns to *although* is called concessive, but represents what is called denial of expectation here.

question represents a context in a direct way: the answer must be understood as relevant to the question. Using questions, it can be demonstrated that context determines the interpretation of a *but* sentence to a large extent. This can be demonstrated by an example from Moeschler (1989), translated into English in (22).[23]

(22) The weather is nice, but I'm tired.

Moeschler (1989) argues (against the assumption that the meaning of *but* is responsible for the interpretation, as Ducrot (1980) claims), that there are two possible tertia comparationis in (22): *r* might be understood as 'let's go out' in a context in which someone asks the speaker whether he wants to go out, and *r* might be understood as 'I'm happy', for instance when someone asks: *what's the matter?*. In the first context, the speaker admits that the weather is nice, but he chooses to stay at home, for he is tired. In the second context, the speaker admits that he is should be happy, but he is too tired to be happy. Thus, contexts determine the interpretation of a concession significantly.

Concessions are easily confused with denials of expectation. Often, conjunctions are ambiguous between denial of expectation and concession. For instance, in (2), the denial of expectation may be replaced by a concession (example repeated here in English version).

(2) The Artist Formerly Known as Prince was married yesterday at his residence.
Prince has had many love-affairs, but he never married.

The context is relating to marriage. If instead, the context were a question, for instance: 'Did Prince look for his true love?', then from clause p, *'Prince has had many love-affairs*, one can infer: 'so he did look for his true love'. From the second clause, *he never married*, one can infer: 'so he did not look for his true love.'

Concessions are, more than denials of expectation, sensitive for their context. For instance, in (23), a concession is made with another tertium comparationis.

(23) Famous artists are often insecure about important decisions in life. Some of them remain indecisive until the last moment.
Prince has had many love-affairs, but he never married.

A relevant question, such as 'Does Prince make important decisions?' could be inserted between context and *but* sentence in (23). This would render a tertium comparationis 'he makes important decisions', which is established for the first clause and denied for the *but*-clause. The

[23]The original example is from Moeschler and de Spengler (1982): *Il fait beau, mais je suis fatigué (donc je ne sors pas)* ('The weather is nice, but I'm tired, (so I won't go out)'). In Moeschler (1989), different contextualizations are applied to *Il fait beau, mais je suis fatigué*.

previous tertium comparationis, 'Prince is looking for his true love', is not consistent with the context in (23).

To a certain extent, context may affect the interpretation of a denial of expectation too, but the expectation is quite constant in different contexts, compared to a tertium comparationis. According to Oversteegen (1995), main clauses of denials of expectations do not share their discourse topic with the preceding context to the same extent as main clauses of concessions. A denial of expectation for the *but*-sentence in its context in (23) would be rather irrelevant. The discourse would not be very coherent.[24]

Concessions may be expressed using *although*. An example is given in (24).

(24) A: Is Theo healthy?
B: Although Theo is gasping for breath, he is not exhausted.

In B's answer in (24), two arguments are provided in favor of, or against the claim that Theo is healthy. 'Theo was gasping for breath, so he is not healthy' is the inference made on the basis of the first clause; 'he was not exhausted, so he is healthy' on the basis of the second.

Sidiropoulou (1992) discusses a borderline case between denial of expectation and concession on the basis of (25) (taken from Sidiropoulou, 1992, p.206). She distinguishes Shared Implicature Concession (SIC) and a Speaker's Attitude Concession (SAC). A SIC is inferred when a background assumption is violated. A SAC is inferred when a speaker is able to assign a positive evaluation to one clause, and a negative to the other. A SAC is, at the same time, defined as not violating any background assumption, because in this interpretation no relevant background assumption is made.[25] Consider the example in (25).

(25) Although he is Viennese, he doesn't like music.

(25) might be SIC or SAC, according to Sidiropoulou (1992). The background assumption, needed for a SIC, is thought of as a conversational implicature, stated as a generic sentence, like in (25′).

(25′) Viennese people like music.

[24]It is, of course, possible to read the denial of expectation independent of its context. But that would only demonstrate the relative context-independency of a denial of expectation.

[25]In her article, Sidiropoulou (1992) tries to analyze SIC and SAC in terms of distributions of the entities mentioned in an *although* sentence (namely, (25)). Distribution of the entities in a SIC would correspond to universal quantification of the variable quantified for both predicates; distribution of the entities in a SAC would correspond to existential quantification of the variable quantified for both predicates. This analysis is left out of the discussion, for it is not clear what the consequences are for her analysis in terms of background assumptions.

In terms of denial of expectation, the background assumption represents the expectation. Sidiropoulou (1992) claims that this background assumption is not necessarily made. For example, if the speaker is *simply 'looking for' or 'interested in' Viennese people who like music* (Sidiropoulou, 1992, p.206), a SAC is derived.[26] In fact, this means that SAC is determined by context, just like concession.

If (25) were contextualized with a question, for instance from someone interested in Viennese people who like music, or someone who is looking for them, a context is provided in which the speaker should be just expressing his attitude towards the state of affairs expressed in each of the two clauses. At the same time, this would be a context in which a concession might be identified. Consider (26).

(26) A: Does John from Vienna like music?
B: Although he is Viennese, he doesn't like music.

Speaker B expresses his attitude towards the state of affairs by saying that John is Viennese (positive) and that he does not like music (negative). Therefore, one could argue, (26) is a SAC. One may also apply a speaker's assumption like (25′). In that case, B's answer violates the assumption. It is dependent on whether or not the speaker's assumption is made in the context of (26).

The definition of concession is more precise in the case of (26). A's question in (26) renders a tertium comparationis that is similar to the negation of the second clause of B's answer: 'John from Vienna likes music' ($\neg r$) is the same as 'he likes music' (q).[27] This is not possible in concessions: a tertium comparationis may not be identified with one of the connected clauses. Rather, the interpretation of B's answer is a denial of expectation, since a suitable expectation is derived, given the context in (26).

Sidiropoulou (1992, p. 212) has a negative and a positive criterion for recognizing a SAC. The negative criterion is that *[i]t is assumed that a SIC reading is possible whenever an implication is calculable.* Given this criterion, a SIC reading is possible in (26). She argues that (25) can be interpreted as a SAC, given the positive criterion: *[t]he main distinguishing characteristic of a SAC is some type of positive or negative evaluation, regardless of the speaker's assumptions about the underlying implications of the propositions involved* (Sidiropoulou, 1992, p. 206). As demonstrated with regard to (26), a tertium comparationis may not be derived from

[26] Being simply 'looking for' Viennese people who like music with respect to (25) does still express a denial of expectation, in my view. A search for Viennese music lovers can be made using a conditional 'if he is Viennese, then he likes music.' This conditional is an expectation, in the sense that if someone appears to be Viennese, it will be checked whether he is a music lover, due to the search for Viennese music lovers. It is not an expectation in the sense that the speaker really expects everyone from Vienna to be a music lover.

[27] *He* in *he likes music* refers, of course, to *John*, of whom it is established in the first clause that he lives in Vienna.

one of the conjuncts, but can only be a contextually motivated statement. This means that the definition of concession is more restrictive than the definition of SAC.[28]

Are there any questions that turn B's answer in (26) into a concession? Consider (26).

(27) A: Is John a regular visitor of the Viennese Opera?
B: Although he is Viennese, he doesn't like music.

In (27), the first clause of B's answer might be an argument towards the conclusion that 'John is a regular visitor of the Viennese Opera' (tertium comparationis), and the second clause is an argument towards the conclusion that it is not the case that 'John is a regular visitor of the Viennese Opera'. So, under more restricted contextual conditions, a concession is possible too for (25).

Concession and denial of expectation are often both possible in *but* sentences, as well as *although* sentences. Context determines when concession is derived. This restriction is more explicit than Sidiropoulou's (1992) contextual restrictions on SAC interpretation.

According to Spooren (1989), concession and denial of expectation differ from semantic opposition in that the conjuncts in a denial of expectation or concessive opposition are 'about' one entity.[29] There are, however, *but* sentences that seem to have parallel intonation and two different topics, but can be interpreted as concessions. An example is (10a), repeated below.

(10) a. King Tsin has great mu shu pork, *but* China First has good dim sum.

Notice that an interpretation of semantic opposition is not excluded with respect to (10a). The restaurant entities *King Tsin* and *China First* are different, and they appear to have different properties with respect to the meals that they serve. It is clear, however, that such an opposition does not express 'indirect speech acts of suggestion', as Sweetser (1990) calls them.

According to Spooren (1989), semantic oppositions can be distinguished from concessions and denials of expectation by presenting them as an answer to a question: the former can only be an answer to

[28]Perhaps Sidiropoulou (1992) has to be understood in such a way, that the background assumption is still available, but not as a generic statement. When one is just 'looking for' or 'interested in', the background assumption is not representing a generic statement, but a mere conjunction: 'There is a Viennese who likes music.' This interpretation of a background assumption for a SAC will not be allowed as a tertium comparationis (for an argument for both r and ¬r must be possible), nor as an expectation. Besides, a SAC was characterized as not having a background assumption, so this solution is not possible for a SAC either.

[29]McKeown and Elhadad (1991) call this aboutness 'thematization'.

a Wh-question (a question introduced by an interrogative pronomen), the latter can only be an answer to a yes-no question. Consider (28).

(28) A: 'Which restaurant is better?'
B: King Tsin has great mu shu pork, *but* China First has good dim sum.

The Wh-question in (28) makes a semantic opposition inevitable. Two entities are compared with respect to their properties. Notice that parallel intonation is still possible here, due to the same structure of both conjuncts. This parallel intonation invites A to look for contrast between *great mu shu pork* and *good dim sum* (following Blakemore, 1987). This will be a quite individual contrast.

A yes/no question is possible too, as (29) shows.

(29) A: Shall we go to King Tsin?
B: King Tsin has great mu shu pork, *but* China First has good dim sum.

From A's question, a tertium comparationis can be inferred: 'we are going to King Tsin.' The first clause of B's answer is an argument in favour of the tertium comparationis, and the second clause is an argument against it. In such a reading, B's answer is a concession, resulting in the suggestion to go to *China First* (following Spooren's (1989) asymmetry hypothesis).

This means that context may force a concession interpretation on constructions that seem typically semantic oppositions. As far as (10) is concerned, a concession interpretation appears to be more natural, since argumentation is involved. The most plausible context for (10) is one in which a decision ought to be taken to go to one or the other restaurant.

Representing argumentation is characteristic for concession. The tertium comparationis represents an argumentative orientation. In the argumentation theory of Anscombre and Ducrot (1977), this aspect of the interpretation of *but* is taken to be central. Both clauses represent arguments with respect to this argumentative orientation. The argumentation is expressed by comparing the values of what has been expressed in the clauses on scales like: 'the more proposition A is the case, the more proposition B is the case,' with respect to a sentence *A but B*. Their analysis is not directly connected to the analysis given in the next chapter of this thesis. Instead of adopting the argumentative approach, Gricean implicatures will be involved in the analysis. In Kalokerinos (1995), 'Gricean theories' are compared with the argumentative approach.

The use of *but* to refute an argument is an aspect that has been discussed in argumentation theories more than in semantic and pragmatic theories. Snoeck Henkemans (1992) gives examples of argumentation

in which *but* is used to refute counter-arguments. One of these examples is given in (30) (taken from Snoeck Henkemans, 1992, p. 133).

(30) I think the library should stay open on Sundays, because that would give people an opportunity to make use of it. They say that they don't have enough personnel to keep it open on Sundays, but if a system of working shifts were introduced there would be no problem at all.

The conjunct *They say ... Sundays* is a counter-argument to the central claim that the library should stay open on Sundays. This counter-argument is refuted by the *but* conjunct *if a system ... at all*. The concession interpretation fits in nicely with this refutation. The tertium comparationis is 'the library can be open on Sundays'. The counter-argument is opposing to this claim, whereas the *but* conjunct is in favor of the claim. The asymmetry of *but* explains why the *but*-clause provides the stronger argument (cf. Spooren, 1989). As a result, the counterargument is not valid anymore in the argumentation for the central claim that the library should stay open on Sundays. The difference between refutation of counter-arguments and concession is the aim of the analysis. In concessions, one clause is giving the best argumentation. In refutations the same happens, but it overrules the other argument in the larger structure of the argumentation as a whole. Refutation will be regarded as concession, for the consequences of concession on a larger scale of argumentation will not be studied in this thesis.

Is it possible to apply the distinction between semantic and pragmatic interpretation to concession? In order to answer this question, it is interesting to look back at (26), repeated here.

(26) A: Does John from Vienna like music?
B: Although he is Viennese, he doesn't like music.

In (26), an epistemic denial of expectation is the most likely interpretation. The expectation is: 'From the fact that John comes from Vienna, I conclude that he likes music'. The expectation is denied in the main clause of the *although* sentence. In (26), the real-world connection supporting the expectation is not obtained by abduction. As shown before, this was not a necessary condition for epistemic interpretation. Changing the context into 'is John a regular visitor of the Viennese Opera?' (in (27)) makes the interpretation of concession possible. In this interpretation, a conclusion is drawn that John does not often visit the Viennese Opera. This is B's conclusion, drawn from a positive and a negative argument in (27). The presence of a speaker's conclusion in the mental representation of B's answer makes the interpretation epistemic. So, while (26) and (27) differ with respect to their interpretation of the contrastive relation, they are both epistemic.

The example in (10a), where concession seemed more natural than semantic opposition, is epistemic too: the use of a semantic opposition in such an argumentative way makes a concession more plausible. With respect to (29), conclusions are drawn from two facts: 'King Tsin has great mu shu pork', and: 'China First has good dim sum'. The conclusions are: 'so we are going to eat at King Tsin', and: 'so we are not going to eat at King Tsin.' If the intended meaning of the speaker were paraphrased, this would be the result: 'from the fact that King Tsin has great mu shu pork, I conclude that we should eat there, and from the fact that China First has good dim sum, I conclude that we should eat there'. Given the assumptions that semantic opposition is semantic, and concession epistemic, concession is more natural in (10a): argumentative use calls for a speaker's conclusion and hence epistemic interpretation. This might be problematic for the recognition of semantic opposition, but not for concession.

In the tertium comparationis, a speaker's conclusion will be represented by definition, and in the clauses, arguments in favor of or against this conclusion are given. Therefore, the interpretation of concession is always connected with epistemic interpretation.

Concession is, in terms of Sanders et al. (1992), an additive relation. Other epistemic relations that were presented, were causal relations. Notice that the paraphrase of the intended speaker's meaning is a conjunction, and that applying abduction, in the way Degand (1996) describes it, is impossible. This is because no causal relation is inferred, but a conjunction on the basis of causal inferences (namely, from clause to tertium comparationis). As a consequence, concession is an additive relation (cf. Sanders et al., 1992, p. 20).

The characterization of concession is now complete, and in agreement with Sanders et al. (1992,1993): concession is a negative, pragmatic, additive relation.

2.3.4 Conclusion

In the analysis of the three kinds of contrast, three different interpretation schemes were presented. Denials of expectation are typically causal: they need an implication between propositions, directly related to the conjuncts of *but* and *although*. Semantic oppositions are determined by their parallel intonation and structure: two contrasting predicates are applied to two different entities. Concessions always form a tertium comparationis, and their clauses form arguments in favor and against this proposition. Concessions mostly concern one entity, but in the appropriate conditions, a semantic opposition (about two entities) might be interpreted as a concession. The cognitive primitives could be applied to each interpretation.

Other contrastive interpretations were reduced to one of these interpretations, or they were identified as a type of language use that is not studied in this thesis. One interpretation is not discussed: the function

of *but* as a conversational marker. This interpretation of *but* will return, in chapter 5.

2.4 Causal Relations

Epistemic interpretation was identified as the speaker's conclusion, and contextual factors or certain connectives could indicate epistemic interpretation. In section 2.2, determination of epistemic interpretation of causal relations was often related to the recognition of a real-world connection. There are cases in which the recognition of a real-world connection is the only way to distinguish semantic and epistemic interpretation of causal relations. In (31), *because* is used three times to indicate a causal relation.

(31) a. Theo was exhausted, because he had run to the university.
b. Theo was exhausted, because he was gasping for breath.
c. ?Theo was exhausted, because he had been resting all day.

Intuitively, a semantic causal relation is expressed in (31a). In (31b), an epistemic relation is expressed. (31c) is unacceptable. In section 2.2, it was already established that *because* did not discriminate between epistemic and semantic interpretations. From the sentences in (31) it can be read that there are preferences for a certain interpretation, dependent on the propositional content of the clauses. Although analyzes of sentences like (31) have already been made in this chapter, the problem of determining causality as a real-world connection has not been addressed yet.

What determines the difference between (31a) and (31b), is the acceptance of a real-world connection: 'if you run, you become exhausted', is accepted as a real-world connection in (31a). In (31b), however, an analogous real-world connection is not accepted: 'if you are gasping for breath, you are exhausted' does not express a cause and effect sequence of events in the real world. Here, the *if* clause is not expressing a cause for the exhaustion. The consequence will be turned into a speaker's conclusion: 'from the fact that you are gasping for breath, I conclude that you are exhausted'. It is possible to recognize a cause and effect in this paraphrase: 'if you are exhausted, you are gasping for breath'. This recognition of the conclusion as a cause for an observed fact is called abduction. It is not a logically valid deduction. In (31c), the real-world connection is unacceptable: '#if you rest all day, you become exhausted'.

This analysis seems plausible, but one question remains for all three interpretations in (31): how are cause and effect determined in each sentence? The interpretations depend on the recognition of cause and effect, but how cause and effect are determined is not clear. In this section, the notion of a real-world connection will be analyzed. This will

not lead to a conclusive answer, but insight in the differences between (31a) (31b), and (31c) will be gained.

2.4.1 A definition of causality

An explanation of why a sequence of events (in our case, the interpretation of an utterance referring to two events) is causal, appeals to the knowledge that is applied to make an interpretation of this sequence. In his interpretation of Hume (1739), Mackie (1974) specifies properties of causation. Hume specifies three elements in our perception of causation: succession, contiguity and necessary connection (Kehler, 1995, takes this distinction as a starting point for classifying coherence relations). Mackie (1974) claims that only Hume's necessary connection is inevitably part of causality, next to other properties Hume did not mention.

In analysing causality, Mackie (1974) uses concepts of sufficient and necessary conditions, incompleteness of causes and causal priority. These notions will be introduced first. Then, Mackie's proposal will be presented. Finally, the proposal will be applied to the sentences in (31).

The notions of necessary and sufficient conditions are defined with respect to an implication. This is done in (32) (adapted from Bonevac, 1987).

(32) With respect to an implication p $\rightarrow$ q:

a. 'p is a sufficient condition for q' means that the occurrence of p always goes together with the occurrence of q.

b. 'q is a necessary condition for p' means that the omission of q never goes together with the occurrence of p.[30]

At first glance, it is not obvious how these definitions may help to define causality. Mackie (1974) illustrates the notions of necessity and sufficiency by comparing three machines, that provide bars of chocolate when a shilling is inserted in their slots. To make the example more up to date, a chip card is inserted, and a cup of coffee comes out when the card has enough value.[31] The performance of two of these machines, $\mathbb{L}$ and $\mathbb{M}$, will be discussed now; machine $\mathbb{K}$ will be discussed below.

Machine $\mathbb{M}$ always produces a cup of coffee when a chip card is inserted. It even produces sometimes a cup of coffee without the insertion of a chip card, or with the insertion of an empty chip card. There is

[30] If p is both a necessary and sufficient condition for q, p and q are equivalent. Suppose that $(p \rightarrow q)$ (p is a sufficient condition for q), and that p is a necessary condition for q: $(\neg p \rightarrow \neg q)$. Application of Modus Tollens gives: $(q \rightarrow p)$. The assumption of both $(p \rightarrow q)$ and $(q \rightarrow p)$ gives $(p \leftrightarrow q)$.

[31] Specific reference is made to the machines at the University of Twente: the only act is the insertion of the card, no buttons need to be pushed.

no known reason for the spontaneously produced cups of coffee. With respect to $\mathbb{M}$, inserting the chip card is sufficient for the appearance of a cup of coffee. $\mathbb{M}$ meets the 'sufficiency criterion'.

Machine $\mathbb{L}$ will not produce a cup of coffee unless a chip card is inserted with enough value. From time to time it may occur that a chip card is inserted but coffee is not produced. With respect to $\mathbb{L}$, inserting the chip card is necessary for the appearance of a cup of coffee. $\mathbb{L}$ meets the 'necessity criterion'.

Mackie (1974) states that, contrary to Locke (1632), Hume's (1739) 'relations of ideas' (causal relations) can not be made certain by using the method of induction. This knowledge will remain probabilistic knowledge. With respect to $\mathbb{M}$, this means that after many cups of coffee, users are able to tell which machine has the properties of $\mathbb{M}$. By observing every insertion, and coming to the conclusion that there are no exceptions to the rule that insertion results in coffee, one may assume that the sufficiency criterion is met. This process is called induction.

According to Mackie (1974), Hume (1739) says that the truth of a necessary condition can only be established by deduction and very direct experiential knowledge (which is not coffee machine experience, because the electronic circuits of the machine are not directly observed), but not by induction. This means that the properties of $\mathbb{L}$, can not be achieved by induction: the insertion of the card does not give coffee in every case, and not inserting the card does not have any effect.[32] To decide that this machine meets the necessity criterion, users need to know beforehand that it is necessary to insert the card.

The problem Hume describes is mainly a scientific problem. The problem formulated with respect to (31a) was, how to accept a relation as causal? If causal relations were characterized by necessary conditions, and necessary conditions were as strictly defined as Hume demands, only few causal relations would be claimed to hold and thus expressed in natural language. But with respect to the use of coffee machines, the same problem occurs: knowledge of the relation between chip card and coffee is important, for users want to be capable of getting coffee out of the machine. And they know the relation on the basis of relatively little evidence, for they insert the chip card in the expectation to get a cup of coffee. So, the problem of causality in everyday use or language use, needs to be relativized.

Summarizing, the problem is that causality in natural language is less motivated than causal knowledge specified with respect to the coffee machines. Is a definition of causality in natural language possible? And is it possible to derive from this definition the difference between epistemic and semantic causal interpretation? Mackie (1974) presents -

[32]The observation could be that whenever coffee comes out of the machine, a card should have been inserted. This is, however, not induction in the strict sense Hume used it.

essentially - a proposal that might answer these questions.

Mackie (1965) proposes to allow for causal knowledge as incomplete knowledge. That is, an effect may have several causes, that do not apply in every situation in which the effect occurs. For instance, a service engineer can check the machine by having it produce a cup of coffee, without inserting a chip card. It is not likely that the insertion of a chip card was a necessary condition to obtain this cup of coffee, or: to obtain a cup of coffee within these circumstances. In a complete set of causes, both the service engineer and the chip card should be present, but within specific circumstances, only one of these causes is realized. Mackie (1974) proposes to look at causality on two levels: one representing a 'total cause' for an effect, which contains all causes possible on every occasion; the other is causality 'within the circumstances': a specific cause, fitting within the circumstances is taken to be the cause for the effect. This means that every causal relation - in everyday use - will contain incomplete causes, but they will be accepted as complete causes within the circumstances.

Mackie's proposal makes the sufficiency criterion, abandoned by Hume, relevant again for causality. The argument that induction never leads to certain knowledge is not denied, but as Hume already explained, induction provides psychologically (i.e. not scientifically) attractive explanations. So, on the basis of few occurrences, people often decide that insertion of the chip card is enough to get a cup of coffee from the machine. When this relation has become part of the knowledge of a user of the machine, the relation between chip card and the machine producing a cup of coffee is determined by causal priority. A cause is causally prior to its effect. This means, that the relation between cause and effect can not be reversed. Applied to the coffee machines, the implication 'if a card is inserted, a cup of coffee is produced', means that the insertion of a card is causally prior to a cup of coffee. The appearance of a cup of coffee is not causally prior to the insertion of a card. Relating causal priority to the implication $p \rightarrow q$ in (32), p is causally prior to q, but q is not prior to p. So, a sufficient condition for the occurrence of an event may be causally prior to the event.

The incompleteness of causes leads to the definition of an INUS condition for results, presented in (33) (taken from Mackie, 1965)

(33) *A* is an INUS condition of a result *P* if and only if, for some *X* and for some *Y*, (*AX* or *Y*) is a necessary and sufficient condition of *P*, but *A* is not a sufficient condition of *P* and *X* is not a sufficient condition of *P*.

This definition is defining the relation between the complete cause of a result, in all circumstances, and a cause given some specific circumstances. If the whole disjunction (*AX* or *Y*) were a conjunction (*AX* and *Y*) it would represent the complete cause, that holds for all circum-

stances, for all occurrences of P.[33] The disjunction may consist of more disjuncts than just two. Within some circumstance, a so-called cause A is an 'Insufficient but Necessary' (IN) part of a condition AX which is itself 'Unnecessary but Sufficient' (US) for the result. If all the disjuncts expressing an US condition for P would apply, the disjunction as a whole is both necessary and sufficient. So, *A* is IN for *AX*, and *AX* is US for *P*.

At this point, it has to be noticed that the use of the term 'necessary' IN is different from the definition given in (32). Necessary part of a condition refers only to the fact that without this part, the condition would not be sufficient for *P*. The definition 'necessary condition' for *P* would express that omittance of the disjunction (AX or Y) in (33) as a whole can not go together with an occurrence of *P*. The phrase 'necessary part' refers to (A) in the US condition (AX).

The definition may be applied to the coffee machine example. Suppose that *A* is a predicate that refers to the insertion of a chip card, and *Y* is the check of the service engineer. Further, *X* contains the information that the machine always works. In the narrowly defined coffee machine world, (*AX* or *Y*) is the complete cause for *P* (i.e. the machine always produces a cup of coffee). The disjunction is both a necessary and a sufficient condition, for the machine will work both with a chip card and by a check of a service engineer, and the production of a cup of coffee always involves the insertion of a chip card into a working machine, and the check of a service engineer. Within more specific circumstances, however, it might be the case that the service engineer is not around. It is not a complete cause anymore: a user that inserts his chip card in the machine is not fulfilling a necessary condition nor a sufficient condition. It might be the case that the machine does not work, so the condition is not sufficient. It might also be the case that the production of a cup of coffee did not take place because a chip card was inserted, but for another reason that can not be traced because the disjunction is incomplete. The condition is not necessary either.

Still, Mackie (1974) calls the relation between *AX* and *P* causal (but incomplete). The reason for this is that *A* is a necessary part of *AX* (or: A is an INUS condition), where AX is an US condition for P within the circumstances. In terms of real world knowledge, this means that *A* is causally prior to *P*. The nature of causal priority is not exactly clear, but it is this property that makes the relation $A \rightarrow P$ asymmetrical. The asymmetry is demonstrated in the observation that *A* is temporally prior to *P*. Causal priority is in the nature of the events (cf. Mackie, 1974, p.160-192).

Going back to natural language, the assumption is that interpreting an utterance containing a causal connection amounts to recognizing

[33] Notice that it would not be possible to take a conjunctive complete cause for the occurrence of one result: one cup of coffee is usually not produced by both a chip card and a service engineer checking it. Because Mackie (1974) aims at the analysis of specific causes within their circumstances, a disjunction of causes is needed.

an INUS condition for a result. The circumstances or context in which the utterance is made narrow down the complete disjunction into the US condition containing the necessary part (i.e., into AX containing A). This will be applied to the examples in (31).

First, assumptions have to be made about the complete cause of being exhausted (i.e., *AX or Y* in (33)): the disjunction of being in a bad condition, running to places, or gasping will suffice for demonstration purposes: other causes might be disjunctively added (except conditions forming disjuncts that can never be a sufficient condition for the result). So, suppose that *A* is representing Theo's having run to the university, with *X* representing the additional knowledge that the distance to the university is far enough to get exhausted. *Y* represents Theo's gasping, and *Z* is Theo's being in bad condition.

As for (31a), the disjunction is narrowed down to the INUS condition that Theo has run to the university, with the additional information that it is a large distance (together: AX), which makes the INUS condition sufficient within the circumstances. The interpretation within the circumstances is explicitly brought back to this disjunct, for the *because* clause gives us this information, and there is no further common ground. Of course, one is free to assume that disjunct *Z* is true as well, but there is no specific information to justify that assumption. Within the circumstances, *AX* represents a sufficient condition for P.

Given the assumption that AX is sufficient for *P*, A is causally prior to P. A is defined as the INUS condition for P. Thus, the recognition of an INUS condition indicates a semantic causal interpretation of an utterance containing *because*.

Does the same definition hold for epistemic causal interpretations? In (31b), the relation is narrowed down to *Y*: Theo's gasping. Since it occurs as a disjunct in the complete cause for *P*, it is sufficient. And this might well be true as long as it is known, within the circumstances, that every time Theo is gasping, he is exhausted (and it does not matter whether he is exhausted for other reasons). But Y does not contain a necessary part, like AX. There is no part of Y causally prior to the result. Rather, the event expressed in the result might well be causally prior to the event expressed in Y. If the events of *Y* and *P* were ordered according to, for instance, their simplicity of explanation, the exhaustion is prior to gasping: it is difficult to reason back from gasping to exhaustion whereas the exhaustion might be easily translated into lack of oxygen and the lungs providing oxygen to the blood. Reversing this takes the 'need for oxygen' out of the explanation, which makes it difficult to speak of an explanation of the exhaustion in terms of gasping. This makes it possible to make a definition of epistemic interpretation in terms of causality: *Y* is, within the circumstances, a sufficient condition for P, but not it contains no necessary part, causally prior to *P*. If P were a condition for Y, P would be an INUS condition. Therefore, the relation is called epistemic.

Within the circumstances, the *because* clause in (31c) is not interpreted as a sufficient condition: therefore, the relation is not interpreted as causal. Possibly, there are contexts in which a sufficient condition could be found, with or without a necessary part.

From the analysis of (31), the following definition can be derived:

- a relation is causal when there is, within the circumstances, an INUS condition for the result;
- a relation is not causal when there is no sufficient condition for a result.

Given this definition, causal interpretations of sentences containing a causal connective like *because* can be distinguished:

- a sentence that contains a clause representing a cause is interpreted as semantically causal only if an INUS condition is recognized.
- a sentence that contains a clause representing a cause is interpreted as epistemically causal, when the alleged cause is a sufficient condition for the result, while not containing a necessary part.

Epistemic interpretation involves the introduction of a speaker's conclusion. The causal relation is not between facts: from the fact, a conclusion is derived. Epistemic interpretation thus 'revalidates' causal priority: the fact is causally prior to the conclusion.

Causal priority, in combination with the INUS condition, is crucial for content interpretation, whereas epistemic interpretation is characterized by lack of causal priority, resulting in revalidation of causal priority in a fact-conclusion relation.

A fact-conclusion relation may be understood as a causal relation. The proposition expressed in the conclusion may be interpreted as causally prior to the proposition expressing the fact. This reversal of cause and effect is called abduction. Abduction is characteristic for the epistemic interpretation of causal relations. It is not necessary, however, to apply abduction to a causal relation, in order to interpret it as epistemic. Contextual factors may make an epistemic interpretation of a causal relation more plausible. In those cases, the relation will be considered as semantically causal by the definitions above, but the relation will be understood as epistemic on other grounds (see section 2.2).

2.5 Conclusion

In this chapter, an answer was given to the first question formulated in chapter 1: which interpretations of causal or contrastive relations should be distinguished? Causal relations were found in a pragmatic

and contrastive interpretation. Pragmatic interpretations could be divided into a group of epistemic interpretations of causal relations, and speech act interpretations of causal relations. Contrastive relations were found in causal and additive interpretations, and in semantic or pragmatic interpretations. The causal contrastive relation is called denial of expectation. This relation may be interpreted semantically and pragmatically: the latter as epistemic interpretation or as speech act interpretation. Two additive contrastive relations are distinguished: semantic opposition and concession. Semantic opposition is semantic and concession is pragmatic (and occurs only in epistemic interpretation).

Epistemic interpretation was analyzed by comparing Sweetser (1990) and Sanders et al. (1992). Interpretation in the epistemic domain (Sweetser, 1990) is analyzed as pragmatic interpretation, because it represents a speaker's conclusion, and thus connects illocutionary meaning with locutionary meaning (which defines pragmatic interpretation in Sanders et al., 1992). An analysis of epistemic interpretation, relating it to the process of abduction, is regarded as an important phenomenon in the interpretation process, but not essential for the interpretation process: without abduction, epistemic interpretation is still possible.

Speech act interpretation also connects illocutionary meaning with locutionary meaning, and is thus regarded as pragmatic. Speech act interpretations appear to be linguistically marked. In speech act interpretation, the uttering of a clause is justified (or a justification is violated) by the other clause. An intrinsic part of the speech act interpretation is the recognition of a clause as a speech act. Linguistic marking is concerned with marking a clause as a speech act: quotation marks, interrogative form or imperative form of the speech act clause are often used to mark it. In a systematic paraphrase of speech act interpretations, the speech act clause is embedded by a speech act verb; the other clause refers to the speech act clause, taking it autonymously.

Contrastive interpretations were described in three different interpretation schemes: denial of expectation, semantic opposition and concession. In a denial of expectation, an expectation is derived from the utterance by combining the propositional content of the *although* clause (or the first clause of a *but* conjunction) with the negation of the propositional content of the other clause: this expectation is violated, because the main clause in an *although* sentence or the *but* clause negates the second part of the expectation. The expectation is an implication: a denial of expectation is causal, next to contrastive. A semantic opposition is characterized by parallel intonation and structure. The parallel form is an instruction for the predicates to find a contrast in their lexical meanings. This contrast is applied to the first constituents of the parallel structures. Essential for concession is the formation of a tertium comparationis on the basis of contextual information. One clause forms an argument against, the other in favor of the tertium comparationis. A semantic opposition is always about two similar en-

tities; a denial of expectation is not represented as typically about one or two entities. A concession may occur in both variants: in parallel structure as well as not typically about one or two entities. Typical of concession are contextual influence on the interpretation and the argumentative orientation.

If contrastive interpretations are related to cognitive primitives (Sanders et al., 1992), they are characterized as follows:

- semantic, additive, negative: semantic opposition
- semantic, causal, negative: content denial of expectation
- pragmatic, additive, negative: concession
- pragmatic, causal, negative: epistemic/speech act denial of expectation

Indeed, it is possible to classify the interpretations in four distinct categories, using the cognitive primitives. It is interesting to note that if pragmatic negative relations (concession and epistemic denial of expectation) are taken together, Sidiropoulou's (1992) SAC is represented. Her SAC is defining a natural class of coherence too.

The causality of a coherence relation depends on the acceptance of an INUS condition for a result.[34] When epistemic interpretation of a causal relation is not marked by context or linguistic markers, it can be recognized by the lack of causal priority of the INUS condition to the result. Epistemic interpretation revalidates causal priority by taking the result as a speaker's conclusion, thus making the fact (the INUS condition) causally prior to the conclusion (the result).

In this chapter, connectives were used to express coherence relations. In fact, no distinction was made between connective meaning and coherence relation. In the next chapter, focus will be on the meaning of connectives. Given all the different interpretations of causal connectives, it might be difficult give a comprehensive lexical meaning definition of such connectives. Sweetser's claim that they are polysemous needs further analysis: her domains are systemically related, but what these relations look like has not been made clear. A representation of these meanings of connectives in formal language would make their systematic relation more clear. In Chapter 3, an attempt is made to come to an account of these meaning properties, using formal devices from discourse semantics and pragmatics.

[34] Result is interpreted here as the consequence of an implication: both the coherence relations Explanation and Result presume an INUS condition for a result.

Chapter 3

Presuppositions for causal connectives

3.1 Introduction

In this chapter, a problem will be solved that most students have when they enter an introductory course in formal semantics. This problem can be demonstrated by looking again at the Greta Garbo sentence, repeated here in (1).

(1) Hoewel Greta Garbo de maatstaf werd genoemd van
Although Greta Garbo the yardstick was called of
schoonheid, is zij nooit getrouwd geweest.
beauty, has she never married (been).
'Although Greta Garbo was called the yardstick of beauty, she never married.'

When students are asked to translate this sentence into predicate logic, they can not find a satisfying translation. Predicate logic provides a logical connective to represent the conjunction in (1), connecting the two elementary propositions: 'Beautiful(Greta)' and '¬Married(Greta)'. This connective is the conjunction, ∧. So, the translation must be Beautiful(Greta) ∧ ¬Married(Greta). In terms of truth conditions, this is a correct translation: both conjuncts need to be true to get the complex proposition true. And, intuitively, in (1) two assertions are made: it is both stated that Greta Garbo is considered the yardstick of beauty and that she has never been married. A student's objection to this analysis might be that this is not entirely what the sentence expresses. This provides the opportunity for a lecturer to explain that the compositionality principle allows only the truth values of the connected propositions and truth-functional connectives to be relevant for the truth conditions of the whole complex proposition (cf. Gamut, 1982a, p. 29). Connectives like *because* are not truth-functional (ibid.).

It will not come as a surprise that students are often not convinced by the limitation to truth-functional connectives only, when logic is

used to analyze natural language. In the previous chapter of this thesis, meaning aspects that were not incorporated in the truth conditions of *although* were described. Certainly some of those aspects might be considered to belong to the (core) semantics of *although*. In general, logical connectives are not capable of expressing causality and contrast, whereas *although* is expressing both.

In this chapter, a lexical semantics of causal and contrastive connectives is presented. As a side effect, the analysis renders a satisfying answer to students that have difficulties in accepting the translation of *although* with a conjunction in predicate logic.

Basically, the proposal in this chapter is not new. Lakoff (1971), König (1986), Lagerwerf and Oversteegen (1994), Kehler (1994) and Oversteegen (1997) made similar proposals earlier. Van Dijk (1977) and Sidiropoulou (1992) made proposals that are related to the proposal, formulated in (2).

(2) **A presupposition for *although*[1]**
Although p,q presupposes $p' > \neg q'$
where p and q are clauses, p' and q' are propositions associated with p and q respectively, and $>$ is a defeasible implication.

In the sentence in (1), *although* presupposes an implication that can be paraphrased as: 'normally, if a woman is called the yardstick of beauty, she is married'. In this paraphrase, the sequence of *normally, if... then...* refers to the symbol of defeasible implication $>$ in (2), introduced in Asher and Morreau (1991).

Clause p, *Greta Garbo was called the yardstick of beauty*, is associated with the more general proposition p': *a woman is called the yardstick of beauty*, whereas q, *she has never been married*, is associated with q': *she never married*. q' is negated in the presupposition: *she married* is the result. This presupposition reflects the expectation. In the utterance the expectation is denied. This is not creating a contradiction, because the defeasibility of the presupposition is making it possible that exceptions to the rule exist (see section 3.7). This way, a denial of expectation may represent an undeniable prejudice.

On the basis of the proposal, it can be explained to students that translations of *although* sentences into logic have to correspond to truth conditional properties of the logical conjunction, but that its causal and contrastive meaning is represented by the assumption of (2).

Lakoff (1971), König (1986) and Kehler (1994) do not give an indication of the consequences of taking their proposal seriously in a formal semantic or pragmatic theory.[2]

[1] Dutch *hoewel* has the same semantics as given in this definition.

[2] Van Dijk (1977) and Sidiropoulou (1992) are considering formal consequences, but they have formulated other proposals. This chapter is an extension of the analysis in Lagerwerf and Oversteegen (1994).

Without saying what is meant with the term presupposition, and what kind of presupposition theory is used, the claim that *although* bears a presupposition is insignificant. Therefore, a short introduction to the assumptions made in the literature on presuppositions will be given first. Presupposition tests will be introduced, and the presupposition of *although* will be tested for 'presuppositionhood' (sections 3.2 and 3.3). The analysis will be extended, to explain the phenomena described in the previous chapter (sections 3.4 and 3.5). The translation of causal and contrastive connectives will be addressed (section 3.6), and the defeasibility of the presuppositional implication (section 3.7). Additional evidence will corroborate the analysis (section 3.8). Gapping phenomena that were not explained before, will provide independent evidence (section 3.9).

3.2 Presuppositions and implicatures

Before the meaning of *although* sentences can be analyzed as expressing a presupposition, implicature, assertion or entailment, definitions of these notions should be given. This is not easy, since a lot of proposals have been made that involve different definitions of presupposition and implicature. Definitions of presupposition and conversational implicature will be given by presenting these notions in their most common interpretation, (using Grice, 1975; Levinson, 1983), and then adjusting the notions to fit in a more recent, discourse oriented approach (like Van der Sandt, 1988; Beaver, 1995).

Grice (1975) introduces the notion of implicature, distinguishing conventional and conversational implicature. Conversational implicatures are non-truth-conditional inferences based on the Cooperative Principle and maxims of conversation, defined in Grice (1975), and represented here in table 3.1. Illustrations of the applications of these maxims will be given below, in (3) and (4).

Grice (1975) defines conversational implicatures as inferences arising from the Cooperative Principle and maxims of conversation. In table 3.2, three properties of conversational implicatures are presented, discussed in order to describe differences between presuppositions and conversational implicatures (extracted from Levinson, 1983, p. 114-122).

These properties will be illustrated on the basis of the examples in (3), (4) and (5). Conversational implicatures may be derived in two ways: following a maxim of conversation, or 'flouting' it: either way, the Cooperative Principle has to be obeyed. Following a maxim of

[3] In the original text in Grice (1975), this maxim is called *relation*. Since then, it is commonly referred to as the maxim of relevance.

Cooperative Principle

Make your contribution such as is required, at the stage at which it occurs, by the accepted purpose or direction of the talk exchange in which you are engaged.

Maxim of Quantity	Make your contribution as informative as required.
	Do not make your contribution more informative than is required.
Quality	Do not say what you believe to be false.
	Do not say that for which you lack evidence.
Relevance[3]	Be relevant.
Manner	Avoid obscurity of expression.
	Avoid ambiguity.
	Be brief.
	Be orderly.

Table 3.1: The Cooperative Principle

conversation is illustrated in (3) (adapted from Levinson, 1983, p. 97).

(3) A: Can you tell me the time?
B: Well, the postman has come.

The contribution of B has to be taken as relevant, and therefore A assumes that the coming of the postman is an indication of the time (namely, later than the arrival of the postman). This assumption (or: conversational implicature) is derived from the maxim of relevance, and consequently, the Cooperative Principle. A reply of A to the contribution of B that would deny the conversational implicature, is: *You mean you don't know*. This reply would declare the contribution of B as irrelevant to the question of A. So, the implicature can be withdrawn without creating an inconsistency. Clearly, it is the intended meaning and not the lexical or syntactic properties of the contribution of B that invokes the implicature. If, instead of B's contribution in (3), the contribution were: *sure, mail has just been delivered*, it would have rendered the same result. All three properties of conversational implicature given in table 3.2 are present, with respect to B's implicature in (3).

Flouting a conversational maxim is a more complicated way to derive a conversational implicature. An illustration of this is given in (4).

(4) Situation: journalist A asks politician B a question at a press conference. B answers.

Conversational implicature

An utterance has a conversational implicature if:

1. the implicature is not tied to a specific lexical item or syntactic construction;
2. the implicature can be withdrawn without creating an inconsistency;
3. the implicature is derived from maxims of conversation, following the Cooperativity Principle (or solves a conflict between maxim and Cooperativity Principle).

Table 3.2: Properties of conversational implicature

A: Do you believe that the critical remarks made by your colleagues have a political motivation?
B: You make me wonder.

A is asking a *yes*/*no*-question: only yes or no are acceptable answers. According to the Cooperative Principle, the answer B gives, has to be interpreted as a yes or as a no (conform the maxim of relevance), and it has to be informative (conform the maxim of quantity). Instead, the answer is *you make me wonder*. This is not in agreement with either of the maxims. The answer is not relevant, nor informative. Clearly, B's contribution will be in conflict with the Cooperative Principle, unless some implicature repairs the conflict. The answer B is expected to give is not just *yes* or *no*: answering with *yes* would certainly be an offensive act towards the colleagues mentioned in the question. Combining the failure of the maxim of quantity and the social desirability of answering *no*, A's implicature is that B's answer is *yes* instead of *no*. This makes B's answer relevant.

However, B may continue his answer with: *that is, I really wouldn't know*. This continuation is inconsistent with a yes-answer. So, A's conversational implicature induced by *you make me wonder* is withdrawn by the second utterance *that is, I really wouldn't know*. This is in agreement with the property that conversational implicatures can be withdrawn without causing inconsistency.

Conversational implicatures can not be conventionally tied to the expression. If the expression *you make me wonder* is replaced by *your suggestion is worthwhile*, the analysis of A's implicature, as well as the possibility to withdraw it, does not change. So, the implicature is not tied to a lexical or syntactic pattern. Applying the criteria in table 3.2,

B's answer in (4) invokes a conversational implicature, derived from (conflicts with) maxims of conversation, not tied to a linguistic expression, and free to be withdrawn.

Conventional implicatures are non-truth-conditional inferences, conventionally tied to a linguistic expression. Levinson (1983) analyzes conventional implicatures as conversational implicatures, except for the way they are triggered in discourse: they are tied to an expression, instead of induced by a maxim of conversation. Levinson (1983, p. 128) mentions that among others, lexical items like *although* have a conventional implicature. Grice (1975) ascribes, among others, the expression of contrast in the use of *but* to conventional implicature. Conventional implicatures are opposed to 'conversational implicatures'. Conventional implicatures can not be denied in a continuation of the discourse without creating an inconsistency. Conventional implicatures are conventionally tied to linguistic expressions, like presuppositions, but presuppositions can be denied in some specific continuations, without creating inconsistency in discourse.[4]

An example of a presupposition is given in (5).

(5) Jones has stopped beating his grandmother. (adapted from Sellars, 1954).

A presupposition of the sentence (5) is: *Jones has been beating his grandmother*. Since this statement can not be an inference from conversation (it may be inferred without conversational context), it is not taken to be a conversational implicature. A reason to argue that it is a presupposition and not a conventional implicature, would be that it can not be withdrawn without problems, as (6) shows.

(6) a. ?Jones has stopped beating his grandmother. He never did beat her, anyway.

b. Jones is not beating his grandmother. He never did beat her, anyway.

The sequence in (6a) is inconsistent, for *he never did beat her, anyway* is denying something that has been assumed on the basis of (5): Jones did beat his grandmother. The sequence in (6b) is consistent, because nothing is denied that was expressed earlier. The fact that it is the formulation with *to stop* that is responsible for the difference between

[4]Karttunen and Peters (1979) dispensed with the term 'presupposition' and introduced a dichotomy consisting of conventional and conversational implicature, in order to make a clear-cut distinction between presupposition and other non-truth-conditional implicatures. Conventional implicatures were both the original presuppositions and some of Grice's (1975) conventional implicatures. An adverb like *too* was considered to have a conventional implicature. Whether or not *but* and *although* were analyzed as presuppositions is unclear, for these lexical items were not taken into consideration. Gazdar (1979, p. 40) discusses *but* as an example of a conventional implicature that can not be analyzed in terms of Karttunen and Peters (1979).

(6a) and (6b), shows that the presupposition is tied to the linguistic expression *to stop*. The three properties that defined conversational implicatures do not seem to hold for this presupposition.

A distinction between conventional implicature and presupposition could be that the former can not, and the latter can be withdrawn (Grice, 1975). A situation in which a presupposition can be withdrawn, is shown in (7).

(7) Jones has not stopped beating his grandmother. In fact, he never started beating her.

The discourse in (7) is acceptable, especially when reading *stopped* with more emphasis. In the second sentence, *he never started beating her* denies the presupposition of *to stop*. The discourse is still acceptable, so this presupposition must have been withdrawn. The claim that conventional implicatures can never be withdrawn is not based on specific evidence presented by Grice (1975), Karttunen & Peters (1979) or Levinson (1983). According to Levinson (1983, p. 207), it must be inferred from the claim in Karttunen & Peters (1979) that conventional implicatures are presuppositions, that both may not be withdrawn. Although this appears to be a matter of definition in Karttunen & Peters's (1979) plugs, holes and filters approach, it remains that with respect to the distinction between conventional implicature and presupposition, the notion of withdrawing to avoid inconsistency has not been defended very explicitly.

The distinction between presupposition and conventional implicature becomes quite lean, this way. With respect to the three properties used in table 3.2 to distinguish conversational implicature from presupposition, presupposition and conventional implicature can not be distinguished.[5]

To avoid confusion about the status of what is inferred by using *although*, this inference will be called a presupposition, and it is supposed to behave like a presupposition, in tests for presuppositions as they are defined in section 3.3. Conventional implicatures will not be considered to be a distinct group in this thesis.

Karttunen and Peters (1979) do not consider conversational implicatures as part of the core meaning of utterances, but as meaning in context. Presuppositions need to be entailed by their context. This makes it possible to define different kinds of contexts: some contexts (defined as, e.g., classes of verbs) entail their presuppositions ('holes'); other contexts do not ('plugs'), and in compound utterances, some logical connectives (e.g. *if...then*, *or*) adjust a presupposition of one of the

[5]This conclusion is contrary to Levinson (1983), although his position on withdrawing is not very clear. He regards conventional implicature as part of the meaning of deictic or discourse-deictic expressions. He claims that *the meaning of such items often involves reference to processes of* conversational *implicature* (Levinson, 1983, p. 128, fn. 22).

connected propositions in a calculable way ('filters'). This is demonstrated in (8).

(8) a. John stopped smoking.
b. Mary asked whether John stopped smoking.
c. Mary noticed that John stopped smoking.
d. If John stops smoking, Mary will be happy.
e. John smoked.

(8a) has as its presupposition (8e). In (8b), this presupposition is not entailed by the context of the embedded sentence (namely, *Mary asked...*). Neither Mary, nor the speaker or hearer, need to believe that John did in fact smoke, to interpret the whole utterance correctly. In (8c), this is different: Mary, as well as the speaker and hearer, ought to believe that John smoked, in order to understand the utterance correctly. In (8c), the context *Mary noticed...* entails the presupposition of the embedded sentence. In (8d), the presupposition of the *if*-clause is entailed in the context of the whole sentence, only for those situations in which John actually smoked. This way, the *if...then* sentence works as a filter for the presupposition of an embedded sentence. The problem of determining which presuppositions are entailed by which contexts, is called the 'projection problem'. The 'plugs, holes and filters' approach is an attempt to solve the projection problem. Geurts (1996) calls these kinds of approaches to solve the projection problem the 'satisfaction theory'of presupposition.

Gazdar (1979) criticizes this approach by showing that the condition that a presupposition should be entailed by its context, is too strong.[6] He replaces this with the condition that a (potential) implicature or presupposition should be consistent with its context, in order to be established as presupposition or implicature. Consistency is defined with respect to the 'satisfiable incrementation' of a discourse. The approach of interpreting presupposition as a part of an incremental discourse has gained ground since. Heim (1983) and Van der Sandt (1982) are taking discourse incrementation as the basis for two different presupposition theories: Heim (1983) follows the satisfaction approach, Van der Sandt (1982) introduces the accommodation approach. The idea that a theory of presupposition is a theory of discourse semantics, or pragmatics, has become common ground: Geurts (1995) and Krahmer (1995) follow the accommodation approach, Beaver (1995) the satisfaction approach.

The problem of how to identify presuppositions, and how to distinguish them from conversational implicatures and other inferences, has received less attention than the projection problem, and the properties

[6]Gazdar (1979) distinguishes between entailments, clausal implicatures, quantity implicatures and presuppositions. Potential implicatures arise from conversational maxims, potential presuppositions from specific linguistic expressions.

of presupposition on discourse level. Van der Sandt (1989) claims that resolution of anaphors in discourse is the same as acceptance of a presupposition. Especially in the case of definite descriptions (*the king of France is bald*) it is imaginable that accepting the presupposition (there is a king of France) amounts to finding an antecedent of *the king of France*, or accommodating an antecedent. The question of identification of presuppositions is left open in Van der Sandt's (1989) theory.

There is however, some debate on the identification of the presupposition of a particular kind of lexical items, namely specifiers that give rise to 'quantity scalar implicatures'. What is interesting in these implicatures is, that conversational implicature and presupposition both seem to play a role in one construction. It is, however, quite a specialized discussion. Therefore, the identification of implicatures with respect to *only* will be exemplified in a small subsection.

3.2.1 Interpretations of *only*

The interpretation of some linguistic phenomena shows an interplay of conversational implicatures, entailments and presuppositions. It is, with respect to such phenomena, quite difficult to distinguish presuppositions, entailments, and conversational implicatures from each other. These difficulties are exemplified by a discussion on the interpretation of *only*. The aim of this section is to show that in the interpretation of *only*, conversational implicatures and presuppositions must go together in the interpretation of linguistic phenomena. In section 3.4.1, presupposition and conversational implicature will appear to go together in the interpretation of some occurrences of *although*.

Research into focus phenomena (Rooth, 1992) and specifiers like *only* (Horn, 1985; Atlas, 1991; Van Kuppevelt, 1996) draws more attention to the question of identification of inferences as conversational implicature or presupposition. Discussions of identification of presuppositions are quite subtle and complicated. Consider, for instance, (9).

(9) Only Socrates is running.

It is difficult to determine which part of the meaning of *only* is asserted in the context of (9), and which part is implicated, presupposed or entailed. For instance, are the propositions 'Socrates is running' and 'someone is running' entailments or presuppositions? 'Socrates is running' entails 'someone is running'. So, if 'Socrates is running' were an entailment or presupposition, 'someone is running' should also be an entailment or presupposition, respectively. Geach (1962) shows that despite this argument, 'someone is running' can not be an entailment. He assumes that the assertion of (9), 'no one other than Socrates is running', is an assertion about 'others than Socrates'. Suppose that there is a situation in which no one is running. This situation would make (9) true, since the assertion itself does not express that Socrates is running. In terms of truth conditions, a logical form of the assertion is:

$\neg\exists x(x \neq s \ \wedge \ Run(x))$ ('There is no x such that x is not s and x runs', or: 'no one other than s runs'). When there is no x for which Run(x) is true, the truth conditions of this logical form are satisfied: the assertion is true. However, the entailment 'someone is running' is not true in this situation. So, according to Geach (1962), 'someone is running' can not be an entailment for (9), whereas it is expected to be, for 'Socrates is running' is an entailment of (9) (which entails 'someone is running').

Horn (1985) tries to solve this problem by claiming that 'Socrates is running' is presupposed instead of entailed. As a consequence, *someone is running* is presupposed too. The assertion is still: 'no one other than Socrates is running'. Both (9) and its negation presuppose the truth of 'Socrates is running'. Atlas (1991) does not agree with this solution, because it leads to problematic cases. One such case is presented in (10). (10a) is an assertion utterance, (10b) is its negation, and (10c) should be the presupposition of both (10a) and (10b).

(10) a. Only Socrates is Socrates.
b. Not only Socrates is Socrates.
c. Socrates is Socrates.

According to Atlas (1991), (10a) asserts that 'no one other than Socrates is Socrates'; (10b) asserts that 'someone other than Socrates is Socrates'. Given the presupposition that Socrates is Socrates, (10b) asserts a logical contradiction: 'someone is Socrates and not Socrates', and as a consequence: 'Socrates is not Socrates'. According to Atlas (1991), it is wrong to consider (10b) a contradiction, whereas it is an acceptable utterance in language (although the meaning of (10b) is not quite clear). Therefore, another analysis should be made.

The real problem in (9), according to Atlas (1991), is what is taken to be expressed by the assertion. This problem is the same for Geach (1962) and Horn (1985). The fact that the assertion is not about Socrates, but about 'others than Socrates', is causing the problems. Alternatively, Atlas (1991) assumes that the assertion is *Exactly one individual, and no one other than Socrates, is running*.[7] The quintessence of this analysis is that *only* turns the assertion into an assertion about someone other than Socrates. The existential quantification ('someone') is unique ('exactly one individual'), the referent of the variable is an alternative for Socrates. Further, (9) has a 'grammatical presupposition', *there is someone other than Socrates*.

This solution solves the problems of Geach (1962) and Horn (1985). The situation that no one is running, can not make the assertion true. The entailments that would arise from that situation, are simply not relevant. In case of the sentences (10a) and (10b), the solution is that (10b) is not asserting a contradiction anymore: 'it is not the case that

[7] This assertion does not assert 'Socrates is running', according to Atlas (1991).

exactly one individual, and no one other than Socrates, is Socrates'. This assertion is still very strange, for it is unclear what happens when more than exactly one individual, or someone other than Socrates, is Socrates. But it is the utterance in (10b) itself, that has a strange interpretation.

Now, the question is, whether 'Socrates is running' is an entailment, or a presupposition of (9). According to Atlas (1991), it is an entailment, based on another property of the lexical meaning of *only*: it is an analytic entailment of 'only Socrates is running' that exactly one person is running. This means that Socrates must be identified with that unique person (like a definite description has a unique reference).

It is not the case, however, that (10b) has an entailment that 'Socrates is running' on the basis of unique reference. In this case, a pragmatic inference (or: conversational implicature), coming forth from the maxim of quantity, is made. *Only* and *also* are two poles on a 'Levinson Informativeness Scale' (Atlas and Levinson, 1981), which means that asserting *Socrates also is running* conversationally implicates that 'not only Socrates is running', and *not only Socrates is running* conversationally implicates that 'Socrates also is running'. It is not the case, however, that *only Socrates is running* implicates that *Socrates also is running*, since the scale <only,also> may be used to derive sentences containing *also* from sentences containing *not only* and vice versa, but not sentences with *only* from sentences with *not also*.

More subtle distinctions in interpretation are achieved when focus intonation patterns are varied; this will not be demonstrated here (see Atlas, 1991). So far, this discussion has shown that determining meaning properties of assertion, entailment, presupposition and implicature is quite delicate in some cases. There may be interaction between assertion, presupposition and implicature. The various approaches in the literature (where *although* is considered to carry a conventional implicature, background assumption or still something else), indicate that similar difficulties with respect to the determination of presupposition and implicature of *although*, may be expected.

As indicated before, the discourse oriented approaches do not say very much about the relation between the form of the expression and the type of inference that is made. The properties of a presupposition in a discourse oriented theory, however, differ from 'sentence oriented' approaches. The main difference is, that the information expressed by the presupposition may already be available in the previous discourse. In the sentence oriented approaches, explicit availability of the presuppositional information was not considered. Presuppositions may be consistent or inconsistent with this information. Therefore, discourse oriented approaches have possibly interesting things to say on the identification of presuppositions. In the next section presupposi-

tion tests will be discussed. They will be used to establish the possibly presuppositional nature of connectives like *although*. There will be a distinction between two kinds of presupposition tests: embedding tests and discourse oriented tests.

3.3 Testing *although*

To check whether *although* sentences behave as presupposition-bearers, two kinds of presupposition tests will be performed. To begin with, it can be established that the presupposition is tied to the linguistic item *although*: the logical connective *and* is sharing its truth conditions with *although*, but does not express any implication in the form of a presupposition.[8]

Embedding tests are based on 'survival' of the presupposition, when it is embedded in specific contexts. An assertion implying some proposition is embedded in a negation context, in a conditional context or a possibility context. If the newly formed complex assertion is still implying the same proposition (in other words, if this implication can be 'projected'), it is a presupposition. The embedding test may also concern the assertion itself: if an assertion, question or imperative all imply the same proposition (or rather: 'project the presupposition of its embedded assertion'), it must be a presupposition. In König (1986), three of these tests are used to characterize the presupposition of *although*: the test of negative context, of interrogative context and of conditional context. The corresponding tests will be performed in section 3.3.1.

The discourse oriented tests introduce a new component in the test: the behaviour of the presupposition when the information is already available in context. Van der Sandt (1989) argues that presuppositions are always interpreted with respect to a context. That is, if the presupposition has already been uttered, it behaves like an anaphor: it is deriving its contents from the antecedent. If an antecedent is absent, it may be accommodated. In both cases, withdrawing the presupposed information is only possible under specific conditions. These tests will be performed in section 3.3.2.

3.3.1 Embedding tests

Embedding tests are based on the principle that a presupposition should 'survive' the embedding, since the context is not blocking a presupposition in general. So, negation and modality are contexts that a presupposition should survive. Questions and imperatives are a different form of embedding. The tests will be applied to *although* sentences.

[8] However, sentences connected with *and* can be understood as causally connected (see, e.g. Kehler, 1994). How connections are understood causally, without the use of causal connectives, will be discussed in the next chapter of this thesis.

The results will be discussed. As Beaver (1995) points out, embedding tests are sometimes difficult to apply. The purpose of such tests is, to find out whether some implied proposition is a presupposition. This is especially relevant in unclear cases: when the implied proposition is not directly recognizable as a presupposition. The embedding test is based on the recognition of the same implied proposition, but now for a complex sentence (namely, the context it is supposed to survive). But recognition of the implied proposition was problematic in the first place. The embedding test is not suited, then, for those cases in which a test is needed.

Negation

Negation is the most classical test for presupposition. In fact, the negation test follows directly from Strawson's (1950) definition of presupposition (taken from Levinson, 1983, p.175).

(11) **Classic definition of presupposition**

A statement A presupposes another statement B iff:

a. if A is true, B is true;

b. if A is false, B is true.[9]

The test that can be derived from the definition in (11) is formulated as follows: if an assertion (A) implies some proposition (B), then the negation of the assertion should imply the same proposition. If this is the case, the definition can be applied correctly.

For instance, (12a) has the same presupposition as (12b), namely (12c).

(12) a. Jones stopped beating his grandmother.

b. Jones did not stop beating his grandmother.

c. Jones was beating his grandmother.

(12b) is interpreted as 'Jones is beating his mother', with an implication that he has beaten her also before he did not stop beating. In (12a), Jones was beating his grandmother before he stopped beating her. The proposition implied in (12a) is also implied in (12b), so it survives a context of negation. Therefore, (12a) and (12b) have the same presupposition, namely (12c).

The negation test is performed for *although* in (13).

(13) a. Although he sauntered to the university, Theo was exhausted.

b. It is not the case that although he sauntered to the university, Theo was exhausted.

[9] In an interpretation more suited in semantic theory, A and B are interpreted as sentences. The *if ... then* clause (11a) should in that case be read as 'in all situations where A is true, B is true' (and the same goes for (11b)).

c. Normally, if you saunter, you are not exhausted.

The alleged presupposition of both (13a) and (13b) is given in (13c). *Not* in (13b) is meant to have scope over both clauses. The main problem with the negation test for (13) is to determine the meaning (and possible inferences) of (13b). This is not only a problem for the application of the negation test for *although*, but also for other constructions, as Seuren (1985) shows. Given the assumption that *although* behaves as a logical conjunction in a semantic representation, the negation can be broken down to the parts of the conjunction, using the De Morgan's Law, given in (14).

(14) `De Morgan's Law`
$\neg(\phi \wedge \psi) \leftrightarrow \neg\phi \vee \neg\psi$

(14) reads: the negation of a conjunction is equivalent with the negations of the disjuncts of a disjunction. Applied to (13b), the equivalent proposition can be paraphrased as: Theo did not saunter to the university, or he was not exhausted. This disjunction is equivalent with the following implication: if Theo sauntered to the university, then he was not exhausted. So, because of the unnaturalness of (13b), it is hard to tell whether the implication projects, but there will be no logical contradictions when it does.

There is no logical consistency problem with (13b). Rather, (13a) seems to contradict its presupposition, (13c). The formulation of the presupposition, using *normally*, prevents contradiction: the defeasibility of the implication contained in the presupposition makes it possible to deny its consequence, while the implication itself is not denied. In the definition of the presupposition in (2), defeasibility is represented as '$>$'. A definition of defeasibility will be given in section 3.7.

Still, the negation test suffers from unnaturalness when applied to *although*. With respect to other presupposition phenomena, this was already noticed by Gazdar (1979). Moreover, the problem of identification of an implied proposition as a presupposition by having to recognize this proposition in both the embedded and the complex sentence, makes the test unreliable, as noted in the introduction of this section.

Modality

In possibility contexts, the presupposition should project too. In (15), this is tested for *to stop*.

(15) a. Jones stopped beating his grandmother.
b. Perhaps Jones stopped beating his grandmother.
c. Jones was beating his grandmother.

The alleged presupposition of (15a) and (15b) is presented in (15c). A possibility context, invoked by *perhaps* in (15b), makes the event or

situation within its scope uncertain: the sentence *Perhaps Jones stopped beating his grandmother* in (15b) is now true when the event of 'Jones stopped beating his grandmother' is likely to happen, as well as when it actually occurs. In (15a) and (15b), it is still assumed that Jones in fact did beat her before he stopped. So, where the assertion of (15b) does not imply that the event of 'stop beating' has actually happened, its presupposition 'was beating' needs to be factual. In other words, the presupposition of *to stop* is projected onto modal contexts.

In (16), *although* is put in a possibility context.

(16) a. It is possible that although he sauntered to the university, Theo was exhausted.

b. Normally, if you saunter, you don't get exhausted.

The interpretation of (16a) is that Theo is possibly an exception on the rule expressed in the presupposition in (16b). So, the presupposition survives embedding in a modal context.

The possibility operator has (wide) scope over both clauses. It is possible, by using comma intonation just before the *although* clause, to have narrow scope over the main clause. Narrow scope over just the *although* clause is not possible. The narrow scope reading is more easily obtained in (17), where the main clause is preposed.

(17) Perhaps Theo was exhausted, although he sauntered to the university.

Perhaps expresses modality in (17). This time there is scope ambiguity.[10]: *perhaps* has narrow scope over *Theo was exhausted* and wide scope over the whole sentence. In the latter case, there is in principle no difference with (16a). The interpretation could be paraphrased as: 'perhaps Theo was exhausted in spite of his sauntering to the university'. In the former case, the interpretation could be paraphrased by 'I only saw him saunter, but perhaps Theo was exhausted'.[11] It seems that narrow scope corresponds with epistemic interpretation and wide scope with semantic interpretation.

Sanders et al. (1992) claim that semantic causal relations have scope ambiguity, whereas pragmatic causal relations may only have narrow scope. Thus, they support the observation made with respect to (17). Their observation that semantic causal relations may have scope ambiguity is not in line with the observations made with respect to (16a).

[10]Of course, preposing the main clause in (13) would lead to scope ambiguity in the negation test. This is giving no interesting results, except some additional evidence for the unnatural results of the negation test.

[11]The presupposition would be: 'normally, from the fact that Theo saunters, I conclude that he will not get exhausted. The real world connection supporting this conclusion, is not obtained by abduction, but corresponds with the semantic interpretation.

Sanders et al. (1992, p. 9) demonstrate for a Dutch example that the semantic causal interpretation of (18) is ambiguous for wide and narrow scope.[12]

(18) Misschien is Jan thuis omdat hij ziek is.
Maybe John is at home because he is ill.

By preposing the *omdat* sentence in (19a), and by splitting the *omdat* sentence in (19b), they try to show that the semantic causal relation in (18) is ambiguous between wide and narrow scope.

(19) a. [Dat Jan thuis is omdat hij ziek is] is misschien zo.
[That John is at home because he is ill] may be the case.
b. Omdat hij ziek is, is het misschien zo [dat Jan thuis is].
Because he is ill, it may be the case [that John is at home].

In (19a), the paraphrase of (18) puts the whole *omdat* sentence in scope of *misschien* ('maybe') (as indicated by the square brackets). In (19b), the paraphrase forces the main clause *dat Jan thuis is* to be in scope of *misschien* on its own (as indicated by the square brackets). What Sanders et al. (1992) do not remark, is that the nature of the relation in (19b) has changed: it has become an epistemic relation. In fact, (19b) is not as much a paraphrase of (18), as it is a paraphrase of (20).

(20) Misschien is Jan thuis, omdat hij ziek is.
Maybe John is at home, because he is ill.

As Sweetser (1990) notes, comma intonation in *because* sentences indicates epistemic interpretation. The real world connection is not reversed by abduction to obtain epistemic interpretation (cf. chapter 2, section 2.2). So, where Sanders et al. (1992) claimed that the semantic interpretation of (18) is ambiguous for narrow and wide scope, the claim should be that (18) is ambiguous for epistemic and semantic interpretation, corresponding with narrow and wide scope reading, respectively.

The conclusion is, that the embedding test using modality is not only confirming the presupposition of *although*, but it also provides different readings for wide and narrow scope. Moreover, similar observations have been made with respect to *because* sentences, which leads to the conjecture that *because* should be analyzed in the same way as *although*. This will be done in section 3.5.

[12] In section 3.5, a presupposition for *because* will be proposed. With respect to narrow and wide scope reading, there are no differences between *because* and *although*, nor between their Dutch counterparts.

Question and imperative

The interrogative test, already performed for *although* in König (1986), is (re)defined in Van der Sandt's (1988) 'constancy under illocutionary force'. The idea behind the test is, that a presupposition is insensitive to differences in illocutionary meaning, contrary to conversational implicatures. Both assertion and question with the same propositional content should have the same presupposition. In (21), this is shown for the presupposition of *to stop*.

(21) a. Did Jones stop beating his grandmother?
b. Make Jones stop beating his grandmother!
c. Jones was beating his grandmother.

The implication of (21a) and (21b) is the same, namely (21c). Thus, the presupposition of *to stop* projects onto questions and imperatives.

Applied to *although* sentences, the result in (22) is obtained.

(22) a. Was Theo exhausted, although he sauntered to the university?
b. Make Theo exhausted, although he is sauntering to the university!
c. Normally, if you saunter, you are not exhausted.

The implication of (22a) is the same as the implication of (22b), namely (22c). In (22a), the possibility that Theo is not exhausted, and in (22b) the possibility that he did other exhausting activities, are more profound than in the asserted sentence (13a). In (22a), Theo does not have to become exhausted, due to the question. In (22b) he has to become exhausted, but this may fail to happen. In both cases, however, it is assumed that sauntering to the university is not usually causing what is asked or demanded. So, with respect to questions and imperative contexts, a denial of expectation is presupposed when using *although*.

In (23), the *although* clause is preposed.

(23) a. *Was although he sauntered to the university, Theo exhausted?
b. *Make although he is sauntering to the university, Theo exhausted!

Preposing the *although* clause is impossible for syntactic reasons, because the main verb of the main sentence is used to form the question or imperative with, as (23) shows.[13]

The embedding test rendered positive results in those cases where result was possible. A remarkable result evolved from the possibility test, where scope ambiguity distinguished between a semantic and an epistemic interpretation. The results are summarized in table (3.3).

[13]The presence of *although* blocks the forming of question or imperative (see Weerman, 1989, for an explanation in syntactic terms).

Test:	Negation	Modality	Question	Imperative
although clause first	√	√	*	*
although clause last	-	√	√	√

Although clause first/last: the sentence containing *although* was submitted to the test with the *although* clause in front of/following the main clause.

-: test not performed; √: presupposition is projected; *: ungrammatical result.

Table 3.3: Embedding tests for *although*

From table 3.3, the following conclusions may be drawn. *Although* behaves like a presupposition in the tests of negation and modality when the *although* clause comes first; in the other tests, the utterances were ungrammatical. *Although* behaves like a presupposition inducer in the tests of modality, question and imperative; for negation, the test gave no interpretable results. The cases in which *although* does not behave like a presupposition, can be explained from the fact that the embedding tests are meant to be performed on singular propositions.

3.3.2 Discourse oriented tests

Around 1980, three theories of presupposition were developed, that took into account the presence of information provided by context. Not only should an embedded presupposition be capable of projecting to its embedding context, it could also be associated with information already available.

In the first approach, Gazdar (1979), a satisfiable incrementation of a discourse is defined. He defines potential presuppositions: if there were no projection problem, or other suppressing mechanisms, all potential presuppositions would be member of the presupposition set of an utterance. Implicatures.[14] are then defined as potential implicatures that survive the interpretation of an utterance in its context. Since there are limitations to projection, only those potential implicatures

[14]Gazdar (1979), chapter 3, speaks of implicatures as Gricean conversational and conventional implicatures. He is not interested in implicatures that are purely conversational (i.e. are not associated with any linguistic entity), but he analyzes generalized conversational implicatures: implicatures that come forth from one of the maxims of conversation, but are also associated with some linguistic pattern. Since Gazdar considers the association of an implicature with a linguistic pattern as more significant for language competence than its motivation in terms of maxims, he prefers the term generalized conventional implicature, for both conventional and generalized conversational implicature. Gazdar (1979, p. 40) remarks that *but* has a conventional implicature, but he does not indicate what kind of implicature *but* would have in his new classification.

and presuppositions that are consistent with their context (and each other), are realized. In the process of interpretation, implicatures are checked before presuppositions, which makes it possible for an implicature to prevent a presupposition to survive, but not the other way around.

The second theory is the satisfaction approach (Karttunen, 1974; Karttunen and Peters, 1979; Heim, 1983). It distinguishes different kinds of contexts that need to entail presuppositions. Only entailed presuppositions may survive. Heim (1983) extends this approach in a discourse theory (File Change Semantics) that defines correctness of an incrementation of a discourse.

The third approach is Van der Sandt's (1989) account. In his theory, presuppositions are in need for an antecedent. When there is no antecedent, it will be accommodated (this idea stems from Lewis, 1979), unless this results in inconsistencies in the discourse representation.

An important difference between Van der Sandt's (1982) theory and Gazdar's (1979), is the way in which presuppositions come about when a sentence is interpreted in its context. With Van der Sandt (1982), any presupposition comes about, by accommodation, unless it creates an inconsistency. Specific explanations, taking contextual factors into account, may be used for those cases. In Gazdar's (1979) theory, potential presuppositions only survive when they are consistent with context and other implicatures. It is quite common for a potential presupposition, not to survive. There are general rules that describe circumstances in which potential presuppositions fail to come about. This approach has a weak side. Contexts determine to a large extent the circumstances in which a potential presupposition fails to survive. Since contexts are unpredictable, not every failure to survive can be described as a 'generalized failure'. Contrary to this approach, Van der Sandt (1982) explains presupposition failure as an odd case, possibly caused by a specific context, and the anaphoric reference or accommodation as the regular case. Beaver (1995) argues that Van der Sandt's (1982) theory is empirically most adequate.[15]

> In an accommodation theory, an explanation of presupposition related inferences may be given without any direct definition of what the presuppositions of complex sentences are. This is the case in Van der Sandt's recent theory, where accommodation cuts and pastes the elementary presuppositions into the logical form itself, until a logical form is produced containing no further presuppositions. Although we can not say that the possible presuppositions of complex sentences are structurally predictable, since complex sentences are given no presuppositions, we may still say that

[15]The theory developed in Beaver (1995), however, is building on Karttunen (1974) and Heim (1982).

> Van der Sandt has employed a *structural* notion of accommodation: what is accommodated is strictly drawn from amongst the elementary presuppositions. (Beaver, 1995, p.119)

'Elementary presupposition' is in the case of *although* a problematic notion. In principle, the elementary presupposition is a presupposition triggered by the linguistic expression. In the light of the projection problem, it is also a presupposition that belongs to a simple, non-complex sentence. The presupposition of *although* is elementary, as it is triggered by *although*, but does not belong to a simple sentence, as it is a connective, inevitably part of complex sentences. Now, according to Beaver (1995), Van der Sandt (1982) does not define possible presuppositions of complex sentences, but he does define a logical form of a sentence in its context, where all presuppositions fit in. In this theory, there is no problem with the not quite elementary nature of the presupposition of *although*, because the projection problem can be avoided. Of course, the phenomena that caused the formulation of the projection problem did not disappear. Van der Sandt (1988) suggests that the filters in Karttunen (1974) can be reformulated in terms of local contexts.[16]

In a discourse oriented approach, presupposition tests concern context more than embedding. The essential change in developing tests for presuppositions is that it can be made explicit in context whether a presupposition is present or not. If the context already provides the information expressed in a presupposition, the presupposition is resolved. If there is information inconsistent with the presupposition, the presupposition fails. If there is no information, the presupposition is accommodated. In conditionals, it is possible that the presupposition only holds for the conditional itself, but not necessarily for its context.

On the basis of these relations between presupposition and context, it can be shown that sentences containing *although* behave parallel to sentences containing common elementary presuppositions. A sentence that allegedly contains a presupposition, is presented in a context that is consistent or inconsistent with the alleged presupposition. If the judgments on sentences containing *although*, in such contexts, are parallel to sentences containing *to stop*, in the same kind of contexts, the assumption of a presupposition for *although* is corroborated. Two kinds of sentences will be tested: simple sentences and conditionals. A simple sentence may not contain a presupposition that is inconsistent with its context, but the same presupposition holds when the context already contains the presupposed information. In a conditional, a presupposi-

[16] Van der Sandt (1988, p. 151) defines different 'local contexts' for each logical connective: the left hand proposition of a connective has another context than the right hand proposition, since the right hand proposition has the left hand proposition as its context too. It is possible, then, to demand that presuppositions be satisfied with respect to their local context.

tion in the consequent may hold when the *if*-clause already contains the presupposed information. This way, the presupposition is resolved within the conditional, and therefore, it does not have to be consistent with its context (the presupposition can be denied, if the information in the *if*-clause is denied). It will be shown that for both simple sentences and conditionals, the presupposition of *although* behaves like other presuppositions.

Context and presupposition

The information a presupposition expresses may already be available in the context. If this is the case, the presupposition is in fact already established, and nothing needs to be done. If there is information in the previous discourse that is inconsistent with the presupposition, the presupposition can not be established: its antecedent is denied and it can not be accommodated. An unacceptable discourse results. In (24), these effects are obtained.

(24) a. John used to smoke a lot. He stopped smoking recently.
b. ?John has never smoked. He stopped smoking recently.
c. John smoked.

In (24a), a sentence containing the presuppositional information comes before the sentence containing the presupposition (which is given in (24c)). In (24b), information that is inconsistent with the presupposition comes before the sentence containing the presupposition. This results in an unacceptable discourse.

The test is applied to an *although* sentence, in (25).

(25) a. Sauntering makes you restful. Although he sauntered to the university, Theo was exhausted.
b. ?Sauntering wears you out. Although he sauntered to the university, Theo was exhausted.
c. Normally, if you saunter, you are not exhausted.

The discourse in (25a) is acceptable, but the discourse in (25b) is unacceptable. The unacceptability can be explained by the assumption of a presupposition for *although*, as given in (25c). This presupposition is not consistent with its context, and therefore (25b) is unacceptable. The judgments on (25) are parallel with the judgments on (24).

Zeevat (1991, p. 191) presents a pair of conditionals, here given as (26), to illustrate that presuppositions may behave differently when contextual information is contained in the *if*-clause of a conditional.

(26) a. If he was crying, then he regrets killing his father.
b. If he killed his father, then he regrets killing his father.

In (26a), the presupposition that *his father* is dead, is accommodated. In a continuation of this discourse, it will be assumed that 'his father is dead'. A continuation of the discourse in which his father appears to be alive, is not accepted, as (27) shows ((27) and (28) are constructed conform Van der Sandt, 1989).

(27) ?If he was crying, then he regrets killing his father. But if he was happy, then his father is alive and kicking.

In (26b), the presupposition that 'his father is dead', is evoked by using *regrets*. This presupposition is resolved by the information given in the antecedent of the conditional. The presupposition is therefore not accommodated in a discourse representation outside the conditional. It is possible to continue with the assumption that his father is alive. This is shown in (28).[17]

(28) If he killed his father, then he regrets killing his father. But if his father is alive, he will be glad that his father managed to survive.

In (28), the first sentence is continued with information denying the presupposition that 'his father is dead'. In the consequent of this second conditional, a presupposition that 'his father is alive', is triggered by *be glad*. The fact that (28) is acceptable, means that the first presupposition did not become part of the information accessible for all anaphors and presuppositions in the discourse of (28) (as a matter of fact, the second presupposition did neither). Instead, the presupposition in the first conditional is resolved by information given in its antecedent. The presuppositional information is therefore only available within the conditional. As a result, the discourse may continue with information inconsistent with the presupposition of *regrets*.

The judgments given in (27) and (28) are the same in analogous sentences using *although*.

(29) a. ?If Theo is in bad shape, he is exhausted although he sauntered to the university. But if Theo is in good shape, he is exhausted because he sauntered to the university.

b. If sauntering makes you restful, Theo is exhausted although he sauntered to the university. But if sauntering is tiresome, Theo is exhausted because he sauntered to the university.

[17] Van der Sandt (1989, p. 284) shows that a presuppositional reading is possible, if the context does not deny the presupposition itself, whereas it does deny (part of) the contextual information. His example is given here in (i).

(i) If John murdered his wife, he will be glad that she is dead, but if she took those pills herself....

In (i), the presupposition that John's wife is dead, is still accommodated at the global level. This example shows that contextual information is more important than calculation based on the 'filter' approach.

(Readers who find (29b) odd, may try to read this discourse with some intonational stress on *because*.) The first sentences of (29a) and (29b) are made analogous to the sentences in (26a) and (26b). Without their continuations they would both be acceptable.

In (29a), the antecedent of the conditional does not contain information with which the presupposition of *although* can be identified. So, the presupposition is accommodated. A continuation of the discourse may not be inconsistent with the information that 'normally, if you saunter you are not exhausted'. In the consequent of the second conditional in (29a), such inconsistent information is given. As a result, the discourse is unacceptable. The fact that the *if*-clause of the first conditional is denied by the *if*-clause of the second, does not have any effect on the acceptability.

In (29b), the antecedent of the first conditional contains information that resolves the presupposition of *although*. The continuation with an *if*-clause denying the first *if*-clause, makes it possible to have inconsistent information in the consequent of the second conditional. And indeed, the discourse in (29b) is acceptable, while the consequent of the second conditional is not consistent with the *if*-clause of the first.

The behaviour of the *because* sentence in (29b) is quite remarkable. Intuitively, it seems that *although* and *because* are used in a contrastive way. But this contrast is not made explicit. The inconsistent information expressed in the *because* sentence is apparently contrastive with the presupposition of *although*. It seems that *because* has a similar presupposition, but with an interpretation that is contrastive with the presupposition of *although*. This is exactly what will be proposed in section 3.5.

As far as discourse oriented tests are concerned, *although* has a presupposition. Information inconsistent with this presupposition leads to an unacceptable discourse ((25b) and (24b) are both unacceptable). Consistent information does not lead to unacceptability ((25a) and (24a) are both acceptable). In conditionals, presuppositions may be accommodated. In that case, an inconsistent continuation results in unacceptability ((27) and (29a) are both unacceptable). When presuppositions are resolved within the conditional, a continuation denying the previous *if*-clause may cause the context to be inconsistent with the first presupposition, and still have an acceptable discourse ((28) and (29b) are both acceptable). These results are presented in table 3.4.

The conclusion that *although* has a presupposition can be read from table 3.4 by the observation that for every test the acceptability judgments are the same for *although* and *regret*.

The test in (29b), the resolved presupposition of *although* in a conditional, gives reason to assign *because* an analysis similar to the analysis of *although* (see section 3.5).

Test:	cc/ass.	ci/ass.	ci/cond./acc.	ci/cond./res.
Regret	√	?	?	√
Although	√	?	?	√

√: the discourse as a whole is acceptable.
?: the discourse as a whole is unacceptable.
cc/ass.: context is consistent with a presupposition in an assertion.
ci/ass.: context is inconsistent with a presupposition in an assertion.
ci/cond./acc.: context is inconsistent with an accommodated presupposition in a conditional.
ci/cond./res.: context is inconsistent with a resolved presupposition in a conditional.
Regret: *regret* triggers presupposition.
Although: *although* allegedly triggers presupposition.

Table 3.4: Discourse oriented tests for *although*.

3.3.3 Conclusion

In section 3.3, presupposition tests are performed on sentences containing *although*. In comparison with tests performed on presuppositions of *to stop* and *to regret*, tests on *although* show, at large, the same results. A distinction is made between embedding tests (section 3.3.1) and discourse oriented tests (section 3.3.2). *Although* does not behave like having a presupposition on all the embedding tests, but the results on the discourse oriented tests support a presupposition for *although* in all cases. This can be explained by properties of some embedding tests (the negation test does not always work), and properties of *although*: being a connective, a complex sentence needs to be incorporated in the test, where ordinary presuppositions can be triggered in a simple sentence. In the case of the modality test, this leads to scope ambiguity of the modal expression. The interpretations match with semantic and pragmatic interpretation. This ambiguity, and the semantic and pragmatic distinction, also occur with *because*. In discourse oriented tests, consistency in context is judged, which leads to more stable judgments for *although*. An interesting parallel between the interpretation of *although* and *because* appears when *because* is capable of denying the presupposition of *although*.

Two tests show a parallel between *although* and *because*. In section 3.5, the presupposition analysis of *although* will be extended to *because*. Before that, in section 3.4, the interpretation of *although* is investigated in more detail. The connective *although* is not interpreted as a semantic denial of expectation only. In the previous chapter, other contrastive interpretations were found as well. Are these interpretations explained by the assumption of a presupposition?

3.4 Extending the analysis

In the previous section, it was shown how a presupposition analysis of *although* survived presupposition tests. However, only one interpretation of *although* was analyzed. Given the fact that interpretations of *although* sentences differ when they occur in different contexts, it would be premature to generalize the results of the presupposition tests in the tables (3.3) and (3.4) to all occurrences of *although*. In this section, these different interpretations with respect to their presuppositional nature will be discussed in two clusters:

1. epistemic and speech act interpretation;
2. concession.

3.4.1 Epistemic and speech act interpretation

The canonical example in (1) was a semantic denial of expectation. But in the previous chapter, three kinds of denials of expectation were presented. In (30), examples of these interpretations are repeated.

(30) a. Connors didn't use Kevlar sails although he expected little wind.
b. Theo was not exhausted, although he was gasping for breath.
c. Mary loves you very much, although you already know that.

(30a) is interpreted semantically, (30b) epistemically, and (30c) as a speech act.

Semantic The presupposition of (30a) is straightforward: from the two propositions a presupposition is derived by generalizing over the subject *Connors*, as (31) shows.

(31) a. Normally, if one expects little wind, it is not the case that one does not use Kevlar sails.
b. Normally, if one expects little wind, one uses Kevlar sails.
c. $\mathrm{Exp}(x, w) > \mathrm{Use}(x, k)$,
where: Exp(x,y) = x expects y; w = little wind; Use(x,y) = x uses y.[18]

In (31a), the derivation of the consequent renders a double negation, because the presupposition is defined as the negation of the proposition in the *although*-clause. In (31b), this negation is reduced to a positive consequent.[19] A translation of (31b) in predicate logic is given

[18] *Little wind* is taken to be a constant here, to keep it simple. See section 3.8 for a discussion of these problems of derivation.

[19] This is not necessary, and in fact problematic, because the Law of the excluded middle does not hold in formal models like Discourse Representation Theory. In Krahmer and Muskens (1995), a proposal has been made to solve this problem.

in (31c). Generalization of *Connors* to *one* is expressed by a free variable. An existential quantifier would establish a wrong interpretation here: the interpretation of (31b) is more like a generic statement on expectants of little wind: 'expectants of little wind use Kevlar sails'.[20]

Epistemic The epistemic interpretation of (30b) is characterized by domain restriction, as was described in the previous section. The paraphrase: 'From the fact that Theo is gasping for breath, I conclude that he was exhausted' could be a formulation of the presupposition of *although* in (30b). The phrase: *I conclude* is introduced in the presupposition to restrict the domain of interpretation. This effect is obtained by perspectivizing the conclusion to a statement for which only the locutor is responsible. The presupposition for (30b) is given in (32b) and translated into predicate logic.

(32) a. From the fact that Theo was gasping for breath, I conclude that he was exhausted

b. Normally, if someone is gasping for breath, I conclude that he is exhausted

c. $\mathrm{GfB}(x) > \mathbf{B}(i, \mathrm{Exh}(x))$,
where i=I (speaker); GfB(x) = x is gasping for breath; **B**(y,Y) = y believes Y; Exh(x) = x is exhausted.

In (32a), a paraphrase of the interpretation of the sentence is given. The speaker's conclusion is a restriction on the consequent of the presupposed implication: its truth value is restricted to the knowledge or belief of the speaker. The presupposition in (32b) is translated into predicate logic in (32c). **B** is translated as a two place predicate that has a discourse participant as its first argument, and a proposition as its second. The interpretation of **B** can be worked out as a domain restriction: **B** restricts the interpretation of the proposition Exh(x) to a part of the domain of interpretation. With respect to discourse representation, it restricts the interpretation of Exh(x) to a specific participant of the discourse.

There is another aspect of the introduction of the **B** operator in (32c). This operator is affecting the interpretation of the presupposition. Does this mean that there is a new presupposition for epistemic interpretation, independent of the original presupposition in (2)? And if it were a new presupposition, does it have to be tied to some specific expression? Clearly, the linguistic expression *although* has not been changed.

[20] According to Asher and Morreau (1991), universal quantification should be used in combination with their defeasible implication >, in order to express generic statements. Thus, the generic variant of (30b) would read: ∀x(Exp(x,w) > Use(x,k)). Since the conditional aspects of the presupposition are more relevant for this chapter than generic quantification, the quantifier will be left out.

In section 3.2.1, it was shown that presupposition and conversational implicature were both involved in the interpretation of *only* (cf. Atlas, 1991). It appeared to be quite difficult to determine which part of the interpretation was due to presuppositions, and which part to conversational implicatures.

With respect to the representation in (32c), **B** can be regarded as the result of the application of a conversational implicature. It is part of the presupposition for (30b), but it is derived as a conversational implicature. There is a way to distinguish **B** within the presupposition. It should be possible to withdraw the conversationally inferred part of the presupposition in a context in which the presupposition itself can not be withdrawn. In the case of **B**, a context should be created in which **B** can be withdrawn from the presupposition without causing inconsistency. An example from the previous chapter is repeated in (33), where context played a decisive role in the interpretation.

(33) When the whole family is together, you can see how different we are. Bill is always funny. *John is shy, because he blushes very quickly.*

It was shown that the epistemic interpretation ('From the fact that John blushes very quickly, I conclude that he is shy') can change into a semantic interpretation by changing context. Is it possible to make the context inconsistent with epistemic interpretation, whereas semantic interpretation still holds? In that case, it would be possible to leave the **B**-operator out of the presupposition. In (34), an attempt is made to create an inconsistency in the continuation of the discourse.

(34) Situation: A tells about family, B interrupts.

A: When the whole family is together, you can see how different we are. Bill is always funny. John is shy, because he blushes very quickly.

B: Well, he just has a ruddy face.

A is presenting John's blushing as evidence for his shyness. The interpretation of A's observation is denied by B: John's blushing is not a sign of shyness, but has a physical background. A reaction of A can be imagined, in which he turns the epistemic relation into a semantic one: *In fact, his ruddy face is the reason for his shyness*. A justifies his use of *because* by specifying the causal relationship he was - apparently - thinking of.[21] A takes B's reaction as a denial of the evidence, not as a denial of the semantic relation. Since the discourse does not become inconsistent after A's reaction, it appears to be possible to forget about the epistemic interpretation while maintaining (or introducing) a semantic one. In any case, a presupposition of *although* will hold.

[21] In (34), the epistemic relation is not obtained by abduction (given the appropriate world knowledge). Therefore, the relation can be understood as semantic without reversing premise and conclusion.

However, if A would challenge B on the semantic interpretation of the causal relation, they would end up in a disagreement. For instance, imagine that A's reaction to B would be: *I can see from his blushing that he is shy*, then A and B would disagree on the causal interpretation of John's physical state. This disagreement can be seen as an inconsistency in the discourse. So, when there is disagreement on the causal relation itself (or: the presupposition itself), discourse becomes unacceptable.

Is it possible to make a context inconsistent with a semantic interpretation of a causal relation, without making the discourse unacceptable? In (35), the semantic variant of (34) is given, presented earlier in chapter 2.

(35) Situation: A is making a statement, B reacts.

A: Some bodily reactions can have nasty effects on people. For example, John is shy, because he blushes very quickly.

B: Well, he just has a ruddy face.

Here, B's reaction can only be interpreted as a small correction to A's remark that John blushes very quickly. The presupposition: 'Normally, if someone blushes very quickly, he is/will become shy' as such is not denied. If B's reply were instead : *well, quick blushers are never shy*, his reaction would be quite odd. It should be introduced by a phrase like: *no, you're wrong, because ...* to prevent inconsistency in the discourse. So, when the presupposition (in its semantic interpretation) is inconsistent with the context, the discourse becomes unacceptable.

The example in (34) shows that consistency in a discourse can be preserved, if the context is inconsistent with just the epistemic interpretation of a causal relation. The example in (35) shows that a context inconsistent with the semantic interpretation of the causal relation leads to an unacceptable discourse. Therefore, it can be concluded that the presupposition of *although* is a presupposition in its semantic interpretation (represented by a defeasible implication), and a combination of presupposition and conversational implicature in its epistemic interpretation (represented by a **B** operator in the defeasible implication).

The analysis of **B** as an operator in a representation of a presupposition (as the epistemic interpretation of an expectation in a denial of expectation) is in accordance with the insight expressed in Beaver (1995), who attributes it to Atlas (1977), that the borderline between conversational implicature and presupposition is not distinct, but fluent. **B** might also be identified as an example of Soames' (1982, p.85-86) speaker presupposition, which is defined with respect to the participants of the discourse, where the defeasible implication reflects utterance presupposition, which is defined with respect to utterances in their conversational context.

At the end of this section, the relation between presupposition and conversational implicature will be discussed. For now, it is assumed

that epistemic interpretation may be a conversational implicature, as it is possible to withdraw the implicature in a context inconsistent with it. A presupposition reflecting a semantically interpreted causal relation cannot be withdrawn in an inconsistent context (but results in an unacceptable discourse).

Speech act Several conversational implicatures are used in deriving the presupposition of (30c), the speech act variant of the denial of expectation (repeated below as (36a)). Deriving the presupposition as if it were semantically interpreted gives an implication that is not intelligible: 'normally, if one already knows it, it is not the case that Mary loves him'. This presupposition suggests a connection between 'knowing something already' and this something not being the case (which is quite the opposite of a self-fulfilling prophecy). Here, a regular derivation does not catch the proper meaning of the presupposition. Intuitively, the presupposition could have a paraphrase like: 'normally, if one already knows it, there is no need to say that *Mary loves you*'. The clause *Mary loves you* is used autonymously. In the presupposition, a justification for not uttering this clause is given: the justification is violated in the utterance itself. The verb *know* indicates that this justification refers to informativity. In fact, what seems to happen in the presupposition is an application of a maxim of quantity: 'do not make your contribution more informative than is required' (see table 3.1). *Mary loves you* is the contribution that is more informative than required, because 'one already knows it'. The instruction 'do not make' refers to 'there is no need to say it'. How such an interpretation can be derived systematically is shown in (36).

(36) a. Mary loves you very much, although you already know that.
b. (?) If one already knows $[\text{that}]_i$, it is not the case: $[$Mary loves one very much$]_i$
c. If x already knows $[\text{that}]_i$, I need not say: $[$Mary loves you very much$]_i$
d. K(x,Q) $>$ $\neg\Box\mathbf{S}(i, Q)$.[22]
e. where: K(x,Q) = x knows Q; **S**(i,Q) = speaker says Q; Q = *Mary loves you*.

In (36b), it is shown how a paraphrase of a semantic interpretation of the presupposition can not be made properly. In (36c), an attempt is made to create a paraphrase of the speech act interpretation. In the previous chapter, it was shown that two properties of this paraphrase were typical for a speech act interpretation: the occurrence of a matrix clause with a speech act verb like *say*, in which one clause is embedded, and the occurrence of an anaphor (*that*) referring to the embedded

[22]Since Q is addressed to x, **S** might also be represented as a three-place operator: **S**(i,Q,x).

clause. In (36d), it is illustrated how these properties are represented. The speech act verb is represented by the operator **S**, and the speaker performing **S** is represented as its first argument, *i*. The presence of the anaphor is reflected in the fact that the second argument of K is identical to the second argument in the **S** predicate, namely Q.

It was suggested in the previous chapter, that apart from these two properties, additional inferences were made in speech act interpretation. With respect to (36a), these inferences result in the occurrence of the negated necessity operator (¬□), in (36c). The necessity to say something when you already know it, is denied. Justifying or, in this case, gainsaying (the necessity of) speech acts is typical for interpretation in Sweetser's speech act domain. Here, it is not the speech act domain, but the restriction of the speaker to gainsay (the necessity of) his own words.

The speech act operator **S** is essential as a marker for speech act interpretation. In (37), another speech act example of *although* is given (taken from Sweetser, 1990, where she used *since*. It is adjusted here for use with *although*).

(37) a. The answer is on page 200, although you'll find it for yourself.
b. ?If you'll find it for yourself, the answer is not on page 200.

In (37a), the interpretation is that it is a bit superfluous to mention the location of the answer, since *you* will find the answer anyway. If a presupposition of *although* were derived straightforwardly from the utterance, something like (37b) would be derived, an unintelligible conditional. In the speech act variant of the presupposition, the mentioning of the location of the answer is gainsaid, rather than the location itself. This can be paraphrased as: 'if you'll find the answer for yourself, I do not tell you (where to find it)'. This is still quite awkward, but if it were modalized it would be better: 'if you find the answer yourself, I do not need to tell you', or even: 'if you know the answer, I do not need to tell you', which might be considered a circumscription of the second maxim of Quantity. Translated into predicate logic, something like (38b) is possible.

(38) a. 'If you'll find the answer for yourself, I don't need to say: "the answer is on page 200"
b. Find(you,answer) > ¬□**S**(i,Locate(answer,page200))

Speech act interpretation of *although* is the result of making inferences from an unintelligible presupposition to an adjusted presupposition, in which the **S** operator is used to gainsay (the necessity of) speech acts. In (38b), the speech act is expressed as *Locate(answer,page200)*. It was mentioned in chapter 2 that the clause expressing the speech act was used autonymously. *Locate(answer,page200)* should thus be identifiable with an argument in the *although*-clause, since the *although*-clause is

stating something about the main clause. The uttering of *the answer is on page 200* amounts to finding the answer, so it is possible to defend autonymous use of the main clause here.

Summarizing the speech act variant of the interpretation scheme: a speech act interpretation is, if not invoked by explicit speech act forms in the utterance, recognized by failure of the semantic or epistemic causality in the presupposition. A repair is made by the insertion of **S** having scope over the representation of the main clause, and some other operations on the basis of inferences that need not be specific for speech act interpretation, in order to justify or gainsay the speech act.

With the introduction of two operators, it is possible to account for three different interpretations of denial of expectation that were distinguished in the previous chapter. In a speech act interpretation one can still assume that the causal relation is presuppositional and the speech act operator a result of a conversational implicature. There is a problem with this assumption, however: the causal relation is not a real world connection anymore. In an epistemic interpretation, there was always some real world connection supporting the epistemic interpretation. In speech act interpretation, failure of the recognition of a real world connection might be indicative for speech act interpretation. The causal relation expresses knowledge about the reason why utterances need to be said or may not be said. It is not possible to withdraw the speech act interpretation, and maintain the semantic interpretation. In this respect, speech act interpretation of *although* resembles concession, as will be shown in the next section. The difference between concession and speech act denial of expectation is that the latter still expresses a causal relation, and will therefore be associated with a presupposition.

Conversational implicatures may alter presuppositions, using operators like **B** and **S**. The interpretation of concession involves more than adjustment of a presupposition, as will be shown in the next section.

3.4.2 Concession: interference of implicatures

An occurrence of *although* does not always have to be interpreted as a denial of expectation. There were two alternatives: semantic opposition, and concession. The interpretation of semantic opposition is left aside, because semantic opposition can not be established by using *although*. The other interpretation, concession, is not characterized by a causal connection between the two propositions in the presuppositional implication. Three questions are in need of an answer.

1. Does a concession interpretation of *although* have a presupposition?

2. If the answer to 1. is negative: how is a concession interpretation derived?

3. What are the differences and similarities in the derivation of both interpretations?

In section 3.4.1, it was shown that conversational implicatures were capable of 'enriching' a presupposition, such that the presupposition maintained, but referred to another structuring of the domain of interpretation.

In the previous chapter, it was shown that a concessive interpretation was determined by context. Concession is not causal: it does not establish a causal relation between the propositional contents of its connecting clauses. Instead, a tertium comparationis is derived by means of various inferences, or using contextual information. So, concession may be affected by conversational implicatures, or even arise from them. In this section, it will be investigated whether a concession interpretation of *although* should be regarded as a kind of enriched presupposition, or as an interpretation based completely on conversational implicatures.

Is concession presuppositional?

To find out whether concession bears a presupposition, the sentence in (39) will be investigated (taken from Spooren, 1989, using *although* instead of *but*).

(39) a. Shall we take this room?
b. Although it has a beautiful view, there are blue coverlets on the beds.

In (39a), the *although* sentence is contextualized: the interpretation of (39b) involves a 'yes or no answer' to the question. This answer is not provided: in the *although*-clause, an argument is given for saying 'yes', and in the main clause, an argument is given for saying 'no'. In other words, there is a tertium comparationis saying: 'we take this room' (r) which is inferred from the *although*-clause, and its negation (¬r), which is inferred from the main clause.

If there were a presupposition for concession, it should be a proposition that contains the tertium comparationis. There are three sensible possibilities: the tertium comparationis itself, its negation, or a complex statement containing the presupposition. The discourses in (40) give evidence for taking neither r nor ¬r as a presupposition.

(40) a. We take this room. Although it has a beautiful view, there are blue coverlets on the beds.
b. We do not take this room. Although it has a beautiful view, there are blue coverlets on the beds.

If r were a presupposition, (40a) should be acceptable but (40b) unacceptable, for the context is consistent with r in (40a) and inconsistent

with r in (40b). If ¬r were a presupposition, (40a) should be unacceptable but (40b) acceptable, for the context is inconsistent with ¬r in (40a) and consistent with r in (40b). Since both discourses are acceptable, r nor ¬r can be a presupposition. So, maybe a complex statement containing r can be a presupposition.

If it were the conjunction of r and ¬r, a contradiction would appear: 'we take the room and we don't' (r ∧¬r). If it were the disjunction of r and ¬r, a tautology would appear: 'we take the room or we don't' (r ∨¬r). In the first case, sentence (39b) would not be accepted, for its presupposition failed, and in the second case there would be no failure possible at all. Spooren (1989) proposes to express the contrast of a concessive opposition on a separate level, using modality markers to form a conjunction with r and ¬r, as in (41).

(41) It is possible that we take the room and it is possible that we don't take this room.

In the concession interpretation, both derived arguments count as valuable arguments, although the second one (we don't take the room) is preferred over the first one. Spooren (1989) does not assume that (41) should be regarded as a presupposition.

Part of the allegedly presupposed information of (41) is represented in an assertion in (42). In (42a), contextual information, consistent with (41), is added. In (42b), information inconsistent with (41) is added.[23]

(42) a. We should not take this room. Although it has a beautiful view, there are blue coverlets on the beds.

b. We cannot possibly take this room. Although it has a beautiful view, there are blue coverlets on the beds.

(42a) contains contextual information consistent with (41). No inconsistencies should arise. Indeed, (42a) is an acceptable discourse.[24] In

[23]Because (41) is a conjunction, denial of only one of its conjuncts will suffice to provide an inconsistent context for (41). Note that the modalization is denied, rather than the state of affairs itself.

[24]According to Sidiropoulou (1992), one argument considered in (42a) is evaluated positively, and the other negatively. Contextual information determines which argument is considered positive, and which argument negative, if the connotations of the *although* sentence do not differ amongst themselves. To this analysis, it can be added that the pattern seems to be that a positive context gives a negative *although*-clause, and a positive main clause, or a negative context is followed by a positive *although*-clause, and a negative main clause. In this light, the discourse in (i) is strange, for the context determines that the *although*-clause should be negatively evaluated.

(i) ?We are very pleased with this room. Although it has a beautiful view, there are blue coverlets on the beds.

A beautiful view can hardly be regarded as a negative connotation. The discourse in (i) is unacceptable, for it does not represent a proper argumentation.

(42b), *we cannot possibly take this room* is inconsistent with (41).[25] If (41) were a presupposition, the discourse should be unacceptable. But (42b) is acceptable, so according to the judgment in (42b), a concession is not presupposed.

The answer to the first question is: a concession interpretation is not due to a presupposition variant of *although*, at least not a presupposition that would be in line with the tertium comparationis analysis. Given the point of view that presuppositions need to be satisfied, and that *although* is considered to be a presupposition bearer, an explanation has to be given for the question why some occurrences of *although* (like in (40)) do not need to have a presupposition. First, it will be argued that a cancellation approach like in Gazdar (1979) is not adequate in this case. Then, a solution will be proposed.

Is expectation cancelled by concession?

If *although* is considered to be a presupposition trigger, it must trigger its presupposition in every occurrence. If an *although* sentence is interpreted as a concession, it must be explained why *although* has no presupposition to be satisfied. A possible solution might be that a concession interpretation, based on conversational implicatures, cancels the presupposition that *although* has triggered.

In Gazdar (1979), it is proposed that presuppositions are derived from 'potential presuppositions', and different kinds of implicatures from potential implicatures. In deriving actual presuppositions and implicatures it is possible that some implicature cancels a potential presupposition. This potential presupposition will not be realized as an actual presupposition. Is it possible that likewise, a potential implicature of concession cancels a potential presupposition of denial of expectation?

To answer this question, a next question needs to be answered: is the interpretation of (39b) a concession because a denial of expectation was not possible in its own right, or because the concession overruled the denial of expectation?

First, it must be checked whether a denial of expectation is possible in its own right in (39b). The presupposed expectation should read: 'if a room has a beautiful view, there are no blue coverlets on the beds.' There is no real world connection between beautiful views and lack of blue coverlets in the world as we know it. It is even unlikely that someone believes that there are no blue coverlets on the beds, as he sees the beautiful view: an epistemic interpretation is impossible. A speech act interpretation would read: 'In spite of the fact that the view from this room is beautiful, I must say this: there are blue coverlets on

[25] This can be shown as follows: (41) can be represented in propositional logic as: $\Diamond p \wedge \Diamond \neg p$. This is equivalent with $\neg\Box\neg p \wedge \neg\Box p$. *We cannot possibly take this room* is represented as $\Box\neg p$. This contradicts the first conjunct of (41), $\neg\Box\neg p$, and consequently the whole conjunction.

the beds'. A presupposition, rendering this interpretation, should read: 'normally, if the view is beautiful, you do not need to say: there are blue coverlets on the beds.' This would not be a possible speech act interpretation of (39b). It is impossible to have a denial of expectation in (39b), whatever variant is used. This impossibility is independent of the possibility of an implicature-based interpretation of concession. This makes it problematic to speak of cancellation, since the expectation could not be established anyhow.

Be cooperative

Cases where *although* is used, and concession is interpreted, appear to be problematic. Concession does not cancel some presupposition expressing an expectation, for it is not possible to derive such an expectation in the first place. But still, presupposition theory predicts that if *although* triggers a presupposition, it should do so on every occasion. There are two questions with respect to the interpretation of (39b):

1. Why does the lack of a presupposition for *although* not lead to unacceptability of (39b)?

2. How does the interpretation of concession come about?

The short answer to both questions is: the Cooperative Principle (stated in table 3.1) prevents unacceptability by turning the interpretation into concession. In this paragraph, it will be shown that making reference to the Cooperative Principle makes sense, and is supported by facts.

Van der Sandt (1988) already demonstrated that utterances with definite descriptions of non-existing entities (*the horrible snowman feeds on radishes*) are felicitous utterances, because speaker and hearer simply assume the existence whenever necessary. The proposition: 'there is a horrible snowman', is simply accommodated in the representation of a discourse, shared by hearer and speaker.

Simply assuming a causal link for (39b), and accommodate it, is not possible, for the causal link has to correspond to a real world connection. To prevent unacceptability, another way of obeying the Cooperative Principle is used. In König and Traugott (1988), an analysis is made of semantic changes in connectives. They observe changes in the interpretation as in the following list:

- From temporal order to causal order (e.g. *after*);

- From concomitance to concessivity (e.g. *still*);

It must be noted first, that 'concession' means both 'denial of expectation and concession' in König and Traugott (1988). In terms of this chapter, the development was from concomitance to denial of expectation. For instance, in (43), *still* did have a concomitted interpretation

first: two events occur simultaneously, and nothing more (König and Traugott, 1988, p.114).

(43) It is midnight and he is still working.

The reason why *still* gets an interpretation of denial of expectation is, that the mere fact of co-occurrence is not newsworthy. What happens is the following.

> [O]ne of these cases where co-occurrence is highly relevant and newsworthy is that where there is a general incompatibility between two situations, where one situation does not normally occur with the other. And this is exactly what concessive connectives express (König and Traugott, 1988).

Again read 'denial of expectation' for *concessive* here. A regular meaning change of a connective is often due to the Cooperative Principle. "Since the interpretative augmentations are conversational implicatures based on maxims of cooperative interaction which later become conventionalized, they are also observable in the synchrony of a language" (König and Traugott, 1988, p.120). The idea that denial of expectation is conventionalized from conversational implicatures, might be extended to the difference between denial of expectation and concession (in the definition of this chapter). Is it possible to make a synchronic analysis of a concession interpretation as an exploitation of one of the maxims? If so, concession can be accepted as coming forth out of a regular meaning change. The analysis need not be the actual reflection of what happens in actual language use, for a meaning change leading to concession might have been conventionalized on its turn again.

A concession coming forth from the Cooperative Principle, can be analyzed as a reaction on the flouting of a maxim of conversation. An example of changing the interpretation because a maxim is flouted, is given in (44) (taken from Levinson, 1983, p. 112).

(44) a. Miss Singer produced a series of sounds corresponding closely to the score of an aria from *Rigoletto*.

b. Miss Singer sang an aria from *Rigoletto*.

The maxim of Manner: 'be brief' is obeyed in (44b), and its interpretation is straightforward. In the context of a review of a musical performance, the flouting of the maxim in (44a) becomes meaningful: Miss Singer did sing the aria from *Rigoletto*, but not quite so good as the reviewer would have wanted to hear. The interpretation of (44a), that she only sang well in a technical sense, is an interpretation of (44a) as an argument in favor of a negative evaluation of the reviewer. The reader interpreted the utterance as argumentative, after the 'be brief' maxim was flouted.

Likewise, a flouting of the maxim Quality: do not say what you believe to be false, may lead to a metaphorical interpretation of a sentence.[26] However, most metaphors in everyday language are not recognized as such, for their metaphorical meaning has been conventionalized (Sweetser, 1990, applied this view to the polysemy of connectives) and is often the regular meaning of words and phrases. Below, an analysis is given of a concessive interpretation coming forth from the flouting of a maxim. Analogue to metaphorical meaning, this does not mean that interpretation of a concession is in everyday language still done by flouting maxims.

In (39b), no presupposition is satisfied, because a real world connection between a beautiful view and blue coverlets on the beds could not be established. As a result, the utterance is unintelligible (it can not have a truth value). A speaker who uses an unintelligible expression, is flouting the maxim of manner: 'avoid obscurity of expression'.[27] Under the assumption that the speaker is obeying the Cooperative Principle, conversational implicatures may change the interpretation of the sentence, in such a way that it can be understood without the presupposition. The context in which the utterance is done, in (39), is the answer to the question: *shall we take this room?* In order to obey the Cooperative Principle, the concession interpretation is performed: the tertium comparationis is given, and two inferences from the two propositional contents to the tertium comparationis are made. Notice that doing this makes a concession argumentative in its context.

The argumentative value of concessions has been discussed in detail by Ducrot (1980), Elhadad (1993) and others. The use of argumentative scales, called 'topoi', accounts for the content of the contrast that is expressed. Originally these topoi have a comparative form ('the more beautiful the view, the more attractive it is to take the room'; 'the more blue coverlets there are on the beds, the less attractive it is to take the room'), but according to Moeschler (1990) and Oversteegen (1995), topoi may express the tertium comparationis as an implication of the individual clauses ('if the view is beautiful, we take the room'; if there are blue coverlets on the beds, we do not take the room.'). The difference between presupposed statements and topoi can be defined as follows:

> (...) the derivation of a presupposed statement can be made by means of reasoning on the basis of linguistic knowledge, whereas the derivation of topoi involves reasoning on the basis of real world knowledge. (Oversteegen, 1997, p. 63)

This corresponds with the observation that a presupposition of *although* can be derived 'stand-alone', whereas the implicatures needed for con-

[26] Grice (1975) claimed that flouting the maxim of Quality was characteristic for metaphor. This is not entirely true. See (Leezenberg, 1995, p. 86-101)

[27] Or, in a Russellian account, the maxim of Quality, because the speaker is saying something that he believes to be false.

cession need context to be derived.

The argumentative approach takes a different angle to the interpretation of a discourse than the Gricean pragmatic approach. From the Gricean maxims one can infer that an objective exchange of information between speaker and hearer form the basic (or: ideal) actions in a discourse. In the argumentative approach introduced in Anscombre and Ducrot (1976), speakers and hearers may take a statement as directing towards a conclusion. This aspect of meaning is part of the 'rhétorique intégré', or the 'argumentative structure'. While the Gricean approach seems to withhold from argumentation, Anscombre and Ducrot (1976) make it a central issue.

It is important to see that the Gricean approach is not really abandoning argumentation: in fact, this approach is capable of defining when informative statements need to be interpreted argumentatively: when a maxim is flouted, argumentative orientation can be one of the modes in which an interpretation is possible. In this view, the theory of Anscombre and Ducrot (1976) is especially relevant to those cases where informativeness on its own can not give a proper interpretation.

Levinson (1983, p. 109) speaks, with respect to the floutings of maxims, of *overtly infringing some maxim*, forcing the hearer *to do extensive inferencing to some set of propositions* in order to sustain the Cooperative Principle. With respect to concessive interpretation, it can not be maintained that the maxim of manner is overtly infringed, when the presupposition is withdrawn. That is, the maxim is infringed, but the interpretation is not marked specifically by the hearer as deviant from 'normal' usage of the presupposition. Geurts's (1995) remark that *what started off as a pragmatic regularity has been encoded in the grammar* (see the introduction of this section), might apply to this flouting too: in some processes, the flouting has become regular, and might even be conventionalized in time. This is in fact what happens with the phenomenon Levinson (1983) mentions as forthcoming out of flouting of maxims: 'the figures of speech'. Many idioms started off as a metaphor, only to be recognized by the overt flouting of a maxim.

There is one objection that can be made to the analysis above, even when it can be accepted that argumentativity is triggered by Gricean pragmatics, and floutings may be common and not consciously noticed by hearers: concessions may have preference over causal interpretations in some cases. For instance, in the example of Sidiropoulou (1992), already discussed in the previous chapter, and repeated here as (45), both interpretations were possible.[28]

(45) Although he is Viennese, he doesn't like music.

In (45), the problem is that concession is preferred in many cases, whereas a denial of expectation is not 'overtly' excluded. So, the con-

[28]It might be a matter of individual preference, but 'out of context', a denial of expectation still seems to be the most salient interpretation.

cession interpretation can not be established as a consequence of presupposition failure (and thus flouting a maxim).

This problem can be overcome by taking an important aspect of the interpretation procedure into consideration, namely the difference between both interpretations with respect to context. Recall that in the discussion of (45), a concession interpretation was forced by contextualizing (45) with the question: *is John a regular visitor of the Viennese Opera?* Sidiropoulou's (1992) contextualizations were that the speaker was looking for or interested in people from Vienna who liked music. This contextualization turns out to be crucial in the acceptatance of the causal relation. The generic statement supporting a semantic causal interpretation is: 'Viennese people like music'. This is not a statement that is universally accepted. Within a more specific context, like the ones just mentioned, it becomes unlikely to assume such a generic statement.[29] Suppose that the presupposition was accommodated in the discourse representation of speaker and hearer. The discourse has already been updated with information on the case of (45). The question *is John a regular visitor of the Viennese Opera?* is not in accordance with a causal relation between Viennese citizenship and loving music. However, real world knowledge might support it. In this case, more specific information will dismiss a real world connection. The defeasible implication that forms the presupposition is defeated when more specific information contradicts the information obtained by defeasible implication. This way, the presupposition of *although* in (45) is defeated when the specific information ('I am not sure whether John is a regular visitor of the Viennese Opera') is not in agreement with the defeasible implication ('so, not all Viennese people are music lovers'). If the main clause defeats the presupposition, the presupposition has been established first, for there was a real world connection and it was not defeated by context. Defeating the presupposition has now become part of the interpretation of the sentence itself.[30] In section 3.7, an analysis is given of the way in which the presupposition is defeated by the main clause of the *although* sentence.

There is a crucial difference between context defeating the presupposition, and context inconsistent with the presupposition. If context defeats the presupposition, it is not the case that the presupposition is inconsistent with the context: it is not the implication that is denied, but only the consequence of the implication. So, discourse will not become unacceptable, but the contextualization of the *although* sen-

[29]There are individual differences between speakers, concerning the kind of context that make the generic statement impossible. The context in which someone is 'simply looking for' Viennese music lovers can be interpreted in terms of expectation, but also in terms of argument: he is from Vienna, so he might be a Viennese music lover; he is no music lover, so he might not be a Viennese music lover.

[30]It might even be assumed that in this case, the defeasible implication is preserved as a general rule, defeated only by the exception in the main clause, giving the extraordinary effect that the rule is established by mentioning exceptions (cf. Lagerwerf, 1994).

tence has changed (the presupposition is 'resolved' in a special way). If context is inconsistent with the presupposition, the presupposition is not resolved and not accommodated. According to the tests in section 3.3.2, this would cause unacceptability with utterances containing presuppositions. Alternatively, the utterances may be reinterpreted as a concession (if *but* or *although* are used), due to a flouted maxim.

Thus far, two ways of deriving concession have been described: first, a concession was derived because a presupposition could not be formed on the basis of a real world connection; second, a concession was derived because a presupposition could be formed on the basis of a real world connection, but was defeated in context.

In the case of (45), an epistemic relation may be formed on the basis of contextual information. How is the difference between epistemic denial of expectation and concession determined? Epistemic interpretation is paraphrased as: 'From the fact that he is Viennese, I conclude that he is a music lover'. It was already discussed that the epistemic interpretation needed another contextualization, namely: 'I can recognize Viennese music lovers at first sight. Take John, for example. *Although he is Viennese, he doesn't like music*'. The same generic statement is needed to derive the epistemic interpretation. The epistemic interpretation is possible only because the context allows the generic statement to be maintained: a relation between Viennese people and music lovers might be assumed in this context. But given the other contexts, the epistemic interpretation is excluded for the same reasons as the semantic interpretation. So, context is making it possible to prefer concession over denial of expectation, but the way in which this happens conforms exactly with the procedure that was introduced earlier. This procedure predicts that concessions and denial of expectations have different behavior with respect to context: although an epistemic interpretation can be preferred in certain contexts, it can not be changed by a context: the causal relationship is given, not created. Contrary to this, concessions are created by context: finding out whether John is a regular visitor of the opera leads to another tertium comparationis, rather than a search for a Viennese citizen who happens to like music.[31]

Now that interference of the conversational implicatures of concession with the presupposition of the denial of expectation has become more clear, it is possible to give a more general schema of how interference takes place in general. Beaver (1995) notices a general tendency in determination of different scope readings in presuppositional utterances, which he calls the 'Atlas method'. It is based on a claim in Atlas (1977), that presuppositional readings of utterances are logically stronger than non-presuppositional readings. Beaver (1995) elaborates on this claim

[31] At this point, it is worthwhile to note that the two contexts Sidiropoulou (1992) mentions, 'looking for', or being 'interested in' are not creating undeniable concessions, as they are not specifically in conflict with the causal relationship.

by proposing that *the fact that presuppositions tend to project might be explained in terms of a general preference for logically stronger interpretations over weaker ones* (Beaver, 1995, p.34).[32] Beaver (1995) makes use of a notion of 'logical strength' to explain the fact that presuppositions can project from elementary sentences to complex sentences, while other inferences do not.

This notion of logical strength may be used to classify the interpretations that can be made of *although* sentences. If presuppositions are logically stronger than implicatures, the prediction is that presuppositions are expected more than conversational implicatures by a reader, when interpreting an *although* sentence. The reader's expectations are part of his competence as a language user. This looks like table 3.5.

Atlas method: logical strength

Most expected interpretation	
semantic denial of expectation	presupposition
epistemic denial of expectation	presupposition adjusted due to context or knowledge
speech act denial of expectation	presupposition reformulated due to presentational factors
concession	argumentative interpretation due to a context-defeated presupposition
concession	argumentative interpretation due to presupposition failure
Least expected interpretation	

Table 3.5: Reader's expectations of the interpretations of an *although* sentence, taking logical strength as a criterion.

The order that is suggested in table 3.5 could be expressed as a consequence of the relative logical strength associated with each interpretation. In terms of the analyses shown in the previous sections, another explanation is possible: the degree of 'inferential effort' to come to a reasonable interpretation. To interpret a semantic denial of expectation the presupposition is needed, but to interpret an epistemic denial of expectation, the presupposition has to be adjusted. These adjustments increase with the speech act interpretation of a denial of expectation (especially the autonymous use of the main clause in paraphrase needs to be captured in a formulation not derived directly from the utterance). To obtain a concession, the presupposition has been defeated, or it has failed. Next, concession has to be derived from context.

There is a problem with table 3.5, and that is the fact that the ordering does not correspond with our intuitions in all cases: concession seems to be preferred in certain contexts, as the discussion of (45)

[32] In his footnote 21, Beaver attributes this preference to Henk Zeevat.

Survival of the fittest: contextual fit

Adjustment to context is easy	
concession	argumentative interpretation, context-determined
concession	argumentative interpretation, presupposition defeated in context
speech act denial of expectation	presupposition adjusted and no direct real world connection
epistemic denial of expectation	presupposition adjusted and real world connection possible
semantic denial of expectation	presupposition reflects real world connection
Adjustment to context is hard	

Table 3.6: Reader's expectations of the interpretations of an *although* sentence, taking contextual fit as a criterion.

pointed out. It is formally assumed that a presupposition is defeated, but the interpretation of (45) seems, on the whole, to take less inferential effort than an interpretation of some speech act interpretations.

Another principle of ordering interpretations might be at work too: the way in which the context may influence the interpretation. This principle might be called 'survival of the fittest', or contextual fit. The order according to this principle is reversed to that of logical strength, as is shown in table 3.6.

In table 3.6, the interpretation of concession after presupposition failure is most easily determined by context, for there are no other implicatures that might interfere. Context determines the tertium comparationis. Concession after a context-defeated presupposition is also determined by context, but the decision to defeat the presupposition is also a matter of real world knowledge and individual preference. A speech act interpretation of denial of expectation, is forced by context and explicit speech act markers. To obtain an epistemic interpretation of a denial of expectation, the context needs a specific turn (to set the utterance in 'observational mode'), and a semantic interpretation can be obtained without any context. Concession can not, but denial expectation can be interpreted 'stand alone', even in contexts that will not immediately support denial of expectation.

In a corpus analysis, Oversteegen (1995) found that concessions share a discourse topic with the previous context more often than denials of expectation. Her findings support the order in table 3.6.

In the process of determining the order of implicatures with respect to *although* sentences, there are two principles that thwart each other, namely the ones in (46).

(46) **Thwarting orders of inferences**
- Atlas method (logical strength)
- Survival of the fittest (contextual fit)

How to predict in which cases the Atlas method wins, and in which cases Survival of the fittest, goes beyond the purpose of this chapter. Given the discussion of (45), it appears that it is important for the Atlas method that the causal relation in the presupposition is strong enough, and that survival of the fittest counts when the context provides specific information.

3.4.3 Conclusion

In section (3.4), it has been shown that given the presupposition analysis of *although*, epistemic and speech act interpretations are fitted in quite easily by defining two operators, restricting the consequence of the expectation. These operators are the result of conversational implicatures. The relation between denial of expectation and concession can be made clear, by assuming that the former is determined by a presupposition, while the latter is not. Moreover, the analysis showed that reader's expectations on interpretations of connectives like *although*, are restricted by two principles: a reader expects the logically strongest interpretation, as well as the best contextual fit. These two properties give rise to different preferences in expected interpretations.

In the next section, one more extension of the analysis will be made. This extension will be done without any extra costs of making additional assumptions, and is, as such, a corroboration of the analysis.

3.5 A presupposition for *because*

In the previous sections, it has been established that *although* has a presupposition. It was also established that a concession interpretation of *although* was non-presuppositional. In the classification of Sanders et al. (1992), concession is marked as an additive (or: non-causal) relation. A denial of expectation is both causal and contrastive. Could it be that typically causal conjunctions are presuppositional? This would mean that *because* has a presupposition analogous to *although*, given in (47).

(47) **A presupposition for *because***
Because p,q presupposes $p' > q'$
where p and q are clauses, p' and q' are propositions associated with p and q respectively, and $>$ is a defeasible implication

This idea has been expressed in Noordman and Vonk (1992), Lagerwerf and Oversteegen (1994), and Kehler (1994).[33]

[33]Noordman & Vonk (1992, p. 377) used the term conventional implicature.

The assumption of (47) may explain the different interpretations of causality, parallel to the interpretations *although* has. This will be illustrated using two examples with *because* from the previous chapter, repeated here as (48a) and (48b); (48c) is added.

(48) a. Theo was exhausted, because he had run to the university.
b. Theo was exhausted, because he was gasping for breath.
c. Theo was exhausted, because you keep nagging about it.

In (48a), a semantic causal relation is expressed; in (48b), an epistemic relation is expressed: 'from the fact that Theo was gasping for breath, I conclude that he was exhausted'. In (48c), a speech act relation is expressed: 'The fact that you keep nagging about it, makes me say: *Theo was exhausted*'. Perhaps a paraphrase of the speech act like *I will admit* sounds more natural, but using *say* is not giving really different results.

Applied to (48a), the presupposition will be: 'normally, if one runs, one is exhausted.' The utterance is now acknowledging the presupposition, instead of denying it, as in the case of *although*. This makes the presupposition less visible, but not less important: the presupposition serves as a warrant, of which (48a) is only one instantiation (Noordman and Vonk, 1992, p. 377). If you agree with the speaker on the acceptability and informativity of (48a), you agree on the shared knowledge on which the utterance is based. The presupposition of (48a) is represented in (48′a). The presuppositions of (48b) and (48c) are represented in (48′b) and (48′c), respectively.

(48′) a. $\mathrm{Run}(x) > \mathrm{Exh}(x)$
b. $\mathrm{GfB}(t) > \mathbf{B}(i, \mathrm{Exh}(t))$
c. $\mathrm{Nag}(j, \mathrm{Exh}(t)) > \mathbf{S}(s, \mathrm{Exh}(t))$
Run(x) = x runs; Exh(x) = x is exhausted; GfB(x) = x is gasping for breath; Nag(x,Y) = x nags about Y; t = Theo; s = speaker; i = I; j = you.

In (48′), no new devices have to be introduced to derive the presuppositions for (48). (48′a) is derived straightforwardly from the definition. The constant representing *Theo* has been replaced by a free variable to account for the generality of the claim. It would be possible as well to formulate the presupposition as a generic statement: *usually, runners are exhausted* (or rather: *usually, runners get exhausted*). In (48′b), the **B** predicate is used in the same way as in (32c), restricting the conclusion that Theo is exhausted to the domain of *i*. The interpretation of (48′c), is showing that the second argument of Nag(j,Exh(t)) is the same as the second argument of **S**(s,Exh(t)). This is a consequence of the use of the anaphor *it* in (48c). *Theo is exhausted* is used autonymously again.

An interpretation of *because* sentences analogous to a concession is not available. A concession interpretation leads to a contrast between

standpoints, when it is not possible to accept the causal relation as a real world connection. In this case, lack of a causal relation just leads to unacceptability, as sentence (49) shows (already presented as sentence (31) in the previous chapter).

(49) ?Theo was exhausted, because he had been resting all day.

In Dutch, there are two connectives that may both be translated with *because*, but have - partly - different interpretations: *want* and *omdat*. Different conversational implicatures are involved in the interpretation of *omdat* and *want* sentences. Preferably, *want* will be interpreted by seeking an interpretation using a **B** predicate; *omdat* will be interpreted by seeking a semantic interpretation, adjusting with a **B** predicate whenever necessary. The difference between *want* and *omdat* is thus interesting evidence for the conventionalization of the **B**-predicate in a connective. In French, the difference between *parce que* ('omdat') and *car* ('want') is quite similar: the **B** predicate has become part of the conventionalized implicature for the presupposition of *car*. Instead of being some peculiarity of Dutch and French, the epistemic and semantic version of causal connectives provide supporting evidence for the assumption of presuppositions for connectives. In section 3.9, a special effect of this phenomenon will be presented as independent evidence for the analysis in this chapter.

In general, it might be expected that other causal connectives can be characterized in the same way. However, whether it is possible to analyze more subtle differences between causal connectives in terms of conversational implicatures, has to be investigated. For instance, the difference between (50) en (51) is not predicted when *zodat* and *waardoor* have a presupposition that would be analogous to the presupposition of *because* (i.e., p *zodat* q and p *waardoor* q both presuppose p $>$ q).

(50) Er heerst griep, zodat Jan ziek is geworden.
There rules flue, so that Jan ill has become.
'The flue is about, so that John has become ill.'

(51) ?Er heerst griep, waardoor Jan ziek is geworden.
There rules flue, whereby Jan ill has become.
'The flue is about, as a result of which John has become ill.'

While (50) is acceptable, (51) sounds very strange. Apparently, the cause for Jan's flue has to be more specific for *waardoor*, as the acceptability of (52) shows.

(52) Iemand stak hem aan, waardoor Jan ziek is
Someone infected him (on), whereby Jan ill has
geworden.
become.
'Someone infected him, as a result of which John has become ill.'

Whether or not these differences have to be represented in presuppositions of connectives, is an empirical question.

3.6 Translation into logical form

In the introduction of this chapter, a problem was posed that beginning students would come across, if they were trying to translate natural language into propositional or predicate logic. In this section, it will appear that not only beginners may profit from a more satisfying answer. The natural language connectives *because* and *although*, can now be translated into logic without interpretation problems.

3.6.1 *Because* as a conjunction

The basic lexical semantics of *because* is given in (47), representing positive causal interpretation. However, this is only the presupposition. This presupposition is not made visible in a translation into logical form. The meaning of *because* in logical form is truth-conditional, that is: it can only be stated that the connective is establishing the meaning of a logical connective. The logical meaning of *because* has always been considered to be a conditional. This posed a problem for the intuitive meaning of *because*. A conditional $p \rightarrow q$ is untrue only in one case: when p is true and q is untrue. It is counterintuitive to assume that a *because* sentence would have the same truth conditions: *because John washes the car, he gets five guilders* seems to be untrue, or at least deviant in case *John* in fact doesn't wash the car.

In the literature, this has been solved by assuming that the subordinate clause, introduced by *because*, was itself presupposed. In that case, the possibility that the antecedent was false would be excluded. This proposal has been formulated in Lakoff (1972). It is recurring in the literature from time to time (e.g. Van Dijk, 1977; Prüst, 1992). However, it seems just a repair of the problem caused by the assumption that *because* has to be translated as a conditional in logical form.

From the analysis presented in this chapter, it follows that there is no need to make such a repair. *Because* has an implicational presupposition that accounts for the causality of the utterance. There is no need to assume a conditional in the logical form for this connective: its logical meaning is conjunction, so its truth conditions specify conjunction instead of implication. Presupposing the truth of the *because*-clause has become unnecessary: its truth is asserted in the logical form.

Note that the *if...then* construction is still conditional and implicational: *if...then* does not have a presupposition, it is translated as an implication, and its *if*-clause is not (pre)supposed to be true.

3.6.2 *Although* is more than a conjunction

The logical meaning of *although* has always been a conjunction: both conjuncts need to be true, in order for the utterance to be true. In an introduction to logic, Gamut (1982a), it was mentioned that the contrastive part of the meaning of *but* was probably couched in a conventional implicature, although it was not mentioned how this implicature was specified. In this chapter, the answer can be given for *although*.[34] The conventional implicature is a presupposition, defined in (2).

Contrastive interpretation arises from the contrast between the consequence of the defeasible implication and its denial in the main clause of the utterance. Causal interpretation arises in the same way as with *because*.

Concession does not arise from a presupposition: two standpoints are contrasted (an affirmation and a negation of the tertium comparationis), and the conjuncts each provide an argument for their corresponding standpoint. The logical meaning of *although* remains unchanged, but its causal, as well as its contrastive meaning is accounted for.

3.7 The exception proves the rule

Up until now in this chapter, no attention was paid to a crucial problem: how can the expectation be denied, and still be maintained? Assuming that *although* bears a presupposition means that the presupposition is true for any acceptable sentence containing *although* in a denial of expectation interpretation. How can this presupposition be true while it is denied in the utterance? Essentially, the answer is that it is not the implication as such that is denied, but its consequence, as a result of which the implication is defeated. This way, more specific information can overrule the generic information without causing inconsistencies. A definition of this interpretation must be given in a non-monotonic logic (this has been done in Asher and Morreau, 1991). In this section, the semantics of generic sentences will be applied to the presupposition of *although*.

In the definitions of the presuppositions of *although* and *because*, the symbol '>' was used to represent what was paraphrased as: 'Normally, if... then'. Symbol and paraphrase referred to what was called a defeasible implication. The symbol was taken from Asher and Morreau (1991), who designed a truth conditional semantics for generic sentences. Consider the sentence in (53).

(53) Potatoes contain vitamin C, amino acid, protein and thiamin.

[34] And in fact, for *but* too: it is the same, but *but* has an extra alternative interpretation, namely semantic opposition.

Sentence (53) is a true generalization about potatoes. Generic sentences do not follow valid argument forms, but they support 'reasonable inference patterns' very well. Asher and Morreau (1991) argue as follows.

> Among the things not entailed by the generic statement that potatoes contain vitamin C is the particular conclusion that *this* potato contains vitamin C. Nevertheless, the generic fact makes it somehow reasonable to expect this potatoe to contain vitamin C, without at the same time making it reasonable to expect any number of other things which are not entailed, like say that the moon is made of green cheese (Asher and Morreau, 1991).

Generic sentences express, in other words, expectations about particular instantiations of the regularity they express. In a denial of expectation, something similar happens: the presupposition gives rise to an expectation about a particular instantiation of the regularity it expresses. However, the expectation is violated by the particular instantiation, instead of confirmed.

The first step in making a semantics for the denial of expectation is to establish that the expectation of a denial of expectation is expressing the same as a generic sentence. To show this, compare the two statements in (54).

(54) a. Normally, if a woman is beautiful, she marries.

b. Beautiful women marry.

There is no difference in propositional content between (54a) and (54b). Both expressions invite a pattern of 'invalid but reasonable generic inference' (Asher and Morreau, 1991). The definition of such an implication is shown in (55).

(55) **Defeasible Modus Ponens**

$\forall x(\varphi > \psi),\ \varphi(\delta) \mid\!\approx \psi(\delta)$,
but not $\forall x(\varphi > \psi), \varphi(\delta),\ \neg\psi(\delta) \mid\!\approx \psi(\delta)$

This rule introduces another symbol, $\mid\!\approx$, which means something like: 'validates defeasibly'. If the *but*-clause is ignored for the moment, (55) reads as follows: For all x, if it is a φ then it normally is a ψ, and δ is a φ, and these two statements validate defeasibly that δ is a ψ. So, $\forall x(\varphi > \psi)$ is the expectation, and $\varphi(\delta)$ an instantiation. From these two statements it may be validly concluded that $\psi(\delta)$, given the epithets *normally* and *defeasibly*. The condition is, however, that the condition in the *but*-clause is obeyed. This condition states that if there is knowledge available contradictory to the conclusion, the conclusion is not validated. So, if besides $\varphi(\delta)$ also $\neg\psi(\delta)$ is known, the conclusion of $\psi(\delta)$ is not validated. That is, the expectation still exists, only the instantiation $\psi(\delta)$ is not derived, for $\neg\psi(\delta)$ is asserted.

The rule of Defeasible Modus Ponens describes exactly what is happening in a denial of expectation. The presupposition that is derived has two properties: it is a generalization from the asserted propositions, and the consequent of the presupposition is the negation of the corresponding proposition. The example in (1) is represented as in (56).

(56) $\forall x(Beau(x) > Marry(x)),\ Beau(g),\ \neg Marry(g) \not\approx Marry(g)$, where Beau(x) = x is a beautiful woman; Marry(x) = x marries; g = Greta

What is stated in (56) is just that it is not allowed to conclude validly from the observation that Greta was beautiful, that she marries. The reason for this is that it is asserted that she does not marry. So, the only thing that is prohibited is to assume that $Marry(g)$ is true. The expectation is not refuted, because the condition on defeasible Modus Ponens is explicitly excluding the possibility that we may conclude to $Marry(g)$, when evidence to the contrary is available.

3.8 Expectation as presupposition

The analysis in section 3.4.2 showed that conversational implicatures are differently employed in deriving 'contextually fitting' presuppositions, or a tertium comparationis. Conversational implicatures could give rise to a **B** or **S** operator to 'save' a presupposition; on the other hand, failure or defeat of a presupposition in its context gives rise to a contextually driven derivation of a concession. Two opposing processes, the Atlas method and Survival of the fittest, were introduced to explain the difficulties in determining the interpretations of occurrences of *although* (and other connectives). A more specific picture of the actual relations between utterance and presupposition (or contextually derived interpretation) is given in Oversteegen (1997). She analyzes the property of 'derivational distance' between utterance meaning and an underlying 'basic scheme' of the interpretation of connectives. A corpus analysis of Dutch connectives like *want* ('because'), *omdat* ('because') and *maar* ('but') shows that differences in derivational distance are found in relation to different basic schemes.

Specifically, one of her results points out that in terms of derivational distance, denial of expectation needs to be distinguished from concession. A basic scheme for concession is derivationally more distant from the utterance than a (presuppositional) basic scheme for denial of expectation. This result supports the analysis made in this chapter, given the observation that presuppositions are logically stronger than contextually driven interpretations.[35]

[35] Contextual fit is not interpreted as a factor in the definition of derivational distance (cf. Oversteegen, 1997, p. 68-69).

Oversteegen (1997) compares two possible analyzes for *but* as a denial of expectation. In one analysis, a basic scheme is formed that has the same properties as a basic scheme for concession, and in the other analysis, a presupposition is assumed that leads to a causal and contrastive interpretation. She shows that the latter analysis accounts better for the facts.

In the next paragraphs, two aspects of Oversteegen's (1997) analysis are discussed: first, her analysis of relations between utterance and basic scheme, and the effect these relations have on derivational distance; second, the difference in derivational distance between concession and denial of expectation.

Basic schemes and derivational distance

Oversteegen (1997) investigates the 'pragmaticality' of the use of connectives. As an operationalization of the notion pragmatic, she defines *derivational distance* between utterance and basic scheme. In order to define factors that determine derivational distance, these basic schemes are given first.

Oversteegen (1997) distinguishes the same interpretations as presented in Chapter 2. Causal relations, expressed by the connectives Dutch *omdat* ('because') and *want* ('because' or 'since'), can have a semantic (*bare causal Basic Scheme*, as she calls it), epistemic (or *belief variant*) and a speech act interpretation (or *speech act variant*). Her three contrastive interpretations of connectives are Semantic Opposition, Denial of Expectation and Concession. Oversteegen (1997) defines a Basic Scheme (BS) for every interpretation. The BSs are presented here in (57).

(57) Utterance contains an expression of the form: *p omdat q*, *p want q*:

- $q' > p'$ (bare causal BS)
- $q' > \mathbf{B}p'$ (causal belief variant)
- $q' > \mathbf{S}p'$ (speech act variant)

Utterance contains an expression of the form: *p maar q*,

- $p' >\!\!-\!\!< q'$ (Semantic Opposition)
- $p' \gg\!\!-\!\!\ll q'$ (Denial of Expectation)
- $p' \gg\!\!-\!\!\ll q'$ (Concession)

where p' and q' are propositions related to p and q respectively; $>$ is a defeasible implication; $p >\!\!-\!\!< q$ is read as 'p is in weak contrast with q'; $p \gg\!\!-\!\!\ll q$ is read as 'p is in strong contrast with q'; **B** is the belief operator; **S** is the speech act operator.

In (57), the first three BSs look familiar: they are not different from the presuppositions formulated for positive causal relations in section 3.5.

The BS for Denial of Expectation is different from the presupposition of *although*, stated in the beginning of this chapter, in (2). The BSs of Concession and Denial of Expectation are both represented using the symbol $\gg\!\!-\!\!\ll$. This symbol expresses strong contrast on an underlying level (for contrast on the utterance level would cause inconsistency).

Oversteegen (1997) assumes (at first) a Denial of Expectation to have a BS similar to the Concession BS. The difference between the two interpretations lies in the way in which the scheme is derived. A Denial of Expectation is derived by forming an expectation $\neg q'$ on the basis of p and contextual information. In fact, this derivation could be represented as: $(p \ >)\neg q' \gg\!\!-\!\!\ll q'$. Likewise, a Concession BS could be represented by introducing r as a tertium comparationis: $\neg r \gg\!\!-\!\!\ll r$. Some researchers prefer to regard Denial of Expectation and Concession as being similar. They consider an expectation to be a proposition based on p and contextual information, which is denied by q (e.g. Foolen, 1993, p. 119-122). In the analysis of Denial of Expectation in this chapter, the expectation is considered to be an implication, the consequence of which is derived by negating q. It is one of the goals of Oversteegen's (1997) corpus analysis, to find out whether this analysis is right (see the next paragraph for the answer).

A semantic opposition is represented through a symbol of 'weak contrast', $>\!\!-\!\!<$. Since a semantic opposition expresses alternative topics on utterance level, this contrast should be 'weak', to prevent inconsistency.

Given the basic schemes, relations between utterance and basic schemes can be formulated. These relations concern a clause in the utterance, and its corresponding proposition in the basic scheme. So, for an expression 'p connective q', p' in Basic Scheme is derived from p, and p' in Basic Scheme is derived from q. Four kinds of relations between p and p' (or q and q') are distinguished, see (58).

(58)
- identity: p' and p are identical;
- generalization: p contains an argument that is generalized in p', all other things being equal;
- implication: p' is a logical implication of p;
- inference: p' is related to p through an inferential step based on real world knowledge.

The notion of distance can now be defined in quantitive terms, with respect to the way in which q' is derived from q, and p' is derived from p. Given an utterance and one of the basic schemes, the distance between q' and q is defined as a valuation of the kind of relation they have.

Identity is valued as the least distant relation, inference as the most distant relation, and generalization and implication are valued as taking the position in-between. The reason for these distinctions is the following. Keeping arguments identical does not take any derivational effort. Generalization and implication do take effort, but they are systematic relations, not dependent on real world knowledge. Inference is, in the definition of Oversteegen (1997), dependent on world knowledge, and not a strictly systematic relation. In order to annotate the distances in Oversteegen's (1997) corpus analysis, each derivation of q′ and p′ from q and p was given a ranking number: 1 for identity, 2 for generalisation or implication and 3 when inferences were made.

This notion of distance enables Oversteegen (1997) to measure distances between q and q′ on the one hand, and p and p′ on the other. Since distance is determined independently of the BS and its derivational properties, it is possible to compare the distances between BSs and their corresponding utterances.

Derivational distance can be related to the notion of logical strength (see table 3.5): the most expected interpretation should correspond with least derivational effort. As for the corpus analysis, it is predicted by table 3.5 that Denial of Expectation has a shorter derivational distance than Concession (see the next paragraph).

From the ease of adjustment to the context (contextual fit, in table 3.6), no predictions on derivational distance can be made, for contextual fit is not among the factors that determine derivational distance.

An example of the assignment of distance to a basic scheme will be given with respect to (59).

(59) Milosevic will never abandon his ideal of a United Serbia - because that is what Vance and Owen will have to ask of him.

The interpretation of (59) is a speech act causal relation, according to Oversteegen (1997). A paraphrase, reflecting the basic scheme, could be: 'If Vance and Owen have to pose a certain question to Milosevic, (it makes sense that) I tell you that Milosevic is going to give a negative answer to that question'. The occurrence of *I tell you* in this paraphrase indicates the speech act interpretation. Given this basic scheme, the distance between p′ and p is 2: *that*, referring to the predicate *abandon his ideal of a United Serbia* is generalized, as the paraphrase indicates. The distance between q′ and q is also 2: *a negative answer* is a generalized description of *will never abandon his ideal of a United Serbia*.

In the derivational distance of (59) to the basic scheme, the **S** operator itself is not calculated. If **S** was taken into account, the derivational distance from utterance to some bare causal BS would have been measured. Since there is no sensible interpretation of the 'bare causal BS' of a speech act interpretation, this would be nonsense. The relation between utterance and basic scheme, represented by S, specifies one interpretation of an utterance containing a certain connective. The re-

lations defined in (58) are not specific for one basic scheme: they may occur in every possible derivation of a basic scheme.

In this paragraph, it has been shown how the derivation of a presupposition from the utterance containing a causal connective can be specified by defining the relations identity, generalization, implication and inference. In the next paragraph it will be shown that taking these relations as factors determining derivational distance, interesting differences between Concession and Denial of Expectation are found.

Denial of expectation and concession have different BSs

It is interesting to find out whether the results of the analysis do correspond with the order of logical strength, proposed in table 3.5. In table 3.5, Concession was logically less strong than Denial of Expectation. In terms of distance, Concession should be derivationally more distant than Denial of Expectation. Is this the case? Results for Denial of Expectation and Concession are given in table 3.7.

Denial of Expectation in a non-causal basic scheme

Relation	p-p′	q-q′
Denial of Expectation	2.67	1.33
Concession	2.53	2.30
Bare causal	1.9	1.9

Table 3.7: Observed distance in relation to type of basic scheme and utterance/basic scheme derivation (see (57); distances ranging from 1 to 3).

A conclusion on the order of Denial of Expectation and logical strength can not be drawn on the basis of the results in table 3.7. Compared with the results for the bare causal BS, using a Mann-Whitney Rank Sum test, the distance p-p′ is significantly higher for both Denial of Expectation ($z=4.54, p<.001$) and Concession ($z=4.02, p<.001$). But for the q-q′ distance, Concession does not differ significantly from the bare causal BS, whereas Denial of Expectation is significantly lower ($z=3.93, p<.001$) than the bare causal BS. The only conclusion that might be drawn on the basis on these results, is that Denial of Expectation is asymmetric for the derivational distance between the parts of its relation, whereas both bare causals and concessions are more symmetric. This does not make sense in the light of a concept of logical strength (and it was also an unexpected result in Oversteegen, 1997, p. 76).

Taking other arguments into account, Oversteegen (1997) decides that the analysis of Denial of Expectation in the BS given in (57) is wrong, and that a presupposition analysis as given in (2) is correct. In the basic scheme of Denial of Expectation, the burden of derivation is put on $(p >) \neg q$, whereas the derivation from q to q′ is very direct. Taking the 'Concession-like' analysis as a starting point for measuring

derivational distance of Denials of Expectation, the results become incomprehensible.

Oversteegen (1997) reanalyzed her corpus, on the basis of the scheme as defined in (2). This time, p′ was derived from p, and ¬q′ was derived from q. Since negation can be linguistically defined, it does not play a role with respect to derivational distance, and it can be neglected in measuring the distance. The results of the reanalysis are given in table 3.8 (taken from Oversteegen, 1997).

Denial of expectation as a presupposition

Relation	p-p′	q-q′
Denial of expectation	1.8	2.0
Concession	2.53	2.30
Bare causal	1.9	1.9

Table 3.8: Observed distance in relation to type of basic scheme and utterance/basic scheme derivation (see (2) for Denial of expectation, and (57) for the other relations; distances ranging from 1 to 3).

A Denial of Expectation is derivational closer to its utterance than a Concession. This means, that the order of Denial of Expectation and Concession, as predicted by logical strength (in 3.5), is established in Oversteegen's (1997) corpus analysis, as logical strength predicts. Moreover, the presupposition analysis in (2), for connectives expressing a denial of expectation, is now corroborated.

3.9 Gapping without a cause

3.9.1 Introduction

In section 3.5, epistemic interpretation of causal relations is explained by the assumption that a **B** operator restricts the interpretation of the consequence of an implicational presupposition. Given this assumption, the difference between the Dutch connectives *want* and *omdat* is explained, as well as the difference between the French connectives *car* and *parce que*.

The placement of the **B** operator in the representation of the presupposition has not explicitly been defended: why should **B** have scope over the consequence, and not over the antecedent of the implication, or over the implication as a whole? Specific linguistic evidence, showing that the operator is making correct predictions in its present representation, has not been presented yet. In this section, evidence is presented for the analysis of **B** in the presupposition.

3.9.2 The problem

An interesting observation on Gapping and causality is made by Levin and Prince (1982) (cited by Kehler, 1994). They claim that Gapping is not allowed in a complex sentence that consists of causally related clauses. Kehler (1994) presents the facts in (60).

(60) a. Bill became upset, and Hillary angry.
b. Bill became upset, and Hillary became angry.
c. # Bill became upset, and as a result Hillary angry.
d. Bill became upset, and as a result Hillary became angry.

Kehler (1994) remarks that (60a) can not be understood causally, but (60b) can. He presents (60c) to show that a causal paraphrase is unacceptable. A causal paraphrase of (60b) is given in (60d), and its acceptability shows that (60b) may be understood causally. Kehler's (1994) conclusion is that causality is excluded in Gapping constructions.

The observations made with respect to (60) predict that Gapping is excluded for linguistic markers of causality. An example of an unacceptable Gapping construction, due to a causality marker, is (60c): the use of *as a result* is not allowed.

Moreover, it is generally assumed that there is a syntactic restriction on Gapping: it has to be a coordinative construction (Neijt, 1979). This means that Gapping is possible only using coordinative connectives. In fact, the assumption that syntactic subordination excludes Gapping seems to explain the examples in (61) better than the assumption that causality excludes Gapping (taken from Prüst, 1992).

(61) a. John bought a book, and Bill a cd.
b. John bought a book, so Bill a cd.
c. ?Bill bought a cd, because John a book.

Prüst (1992) argues that (61a) is natural and straightforwardly explained. His rule of Rhetorical Coordination allows for (61b) (see chapter 5 for an introduction to Prüst's discourse rules). Prüst (1992) mentions the unacceptability of (61c) as a problem, because his rule of Rhetorical Subordination does not account for it. However, if syntactic subordination is considered to exclude Gapping, the judgments in (61) are explained straightforwardly: (61a) and (61b) are coordinative, and acceptable; (61c) is subordinative, and unacceptable. Since (61b) and (61c) are both causal, but not both unacceptable, causality does not seem to give the right explanation for the judgments in (61). On the other hand, if syntactic subordination were the only restriction on Gapping, the unacceptability of (60c) would not be explained. Consequently, neither of the assumptions explains all the data satisfactorily, nor does a combination of both assumptions.

In French and Dutch, *so* is translated with *donc* and *dus*, respectively. Using these connectives, Gapping is allowed. This is shown in (62).

(62) a. Jean lit le journal, donc Marie un livre.
b. Jan leest de krant, dus Marie een boek.
c. John is reading the newspaper, so Mary a book.

All three cases of Gapping in (62) are acceptable. Some native speakers of French, Dutch and English may complain that they need context to accept the sentences in (62). More particular knowledge on the situation in which these utterances are made, would certainly reduce the inferential effort needed for a proper interpretation. This need for context does not concern a particular language.

In both French and Dutch, there is a coordinative connective that is translated with English *because*: French *car* and Dutch *want*. If the rule were that only syntactic subordination excludes Gappping, one would expect *car* and *want* to be capable of forming a Gapping construction. The sentences in (63), however, show that this is not the case.

(63) a. ?Marie lit un livre, car Jean le journal.
b. ?Marie leest een boek, want Jan de krant.
c. ?Mary is reading a book, because John the newspaper.

In (63a) and (63b), Gapping is not allowed. In (63c), Gapping is not allowed either, but this can be explained from the fact that *because* is subordinative. The unacceptability of (63a) and (63b) show that the rule 'only syntactic subordination excludes Gapping' is not correct for French and Dutch: *car* and *want* are coordinative connectives, but Gapping is not allowed. There must be some other restriction.

The examples in (62) and (63) lead to a dilemma. If only syntactic subordination excludes Gapping, (63a) and (63b) (and (60c)) need to be explained, for they form coordinative constructions, but do not allow for Gapping. If causality excludes Gapping, (61b) and (62a-c) need to be explained, for they express a causal relation, but Gapping is allowed.

In order to find a way out of this dilemma, the acceptability of Gapping with *so*, *dus* and *donc* will be examined first. Under the assumption that causality excludes Gapping, the acceptability of (61b) and (62a-c) is problematic. Maybe, the causality restriction is too broad. There are different interpretations of causality. For instance, causal relations can be interpreted semantically or epistemically. To show that different interpretations of a connective do in fact make a difference for Gapping, Dutch *maar* is used in a Gapping construction, in (64).

(64) Jan leest de krant, maar Marie een boek.
John is reading the newspaper, but Mary book.

The acceptability of (64) shows that *maar* does not exclude a Gapping construction. But *maar* can have different interpretations: semantic opposition, concession and denial of expectation. Are these three interpretations possible? Given the description of *maar* as a semantic opposition in chapter 2, the parallel Gapping construction makes a semantic opposition construction most likely. The other two interpretations can be enforced by using adverbs: a concession is enforced when *weliswaar* ('albeit') is used in combination with *maar*; a denial of expectation is enforced using *toch* ('still')in combination with *maar* (cf. Spooren, 1989). These two tests are performed in (65).[36]

(65) a. Jan leest weliswaar de krant, maar Marie een boek.
'John is reading the newspaper, it's true, but Mary a book.'
b. ?Jan leest de krant, maar Marie toch een boek.
'John is reading the newspaper, but still Mary a book.'

(65a) is acceptable in Dutch, although it is not a preferred way of expressing concession. In chapter 2, it was argued with respect to (29) that *but* sentences with different topics and parallel clauses, express a concession in the context of a yes/no-question, or another appropriate context. With respect to (65), such a question could be: *Zijn Jan en Marie geïnteresseerd in het dagelijks nieuws?* ('Are John and Mary interested in the daily news?'). The acceptability of (65a) shows that concession does not exclude Gapping. In (65b), a denial of expectation is expressed, enforced by the use of *toch* ('still'). This results in unacceptability. The unacceptability of (65b) shows that denial of expectation excludes Gapping. In section 3.8, it was shown that a crucial difference between *maar* in a denial of expectation and *maar* in a concession was, that the former interpretation was causal and the latter was not. Concession is not interpreted as having a causal relation between its clauses, and it allows for Gapping. Denial of expectation, being a causal contrastive relation, excludes Gapping.

Besides a confirmation that causality does play a role in excluding Gapping, the sentences in (65) provide a key to a solution: is it possible that causality excludes Gapping in its semantic interpretation, but allows for Gapping in its epistemic interpretation?

3.9.3 A solution

The connectives *so*, *dus* and *donc* used in (62) all have epistemic readings: all three sentences can be paraphrased as: 'from the fact that John reads the newspaper, I conclude that Mary reads a book'. Apparently, the speaker knows that *John* and *Mary* live together, share a newspaper, and may both be reading at the same time. The acceptability of the

[36]Nothing will be said on French and English at this point, for a native speaker is needed to explore such disambiguation tests.

utterance is not dependent on this additional information, since the speaker restricts his conclusion.

An important difference between semantic causal interpretation and epistemic causal interpretation is, that the cause is prior to the effect in a semantic relation (see also chapter 2, 2.4). According to Mackie (1974), this is not an intrinsic property of causal relations, but it is one without counterexamples. Lascarides and Asher (1991) formulate a principle in this direction as an axiom, in (66).[37]

(66) **Causes Precede Effects**

$\text{Cause}(e_1, e_2) \rightarrow \neg e_2 \prec e_1$,

where $\text{Cause}(e_1, e_2)$ means that the main event of clause 1 causes the main event of clause 2, and $\neg e_2 \prec e_1$ means that there is no main event of clause 2 preceding the main event of clause 1.

(66) states that if an event causes a second event, the second event may not precede the first. This axiom on causal relations refers to the real world connection that will be inferred when a reader receives a linguistic (or contextual) indication that two connected clauses need to be interpreted causally. In this respect, there is a difference between semantic and epistemic interpretations: semantic interpretations of causal relations preserve the order of the events in the real world connection; epistemic interpretations of causal relations do not necessarily preserve the order of the real world connection. A street can only become wet after it has started to rain, or after some other wetting event has taken place. But observing a wet street, and then drawing the conclusion that it has rained, is possible in an epistemic interpretation (even though it is not a valid conclusion). The difference between semantic and epistemic interpretation of a causal relation is, that semantic interpretation should obey (66), whereas epistemic interpretation does not usually associate the observation with the real world cause and the conclusion with the real world effect. In this sense, (66) does not hold for epistemic interpretation of a causal relation. One might say that epistemic interpretation does not impose an order of events on its real world connection.

Gapping as it is demonstrated here, may be regarded as verb deletion. As a consequence, the deleted verb must be identical to the verb in the first clause. This means, that the event semantics of the deleted verb must be identical, for deletion takes place under identity.[38] Only

[37] The definition taken from Lascarides, Asher & Oberlander, 1992; in chapter 4, section 4.3, the rule will be clarified within its system.

[38] Given a semantic analysis of Gapping, the following argument could be used: the gap in the second clause has to be reconstructed on the basis of the verb in the first clause. Copying the verb semantics creates identity of events.

the arguments of the verb may differ.[39] So, Gapping needs two similar events, presented next to each other (these restrictions can be extended with the restrictions on interpretation of parallel intonation, described in section 2.3 in the previous chapter).

Epistemic interpretation of a causal relation involves a **B** predicate that restricts the conclusion to a speaker's conclusion. This makes it possible to dodge the axiom Causes Precede Effects: the relation between antecedent and consequent in the presupposition is not interpreted as a real world cause and effect, but as a fact and a speaker's conclusion. So, the acceptability of (62a-c) is explained by assuming that the **B** operator in the presupposition makes it possible to dodge (66).

The assumption that causality excludes Gapping is now specified as: semantic causality excludes Gapping. This explains the acceptability of (61b), (62a-c), and the judgments in (60).[40] But the unacceptability of (63a,b) is still in need for an explanation. The causal relation expressed by *car* or *want* is epistemic as well, and the restricted assumption that semantic causality excludes Gapping does not exclude the sentences in (63a,b).

In order to explain the unacceptability of the sentences in (63), the derivation of the presuppositions of *donc* and *car* will be shown. It is not the epistemic interpretation itself that is the problem, but the derivation of the presupposition from its utterance. To make this more clear, it will be shown how the presupposition of *donc* is derived properly. This is shown in (67) (the example might equally well be presented in English or Dutch).

(67) Jean lit le journal, donc Marie un livre
p q

Presupposition: $p' > \mathbf{B}\ q'$

Step 1: Lit(quelqu'un,journal) $> \mathbf{B}\ \emptyset$ (autre,livre)

Step 2: Lit_i(quelqu'un,journal) $> \mathbf{B}\text{Lit}_i$(autre,livre)

In the derivation of the presupposition of *donc* (67), the representation of the verb *Lit* occurs twice: once in the antecedent of the implication, and once in its consequence, in the scope of **B**. The latter occurrence of *Lit* is recovered from deletion (the presupposition is derived form the

[39] In Sturm (1995), a restriction on 'Subject Gap in Fronted finite verb coordinations', or SGF-coordination, is discussed that supports this idea: SGF-coordination is allowed only when the events in both conjuncts are independently perceived.

[40] A causal interpretation in a Gapping construction with *and* can only be inferred, when real world knowledge is supporting it. As a result, the real world connection will always be the basis of a causal relation between two clauses connected with *and*, and it is predicted that epistemic causal relations will not arise in Gapping constructions with *and* (exclusive of epistemic markers). So, the observation that causality is excluded in (60a) is still explained.

utterance, so the gap has to be reconstructed). This presupposition is formed regularly.

In the case of *car* in (63a), derivation of the presupposition fails, because the verb *lit* can not be recovered.

(68) ?Marie lit un livre, car Jean le journal
p car q

Presupposition: $q' > \mathbf{B}\ p'$

Step 1: $\emptyset$ (quelqu'un,journal) > **B**Lit(autre,livre)

Step 2: No extraction from restricted contexts is allowed.

The difference between the derivation in (67) and (68) is this: the predicate *Lit* can be recovered from the antecedent in the presupposition of (67), but not from the consequent in the presupposition in *car*. The **B**-operator creates a restricted context and it is not allowed to recover *Lit* from such a restricted context. The **B** operator is restricting the consequent of the presupposition of both connectives, but the gap in the consequent of the *donc*-presupposition has appeared in the antecedent of the *car*-presupposition. Extraction of the verb from the consequent to the antecedent of the presupposition is impossible, and the presupposition fails.[41]

The assumption that the epistemic operator **B** does not allow information within its scope to be extracted, is motivated by others. Sanders and Spooren (1996) observe that epistemic modifiers mark perspective (which leads to subjectivity in utterances containing those markers). Spooren (1989) argues that information from perspectivized contexts can not percolate to other contexts. This assumption is used to explain differences between Dutch *want* and *omdat* in Spooren and Jaspers (1989). In other words, the assumption that information is not allowed to be extracted from a **B**-context is not only justified on the basis of generalizations of other linguistic phenomena, but also on earlier observations of *want*.

The relation between Gapping and causality can be summarized as

[41]The unintelligibility of (68) might lead, through the flouting of a maxim, to some kind of reinterpretation. There is a very marked, if not unacceptable, use of *want* with SGF (see footnote 39) in *de Volkskrant*. An example of this use is:

(i) a. ?Moest je d'r overheen klimmen, want dubbel geparkeerd.
'You had to climb over it, because double parked.'
(*De Volkskrant*, 20-12-1997)

It seems that this use of *want* is only acceptable in the inner circle of journalists and modern intellectuals in Amsterdam (called the 'Grachtengordel'). Because of the impact of the Grachtengordel's language use on Dutch in the Netherlands, one might expect to see a language change with respect to the use of *want* SGF.

follows.

(69) **Causality and Gapping**

1. semantic causality excludes Gapping;
2. epistemic causality allows for Gapping, for the clauses expressing the real world cause and effect do not need to be ordered;
3. Using *want* or *car* in Gapping is impossible, for the gap in the presupposition can not be interpreted with information contained in the scope of **B**.

This analysis of Gapping with causal connectives supports the analysis of causal connectives presented in this chapter. The assumption of an implicational presupposition, with its consequent restricted by a **B** operator, is motivated independently in this section.

Two questions remain, and deserve more attention and further research. The first is: to what extent is syntactic subordination excluding Gapping? Looking back at (61), it can be observed that the unacceptability of (61c) is due to the use of *because*. Is it perhaps causality (either step 1. or step 3.) that excludes Gapping, instead of syntactic subordination? In English, word order is the same for main and subordinate clauses (whereas Dutch has different word orders for main and subordinate clauses), so subordinate properties depend on the connective itself. Examination of other connectives on their meaning and syntactic properties will provide an answer. And it will give rise to the second question: is causality the only (discourse semantic) restriction on Gapping? To account for causality as a restriction on Gapping, the order of the clauses with respect to the real world connection of their events appeared to be a crucial element. Lacking a requirement on event order in the real world connection, like in epistemic causality, allows for Gapping. Do requirements on the real world connection of events, like the one in (66), exclude Gapping in general? For instance, temporal connectives (or adverbs) may or may not allow for Gapping. Research into their ordering requirements (based on, e.g. Oversteegen, 1989; Caenepeel, 1989; Lascarides and Oberlander, 1993) might explain differences with respect to Gapping constructions. If the answer to the second question is, that there is a relation between ordering requirements on events and the possibility of Gapping, the answer to the first question might be, that syntactic subordination is not needed to explain the behaviour of connectives in Gapping (in English, at least).

3.10 Conclusion

In this chapter, the claim was defended that causal and causal contrastive connectives have a presupposition in the form of an implication that expresses causality. Not only causality in content interpretation, but also epistemic and speech act interpretation, can be explained

by means of this presupposition. The assumption of a **B** operator for epistemic interpretation and a **S** operator for speech act interpretation is interpreted as the result of conversational implicatures, executed in order to obey Grice's (1975) maxims of conversation. *Although* has a presupposition that represents the expectation, systematically derived from the clauses connected by *although*. The cases in which *although* does not express denial of expectation, but concession instead, are analyzed as cases in which the presupposition is defeated, or fails. In the first case, interpretation is determined by the more specific, defeating context. In a diachronic reconstruction of the second case, a maxim is flouted, giving rise to an argumentative interpretation of the contrastive relation. Synchronically, argumentative use is conventionalized, and context has become more decisive for concessions than presupposition failure. In general, context is much more decisive for the interpretation of a concession than of a denial of expectation. The assumption that the former interpretation is derived by inference, and the latter by presupposition, explains this observation. The analysis leads to a specific choice for a translation of *because* in predicate logic: it is a conjunction, instead of an implication. It does nevertheless presuppose a defeasible implication. Likewise, *although* asserts a conjunction and presupposes an implication. An analysis of Gapping gave independent evidence for the analysis of the epistemic interpretation of English *so*, Dutch *want* and *dus*, and French *car* and *want*.

Chapter 4

Inference and enforcement

4.1 Introduction

This chapter will be concerned with differences between inference with, and inference without connectives. The Greta Garbo sentence is repeated again, in (1). A minor change in the formulation has been made.

(1) Greta Garbo werd de maatstaf genoemd van
Greta Garbo was the yardstick called of
schoonheid. Zij is nooit getrouwd geweest.
beauty. She has never married (been).
'Greta Garbo was called the yardstick of beauty. She never married.'

The interpretation in (1) is different from the interpretation of the original sentence in the previous chapters. This has an obvious reason: *although* has been left out. Accordingly, the discourse in (1) lacks a contrastive interpretation. Instead, the second sentence is preferably interpreted as a result of the first. This means, that a causal relation is assumed between the two propositional contents: 'normally, if a woman is beautiful, she does not marry'.

The causal relation of the original *although* sentence, was: 'normally, if a woman is beautiful, she marries'. The consequent of this relation is opposite to the consequent of the causal relation that is assumed with respect to (1). The effect of *although* on the causal relation between two propositional contents is quite strong. In theories defining coherence relations on the basis of the propositional contents of two connecting clauses (e.g. Hobbs, 1979; Mann and Thompson, 1988; Lascarides and Asher, 1991; Sanders et al., 1992), connectives are considered to be indicative for a coherence relation. This indication is, in these theories, not worked out as a specific operation in the calculation. Lexical and

world knowledge need to be explored in order to find the right connection. This is a laborious and uncertain process.

In this chapter, it is demonstrated how causal coherence is calculated by means of a causal connective. A causal relation is presupposed when a causal connective is used. Knowledge of the world and lexical knowledge are applied to derive the specific relation established by the connective. Since it is already known what relation will be derived, the process is certain and easy.

How is lexical and world knowledge explored to derive the coherence relation Result in example (1)? There are three (or even more) possible backgrounds for taking 'beautiful women do not marry' as a plausible connection. One can assume that Greta Garbo was unattainable because of her beauty: she was too impressive for potential grooms. Alternatively, one can imagine Greta Garbo as a femme fatale, and assume that beautiful women are mostly femmes fatales (and: femmes fatales do not marry). Or, using another prejudice: beautiful girls are very popular in high school, but when it comes to marriage, a decent and caring prospective mother will be chosen.[1] A side effect of having several backgrounds for the connection that beautiful women will not marry is that the real reason for Greta Garbo remains a mystery.[2]

Besides the derivation of a Result, there is also another possibility in (1): the second sentence explains the first sentence. The coherence relation between the two clauses is Explanation. This reading is made explicit by reading *she never married* as: *she never married, you see*. The causal relation that supports an explanation in (1), is: 'normally, if you never married, you are beautiful'. One can think that an unmarried life means freedom, and that freedom keeps you beautiful. An association between being married and having children is possible: not having children keeps you beautiful. Also other prejudices may be applied to create a causal relation supporting an explanation.

Notice that the uncertainty of interpretation does not lead to an unacceptable discourse. A causal relation between beauty and marriage in (1) in one of both directions is assumed to yield the relation between the clauses as result or explanation. The causal relation is not inherent to the combination of the propositional contents: in an appropriate context, the causal connection will disappear, as the discourse in (2) shows.

[1] This prejudice is perhaps in line with the times in which Greta Garbo was in a marriageable age - but as a movie star, the femme fatale version seems to fit better. Being a movie star, she was of course unattainable for most people, so that would be plausible too.

[2] This is not in accordance with the Gricean principle of cooperativity, but (or: so) it gives a nice rhetorical effect.

(2) Greta Garbo died in her apartment in New York. She had been a great movie star. She was called the yardstick of beauty. She never married.

In (2), a list of properties and circumstances regarding Greta Garbo is given. The last two sentences are just contributing their part to this list, without having a causal connection between them. The causal connection as presented in (1) can thus be replaced by an additive connection without any problem, if the context triggers such an interpretation.

If *although* is left out, the resulting discourse lacks a contrastive interpretation. Instead, two positive causal relations may be inferred between the two clauses (but not at the same time), unless context alters the interpretation to some non-causal relation. With respect to (1), it seems that both causal and additive relations between the clauses are allowed, but not contrastive relations.

A claim generally made in literature on coherence relations, is that connectives indicate the coherence relation between two clauses. In this chapter, the claim will be made that causal connectives do more than just indicate the coherence relation: a causal relation is not derived from the propositional contents of two connected clauses, but it is given in the presupposition of a causal connective, enforcing a causal relation between the propositional contents. This way, world knowledge and lexical knowledge do not need to construct a causal relation, but they only have to support it. Besides, the use of a connective helps to pick out the right interpretation of a causal relation. How this should be realized will be shown within the framework of Discourse Inference and Commonsense Entailment (DICE: e.g., Asher, 1993; Lascarides et al., 1996).

In the framework of DICE, coherence relations are calculated on the basis of propositional contents, real world knowledge, lexical knowledge and linguistic knowledge. Inferences are made by executing rules that define coherence relations in terms of knowledge of the world and lexical knowledge. The interaction of the rules is submitted to certain principles. In DICE, it is not worked out what happens when a connective is inserted, other than that it would indicate a relation that may be constructed independent of the connective. It will be demonstrated that the framework does allow for definitions of connectives, so a difference between coherence with or without connectives may come about in DICE.

A short overview of studies on coherence will be given in section 4.2. At the same time, the choice for DICE will be motivated. In section 4.3, DICE will be introduced. Since DICE is a deductive system, based on non-monotonic logic, its main principles and rules are introduced. Knowledge of this section is relevant for the sections coming thereafter. Whenever it is relevant, in this chapter, reference will be made to the tables containing the rules. In section 4.4, the difference between inference with and without connectives will be introduced; in section 4.5,

it will be demonstrated that a distinct treatment of causal connectives in DICE will result in a less laborious way of inferring coherence when using connectives.

4.2 Coherence relations

Theories of coherence relations often deal with the problem of inferring coherence while it is not explicitly indicated. The example in (3) is a crucial example in the theory of Lascarides and Asher (e.g. Lascarides and Asher, 1991; Lascarides et al., 1992).

(3) Max fell. John pushed him.

According to Lascarides and Asher (1991), the discourse relation Explanation (see table 4.1, in section 4.3) holds between the two clauses, because the contents of both clauses determine that the event of the second sentence caused the event of the first. So, coherence is inferred from the semantics of both propositions, and dependent on the lexical items used in the utterance. In this case, *fell* and *push* are verbs that can be understood as parts of eventualities that have a causal connection. Lascarides and Asher define a system of lexical and real world knowledge that determines the coherence between the two clauses in (3). In this system, connectives do not play a distinctive role: it indicates the inference, but there is no principled difference in the way in which the coherence relation is inferred from the connective. This is a common view on coherence, expressed by, for instance, Hobbs (1979) and Mann and Thompson (1988).

Below, a short overview of different theories of coherence relations will be presented. The choice to analyze causal connectives in DICE will be motivated.

4.2.1 Different approaches to coherence of texts

In this section, several influential theories about coherence in text are discussed. Theories of coherence relations can be classified in three groups, according to their aims:

1. the analysis aims at a systematic description of coherence relations;
2. the analysis aims at the selection of the correct linguistic realization of a coherence relation;
3. the analysis aims at an automatic recognition of coherence relations.

In the first kind of theory, there is no principled difference between production or perception of language and discourse. The presence of a connective is used instrumentally. An answer to the question: 'is it possible to insert the connective *because*?', is an indication for the possibility of a causal relation between two clauses. In this chapter, it is not the possibility to insert connectives that matters, but the difference between presence and absence of connectives.

In the second kind of theory, connectives (and other realizations) are chosen on the basis of a given coherence relation. In this approach, the problem of the difference between coherence relation and connective is defined as follows:

> (...), we need to determine how the rhetorical relations of a text may be mapped onto the lexicogrammatical realizations (...). (Degand, 1996, p. 107)

In this approach, a coherence relation is lexically realized as a connective (or another lexical realization). What will happen in this chapter is the derivation of a coherence relation from the presence of a connective. This is a mapping in the opposite direction.

The third kind of theory derives coherence relations from text, by calculating them from the propositional contents of pairs of clauses. Perception of discourse is characteristic for this approach, perception. It is the process of inference that is simulated by the derivation of coherence relations.

Below, the most influential theories will be mentioned, and they will be classified according to the tripartition made here. An extensive comparison between several coherence theories, and their performance on the analysis of the same text for each theory, is given in Bateman and Rondhuis (1994).

Hobbs Hobbs (1979) defines several coherence relations in terms of the assertions clauses express. To infer a relation called 'Explanation' (Hobbs, 1990, p. 91), *the state or event asserted by* S_1 *causes or could cause the state or event asserted by* S_0. Applying this definition to (3), S_0 is *Max fell* and S_1 is *John pushed him*. The event of Max's falling is asserted by S_0, and the event of John's pushing him by S_1, and the latter event causes the first. The definition aims explicitly at the inference of coherence relations. It is not dependent on connectives. With respect to the role of connectives, Hobbs (1979) informally presents a check on coherence: in (3), it ought to be possible to connect S_1 and S_0 with *because* (as in (5)). Such a check is not part of the procedure Hobbs (1979) defines for Explanation.

Hobbs (1979) is classified in the third group. His theory will return below, when TACITUS is discussed, based on Hobbs, Stickel, Appelt & Martin (1993). Besides, his theory returns in other theories: Lascarides and Asher (1991), discussed below, and Scha and Polanyi (1988), discussed in the next chapter.

RST Mann and Thompson (1988) present a discourse structure theory that has been used by many discourse analysts: Rhetorical Structure Theory (RST). They claim that *(...) RST provides a general way to describe the relations among clauses in a text, whether or not they are grammatically or lexically signalled.* They do not claim that their definitions of coherence have a cognitive status. Their aim is to develop a descriptive framework for the analysis of text. In the discourse *Max fell. John pushed him*, the first clause is characterized as the 'nucleus', as *John pushed him* is dependent on the first clause (cf. Mann and Thompson, 1988, p. 266): the information of John's pushing is not representing the main information of both clauses. *John pushed him* is called the 'satellite'. The definition of Volitional Cause demands that the nucleus present a situation that has arisen from a volitional action, which is presented in the satellite (cf. Mann and Thompson, 1988, p. 274). This is the case in (3). The relation in (3) is characterized as 'Volitional Cause'. Mann and Thompson (1988) do not give an account of connectives in their definitions. In RST, coherence relations may exist between larger text spans than just two clauses.

In the classification, RST is in the first group. In their definitions, an analyst is involved to make decisions, for instance with respect to the possibility to omit a clause in the discourse, in order to determine nucleus and satellite. Several computational text generation theories have implemented RST definitions of relations (e.g. Hovy et al., 1992; Bateman et al., 1991).

Linguistic realization of coherence Martin (1992) uses properties as 'causal' or 'volitional' to define conjunctions: a connective is selected on the basis of this kind of properties. Combining all the properties and all the realizations, a 'systemic network' is formed, that is capable of generating text. It is not likely that Martin's (1992) system could generate (3), unless the lexical meanings of *to fall* and *to push* were the linguistic realization of the properties causal and volitional. This seems to be quite difficult to achieve. One of the problems is, that in Martin's (1992) framework, no distinction is made between coherence and connectives. In Oversteegen (1995), a fragment of a systemic network is presented that does not suffer from this problem, for she does make a distinction between coherence relations and connectives. In Degand (1996), an extensive analysis of Dutch connectives is given in terms of the systemic functional approach, making the same distinction as Oversteegen (1995). Systemic networks fall into the second group of theories, for selection of the correct linguistic realization is their aim.

Knott and Dale (1994) analyze connectives in order to come to a classification of coherence relations on the basis of a classification of cue phrases. This approach provides an answer to the question that was raised in Hovy (1990): how many coherence relations are there,

and how are they classified?.[3] The answer Knott and Dale (1994) give, presupposes that the complete set of coherence relations is a subset of the complete set of connective meanings. In other words: if there is a coherence relation between the two clauses in (3), there must be some connective that can be inserted between them without changing the meaning of (3).

Knott and Dale (1994) observe coherence from an analyst's point of view. An analyst is able to insert connectives and check the result. The purpose of doing so is to come to well-defined descriptions of coherence relations. This makes their theory fall into group 1.

Argumentation The theory of argumentative orientation, defined by Ducrot (1980), gives an analysis of (3) that differs from the coherence approach. First of all, there should be an indication that the speaker is aimed at defending a claim. Suppose that the claim is that *Max fell*. The next clause, *John pushed him* should be interpreted as an argument in favor or against the claim. In order to make the argument meaningful, it has to relate to an argumentative scale (or 'topos') concerning pushing and falling. These scales are formulated as comparative scales: 'the more John pushes Max, the more he is inclined to fall'. This way of representing knowledge is not very plausible, in this case. According to Moeschler (1990), implications should be possible, next to argumentative scales. The implication would read: 'if John pushes Max, he may fall'. This provides the correct derivation of the argument: the claim is justified by the implication (instead of the an argumentative scale).

It is difficult to classify this group into one of the three categories. Since the theory is about argumentation, the only coherence that is expressed on the level of connectives, are argument-claim relations. On a more abstract level, the theory is concerned with the argumentative purposes of the speaker. On this level, the theory is more about intentions than about coherence.

There is an application of this theory in text generation, namely Elhadad (1993). He makes use of the observation that (among other linguistic means) connectives indicate argumentation. Just like Ducrot (1980), Elhadad uses knowledge from 'topoi' with respect to argumentative orientation to determine the selection of a connective. This approach can be connected with a presuppositional view on causal connectives, as Oversteegen (1995) shows. Elhadad's (1993) aim is to select connectives that fit in the right context, i.e. connectives that are in agreement with a specific argumentative orientation. His theory falls into group 2.

TACITUS Hobbs, Stickel, Appelt & Martin (1993) developed the Abductive Commonsense Inference Text Understanding System (TACITUS),

[3] Sanders et al. (1992, 1993) provide an alternative answer to the same question.

a system organizing reader's inferences from text by formulating rules of inferences in an automated system.

The general principle of the system is that an utterance can be interpreted by proving specific assumptions with respect to that utterance. For instance, when an utterance contains a pronominal, its reference can be established by proving that the assumed reference is correct. Likewise, a coherence relation is established whenever a proof has been provided that a pair of clauses.[4] form a 'segment' (which is a composition of clauses). Applied to (3), the sequence of the two clauses needs to be interpreted as a meaningful assertion.[5] or topic. *Max fell* and *John pushed him* create an assertion that consists of the composition of the two basic assertions, and some relation between those assertions, in this case the coherence relation 'Explanation'. This assumption has to be proved (this procedure is essentially the abductive interpretation). One way to prove Explanation is that the assertion of *John pushed him* causes the assertion of *Max fell*. In that case, an 'axiom' should exist that says that 'pushing causes falling'. This way, the Explanation between the two clauses is proved, and established.

Suppose there is an alternative assumption, for instance that the coherence relation is Narration.[6] Next, suppose that a proof for this assumption was made too. Then a choice is made between both assumptions by 'weighted abduction'. All premisses are assigned certain costs, and the total cost of a proof is determined by the sum of the costs of the premisses. The cheapest proof wins. TACITUS is a theory from the third group, for the calculations are made in order to recognize coherence in an automated way.

DICE Lascarides and Asher (1991) introduced a system of Discourse Inference and Commonsense Entailment (DICE), trying to achieve the same goal as TACITUS: it systemizes reader's inferences from text by formulating rules in a deductive system. A comprehensive introduction to DICE will be given in section 4.3.

DICE and TACITUS are organized differently. Both TACITUS and DICE begin with the assumption of a coherence relation. Instead of providing a proof for that assumption, DICE formulates rules: given certain conditions, a specific coherence relation holds between two clauses. Several coherence relations may be assumed, as long as they are consistent with each other. The assumption of a coherence relation has consequences: assuming Explanation means that the causing event (in the second clause) must precede the resulting event (in the first

[4]Hobbs et al. (1993) use the term 'sentence' for what is called 'clause' in this thesis.

[5]An assertion is more or less the same as a proposition: it expresses a situation or event, but not more particular aspects of its use in context.

[6]Hobbs et al. (1993) do not work out the possibility of more than one coherence relation for one conjunction; they develop an analysis of coercion that seems to be easily applicable to coherence. They do not mention Narration explicitly as a possible coherence relation.

clause). The assumption of Narration has as a consequence an event order that is reverse to the event order implied by Explanation. This means that assuming both relations leads to inconsistency. Three principles of deduction govern the possibilities to maintain or withdraw the assumption of a coherence relation. Avoiding inconsistency is the leading principle behind discourse coherence. Choices between coherence relations are made taking the relation that is based on the most explicit indications in the context. This choice might coincide with the choice of the cheapest proof in TACITUS, but there is no systematic correspondence between the two models. DICE belongs to group 3, just as TACITUS.

TACITUS or DICE? In this chapter, a theory from group 3 is selected to show how inference of coherence relations with connectives differs from inference of coherence relations without connectives. Theories from group 3 were suited, in principle, to show these differences. There are two theories argued to belong to group 3: TACITUS and DICE. Of these two, DICE is chosen. There are two arguments for that decision.

First, for DICE, inconsistency of assumed coherence relations guides the process of inference. Different relations may be derived, as long as they are not inconsistent with each other. When there are inconsistent relations, they are compared with respect to the most explicit indications for one relation or the other. In TACITUS, proofs of assumptions of different coherence relations will be compared regardless of possible inconsistencies. It all depends on weighed abduction.

Secondly, the weights of the costs are not easily determined. Who determines the costs of interpretations? Hobbs et al. (1993) do not explain how axioms may arise (with regard to their example, they note: *Suppose, plausibly enough, we have the following axioms: (...)* Hobbs et al., 1993, p.109). Although reasoning itself is not affected by an axiom 'out of the blue', the preference for one proof over another is now determined without any other ground than what is supposed to be plausible. Hobbs et al. (1993) suggest that psycholinguistic experiments can determine relative plausibilities, but it would take quite a program of experiments to establish these values, if possible at all. In DICE, the assumptions of coherence relations, as well as consequences of these assumptions, represent linguistic, world and lexical knowledge.[7] Their interaction is explicitly defined in three principles. In this respect, DICE models, better than TACITUS, intuitions and knowledge on the coherence of discourse.

The conclusion of this section is that DICE will be chosen. In the next section, the system will be introduced. The subsequent sections

[7] It has always been considered a weak point of DICE that lexical and world knowledge could not be described adequately. Recent publications like Lascarides et al. (1996) show that the formulation of lexical knowledge and the organization of the lexicon have been improved. Moreover, the improvement of the model that will be proposed in this chapter is addressing the problem specifically.

analyzes the differences between inference with and without connectives in DICE. These sections might be interesting for readers who are not primarily interested in DICE, but it is perhaps problematic to fully understand the argumentation, without reading section 4.3 first. Still, it should be possible to read only the introduction of the next section, and skip the rest. In sections 4.4 and 4.5, reference will be made in the text to relevant parts of section 4.3, whenever this may be convenient.

4.3 Deduction with DICE

4.3.1 Introduction

Discourse Inference and Commonsense Entailment (DICE) is a system of commonsense reasoning, organized in such a way, that a model of a reader is constructed: like a reader, DICE makes inferences when it analyzes a text. What is important in DICE, is the way such inferences are handled. A 'natural reader' makes use of lexical and world knowledge in making inferences. How this knowledge is organized, is difficult to observe. So, a model that organizes inferences in such a way that a coherent interpretation of a text fragment may be derived, explains what inferences a reader could be using in deriving a coherence relation.[8] DICE provides such a model.

At large, the organisation of the model is quite simple. Three deduction principles play a crucial role in governing the interplay of different kinds of laws and axioms. The differences between these laws and axioms are determined by their contents and by the property of being (in)defeasible. The interaction of axioms and laws is specified in the principles. They all have the form of an implication, so the fulfilment of the antecedent of a rule makes the rule work. The deduction principles govern the interaction by defining and solving inconsistencies. One principle governs the application of the rules on the input from the text (Defeasible Modus Ponens). The other two principles govern the cases in which inconsistent assumptions have been made. One of these principles states that the law expressing the most specific information, wins. The competing law is defeated (Penguin Principle). The other principle defines a situation in which a certain combination of assumptions has made a discourse inconsistent (Nixon Diamond). The assumptions that have been made need to be withdrawn. What happens next is not defined: the system may try again, making new assumptions that may not end up in the Nixon Diamond, or the discourse is in fact incoherent, and the system has located a spot in the discourse that needs to be repaired. These principles will be introduced after all the laws and axioms, for they can be put to work only with the whole set of rules.

[8] This explanation concerns the possibility for a reader to make inferences. It is not describing what a reader does 'on line'.

While the overall organization seems quite simple, the system will soon become quite complicated. The reason for this is, that knowledge of the world needs to be incorporated. It is quite difficult to define world knowledge in a systematic way. This makes the inference of a coherence relation on the basis of complex and specific definitions of world knowledge, just for one utterance, seem rather overdone. In order to have a good understanding of the system, readers should, as it were, look through the world knowledge definitions. Then it is possible to see the interesting side of DICE: it provides a way of defining knowledge of discourse processes, or linguistic knowledge, to infer coherence in a systematic way. In the remainder of this chapter, a little piece of such linguistic knowledge will be defined, and the advantages of doing so will be shown.

In this introduction, the organisation of DICE will be sketched. In the subsequent sections, different kinds of rules are introduced, ending with the principles that govern the interaction of these rules. The organisation consists of three principles, governing the interaction between several kinds of rules.

A definition of a 'rule' is given in the first principle: 'Defeasible Modus Ponens'. It defines an implication that is defeasible. When the actual discourse would disagree with the consequence of such an implication, it does not cause inconsistencies. For instance, if it is a rule that 'if you push someone, he falls', and in the current discourse it is stated that someone was pushed, and he did not fall, the rule is defeated for the occasion, but it still is a general rule. Defeasible Modus Ponens features in rules that represent world knowledge, discourse processes, and the assumption of coherence relations. The rules that define these assumptions are read as: normally, if a discourse is extended with a clause by connecting to a clause belonging to that discourse, some coherence relation is assumed. It depends on information defined in the conditions of each specific rule, which relation will be assumed. This information is related to the propositional contents of the clauses (or context). Every coherence relation that is allowed by the definition of its rule, may be assumed. However, inconsistencies may occur, for assumptions of coherence relations may have contradicting consequences. This is what the other two principles are used for: getting rid of the inconsistencies (or: define inconsistencies). When inconsistencies have been cleaned up, the remaining coherence relations represent a coherent text fragment.

The second principle is capable of choosing between coherence relations, when they cause inconsistencies ('Complex Penguin Principle'). The way in which this is done seems rather complicated, but the essence is quite simple: the Complex Penguin Principle is only stating that more specific information overrules general information.

The third principle is capable of defining incoherent discourse, when coherence relations are causing inconsistency in a specific constellation ('Nixon Diamond'). Again, the deduction seems complicated, but

essentially, the Nixon Diamond only forbids contradictions, coming forth from assumptions. Such contradictions may easily be recognized when reading a discourse.

In most of the rules, knowledge of the world and linguistic knowledge are used to make assumptions on the coherence of a text. Discourse relations are rules defined by Defeasible Modus Ponens, and executed when certain conditions are fulfilled. Defeasible laws, representing world knowledge, may specify some of these conditions. For instance, the Push Causal Law (in table 4.3) represents the knowledge that the relation between pushing and falling is causal. This information is needed to assume the discourse relation Explanation in *Max fell. John pushed him*.

Regarding the example just given, a reader will use this world knowledge in an ad hoc manner: when certain knowledge is needed for the interpretation of an utterance, it is invoked, and when it is not needed, it does not play a role. This ad hoc character may be reduced in two ways. First, the rules defining world knowledge may be derived from the lexicon in a systematic way. This makes the occurrence of world knowledge more comprehensible: no loose rules of knowledge are defined, but a systematic relation with the lexicon is employed. The Push Causal Law is thus nothing more than a specification of the causal relation that is derived when two lexical items *to push* and *to fall* are associated with each other. The existence of the Push Causal Law as such, as an independently motivated piece of knowledge, is not important: it is just the description of the knowledge people infer when the words *to push* and *to fall* are associated with each other. The fact that the derived relation is causal, is determined in the lexicon (and a reflection of world knowledge, of course). Asher and Lascarides (1995) and Lascarides et al. (1996) take the question of deriving causal laws like the Push Causal Law from the lexicon as an important research topic. Second, linguistic rules can often take over rules of world knowledge. Linguistic rules are generally applicable, and independent of world knowledge. They model the interpretation of a sentence, making it easier to fill in world knowledge where its needed.

The different kinds of rules DICE employs, have an equal status to the principles. There are discourse (i.e., coherence) relations, indefeasible axioms, laws on lexical or world knowledge and laws that define discourse processes (or linguistic rules). They will be introduced in this order, in the next sections. Only the indefeasible axioms are different: they may not be defeated, so they play another role in the execution of the principles (this can be read from the definitions in 4.5). The introduction of rules ends with the three principles that organize the system.

After this introduction of DICE, arguments will be given for the representation of causal connectives in DICE. These arguments will be given in an informal way, but references will be made to relevant parts of this section. So, it will be possible to skip the remainder of this

section, and return to it whenever necessary.

4.3.2 DICE: discourse relations

DICE starts with the assumption that discourse (or coherence) relations are present in a coherent discourse. Given the assumption that a reader reads a text clause by clause, a new clause must be added to one of the clauses already read. Between these two clauses, a discourse relation is assumed on the basis of the propositional contents of the clauses, or the context of the clauses. The form of the rule is a defeasible implication, with a discourse relation as its consequence. The conditional part of the rule contains the inferences that a reader should make to conclude to a specific relation.

Discourse relations used in this chapter are defined in table 4.1. Every rule is formulated according to the Defeasible Modus Ponens.

Table 4.1: DICE: discourse relations

Narration	$\langle \tau, \alpha, \beta \rangle \ > Narration(\alpha, \beta)$
Result	$\langle \tau, \alpha, \beta \rangle \ \wedge \ cause(e_\alpha, e_\beta) \ > Result(\alpha, \beta)$
Explanation	$\langle \tau, \alpha, \beta \rangle \wedge cause(e_\beta, e_\alpha) \ > \ Explanation(\alpha, \beta)$
Background	$\langle \tau, \alpha, \beta \rangle \ \wedge \ overlap(e_\alpha, e_\beta)$ $> Background(\alpha, \beta)$
Elaboration	$\langle \tau, \alpha, \beta \rangle \wedge Subtype(\alpha, \beta) > Elaboration(\alpha, \beta)$

The connective '$>$' is an essential part of this formulation. $>$ represents a defeasible implication, meaning *Normally, if ..., then...* The semantics of this connective is described in Asher and Morreau (1991), where it is introduced to account for the semantics of generic sentences. In the previous chapter of this thesis, it was used for the presupposition of connectives. Here, it defines the knowledge that is needed to assume some discourse relation.

In table 4.1, some discourse relations are defined. There are more relations defined in DICE, but only discourse relations mentioned in the text of this chapter are included. Every discourse relation rule in table 4.1 is defined with respect to an update function $\langle \tau, \alpha, \beta \rangle$: α and β are representations of clauses and β is added to α via a proper discourse relation. α is the representation of a clause in the discourse that is already updated (symbolized by τ), and is allowed to have a relation with β.[9] In short, τ is updated with β via a proper discourse relation between α and β.

The information in the condition of a discourse relation is often expressed by 'e_α' instead of α. e_α stands for main eventuality (that is, a state or event, including processes) of α (following the format

[9] In the next chapter, this property of clauses will be discussed.

in Lascarides et al., 1992). Formulated this way, reference is made to properties that may be bound to an ordering in time, or differ in time structures (e.g., a state is not bound to an end, but an event might be). These properties have a strong influence on the coherence of a text. Below, the discourse relations defined in table 4.1 will be introduced one by one.

The defeasible rule of Narration is least demanding: Every clause β that can attach to a clause α in the discourse τ may be connected with α through Narration. The other relations demand some extra condition. Narration is restricted in other ways (e.g. its axiom), but it may easily be assumed.

In an Explanation, the second clause explains the first. So, two eventualities need to be in a causal relation, with the event of β as the cause, given an update $\langle \tau, \alpha, \beta \rangle$. The eventuality that represents the cause, is the last clause of τ, namely β. e_α is the effect. So, in Explanation(α, β), α is the clause expressing the effect, and β is the clause expressing the cause. In '$cause(e_\beta, e_\alpha)$', β returns as the first argument: this position is defined as the cause. These cause predicates are defined by causal laws, like in table 4.3.

The difference between Result and Explanation concerns the order of the clauses: in Result(α, β), α expresses the cause, and β expresses the effect. In the condition of the Result rule, $cause(e_\alpha, e_\beta)$ is defined as e_α causes e_β.

β is a Background for α if it is the case that $overlap(e_\alpha, e_\beta)$. *Overlap* is a predicate referring to the partial co-occurrence of two eventualities in temporal order, as they occur in reality. These eventualities are states, or one of them is a state. An interesting difference with the *cause*-predicate is, that *overlap* represents linguistic knowledge, and not world knowledge. This difference has no effect on the status of the rules.

Elaboration is a relation that is difficult to define. The history of the rule Elaboration shows this: different definitions appear in Lascarides and Asher (1991), Lascarides and Asher (1993), Asher (1993), Asher and Lascarides (1995) Lascarides et al. (1996). The definition in table 4.1 is most recent, at the time of writing this thesis.[10] The *subtype*-predicate in Elaboration is defined as (...) *the event condition in α is a subtype of that in β* (Lascarides et al., 1996, p. 51; read for 'event condition': 'eventuality'). This is supposed to capture the idea that an elaboration extends the information given in the former clause.

[10]The definition of Elaboration in Asher (1993) is based on progression of the topic: there is a group of this kind of relations, the structural relations. Structural relations are typically not causal (Lagerwerf, 1996). The definition in Lascarides and Asher (1993) concerns the qualia structure of lexical items (Pustejovsky, 1993, p. 86) that occur in α. The other definitions are more or less like the one in table 4.1.

4.3.3 DICE: indefeasible axioms

Discourse relations may be easily assumed, but there are restrictions on the assumptions. The axioms on discourse relations in DICE are indefeasible, as the use of '$\rightarrow$' instead of '$>$' indicates, in table 4.2. If

Table 4.2: Indefeasible axioms and laws on discourse relations

Axiom on Narration	$Narration(\alpha, \beta) \rightarrow e_\alpha \prec e_\beta$
Axiom on Result	$Result(\alpha, \beta) \rightarrow e_\alpha \prec e_\beta$
Axiom on Explanation	$Explanation(\alpha, \beta) \rightarrow \neg e_\alpha \prec e_\beta$
Axiom on Elaboration	$Elaboration(\alpha, \beta) \rightarrow \neg e_\alpha \prec e_\beta$
Axiom on Background	$Background(\alpha, \beta) \rightarrow overlap(e_\alpha, e_\beta)$
Causes precede Effects	$cause(e_\beta, e_\alpha) \rightarrow \neg e_\alpha \prec e_\beta$

the assumption of a discourse relation (with a defeasible rule) results in a violation of one of its axioms, the assumption must be withdrawn (Lascarides et al., 1992; Asher, 1993). The axiom on a discourse relation is triggered by the discourse relation rule (in table 4.1). The condition of the axiom is identical with the consequence of its corresponding discourse relation.

Axioms state causal and temporal properties of eventualities. Asher (1993) also defines axioms concerning topic formation. These axioms are not presented in table 4.2, since they are associated with structural relations, not discussed in this chapter. In principle, the axioms can refer to any indefeasible knowledge on eventualities.

The logical operator '$\prec$' in the axioms of table 4.2 is a temporal ordering on events: '$e_\alpha \prec e_\beta$' means that the main eventuality of α precedes the main eventuality of β.

In table 4.2, the Axiom on Narration is identical with the Axiom on Result, and the Axiom on Explanation is identical with the Axiom on Elaboration.

The Axiom on Background is the reverse of the Background discourse relation, only the axiom is indefeasible. Background is assumed only if there is an overlap of the events of α and β.

The axiom Causes precede Effects is not an axiom on a discourse relation, but on rules expressing lexical knowledge, like the Push Causal Law (in table 4.3). Explanation has $cause(e_\beta, e_\alpha)$ in its condition, which is the condition of Causes Precede Effects. The latter has the same consequence as the Axiom on Explanation, namely $\neg e_\alpha \prec e_\beta$.[11] This makes the Axiom on Explanation a special case of Causes Precede Effects.

The axioms mentioned in table 4.2 suggest that all axioms concern

[11] $\neg e_\alpha \prec e_\beta$ must be read as: $\neg(e_\alpha \prec e_\beta)$. Apparently, no other reading is possible in DICE.

temporal relations. It is, however, not a characteristic property of indefeasible axioms.

4.3.4 DICE: defeasible laws on world knowledge

In the two previous sections, discourse relations were introduced, and their axioms. These two kinds of rules are directly involved with the coherence of a text fragment. They define, independent of particular knowledge, what relations may be recognized, and what the consequences of this recognition are (the interaction of relations, consequences and laws will be discussed with respect to table 4.5). The discourse relation rules, however, need more specific input to be initiated. For instance, Explanation needs a specification of $cause(e_\beta, e_\alpha)$ in its condition, in order to be assumed.

Defeasible laws specify (causal) relations on the basis of world knowledge or lexical knowledge. In table 4.3, world knowledge is represented

Table 4.3: Defeasible laws of world knowledge

Push Causal Law	$\langle \tau, \alpha, \beta \rangle \ \wedge \ fall(m, e_\alpha) \ \wedge \ push(j, m, e_\beta)$ $> \ cause(e_\beta, e_\alpha)$
Revolt Law	$\langle \tau, \alpha, \beta \rangle \wedge revolt(b, e_\alpha) \wedge pacified(b, e_\beta)$ $> \ \neg overlap(e_\alpha, e_\beta)$
Light Switch Law	$\langle \tau, \alpha, \beta \rangle \wedge Switchoff(m, light, e_\alpha)$ $\wedge \ Dark(room, e_\beta) \ > cause(e_\alpha, e_\beta)$
Blinds Law	$\langle \tau, \beta, \gamma \rangle \wedge Draw(m, blinds, e_\gamma)$ $\wedge Dark(room, e_\beta) \ > cause(e_\gamma, e_\beta)$
Beautiful Women Marry	$Beautiful(x, e_\alpha) \wedge Marry(x, y, e_\beta)$ $> cause(e_\alpha, e_\beta)$

in defeasible rules, also called laws in DICE. The most important difference between the axioms in 4.2 and laws is their defeasibility: axioms are indefeasible and laws are defeasible. Two axioms with contradicting consequences may not co-exist for the same α and β; two defeasible laws can go together, as long as their consequences are not instantiated as facts.

A defeasible law may be created at the moment two clauses are connected, and their propositional contents need to be associated with each other. Essentially, this is what the laws express in their conditions, in table 4.3. A discourse τ containing α is updated with β. The events of α and β are put next to each other, as in the Push Causal Law: $fall(m, e_\alpha) \ \wedge \ push(j, m, e_\beta)$. The events of α and β may be related this way, because this knowledge is (or should be) represented in the lexicon. Given the information about a relation between the two events, it may be assumed that the clauses are causally related.

Defeasible laws of world or lexical knowledge have two properties that make the term 'law' a bit pretentious: they are derived from the lexicon, and they are context specific. This means that such a rule is dependent on the meaning aspects of the verbs and their arguments within their context. The Push Causal Law has been formulated explicitly in several publications, which makes it seem to be quite an important piece of knowledge. And if even the Push Causal Law is important, how many even more important Laws should be formulated in a complete system of inferences? This is not how the Push Causal Law should be regarded. In fact, this law may be derived anew on every occasion, by lexical knowledge. An indication for this more explicit connection between lexicon and laws is the blend of the Push Causal Law and Explanation (in Asher & Lascarides, 1995 - see footnote 24). This blend indicates that knowledge steers the assumption of discourse relations from context directly, given the lexical knowledge of the words determining the events of α and β.[12]

The fact that five laws are given in table 4.3, is meaningless. One could argue that there should be thousands of similar laws, but one could also argue that there are no specific laws of world knowledge. Only when a specific context needs to be interpreted, a law may be derived from the lexicon. Thus, they exist for the sake of coherence of discourse. What matters, is not the question whether laws are permanent, but whether it is possible to derive them from the lexicon. It was already indicated that this question is the main question in recent developments in DICE (cf. Asher and Lascarides, 1995; Lascarides et al., 1996).

In the Push Causal Law in 4.3, *fall*, *push*, *m* and *j* are directly referring to the eventualities and individuals in a discourse like *Max fell. John pushed him*. The Push Causal Law results in a cause predicate, and a cause predicate may satisfy Result or Explanation.

The Revolt Law defines knowledge that is associated with revolts and pacification, in a discourse like: *the backbenchers revolted. They were pacified.* In this definition, *b* refers to the backbenchers.

The last three laws are not taken from other publication. They are defined parallel to the former ones and in service of the examples used further on in this chapter.

The Light Switch Law states that one normally infers from the information that Max switches off the light and the room becomes dark, that the switching off causes the darkness.

The Blinds Law states that one normally infers from the information that Max draws the blinds and the room becomes dark, that the drawing causes the darkness. The specific use of indices in these laws is connected with the examples they are meant to explain.

[12]The alternative representations are, besides the more suggestive presentation, notational variants of the original representations. The original representations will be presented in the tables.

Beautiful Women Marry formulates knowledge that supports the assumption of a denial of expectation in *Although Greta Garbo was beautiful, she never married*. Free variables have been used instead of constants, because, as was explained in the previous chapter, it is just the specific case in the utterance that defeats the law.

4.3.5 DICE: defeasible laws on discourse processes

Defeasible laws on discourse processes specify possible and impossible sequences of clauses in discourse. The (im)possibilities are based on temporal, causal and lexical phenomena. Defeasible laws on discourse processes are more general and may be part of a reader's linguistic knowledge. They are not derived from the lexicon and independent of world knowledge.

Defeasible laws specifying world knowledge are context specific and volatile. Adding defeasible laws on discourse processes to the system (where the defeasible laws all have the same status with respect to the deduction rules represented in table 4.5) makes it possible to reduce the amount of inferences.

Table 4.4: Defeasible laws on discourse processes

States Overlap (a)	$\langle \tau, \alpha, \beta \rangle \wedge state(e_\beta) > overlap(e_\alpha, e_\beta)$
States Overlap (b)	$\langle \tau, \alpha, \beta \rangle \wedge state(e_\alpha) > overlap(e_\alpha, e_\beta)$
Maintain Causal Trajectory	$\langle \tau, \beta, \gamma \rangle \wedge R(\alpha, \beta) \wedge cause(e_\alpha, e_\beta)$ $> \neg cause(e_\gamma, e_\beta)$
Conceptual Immediacy	$\langle \tau, \alpha, \beta \rangle \wedge \beta \rightarrow Result(\gamma, \delta)$ $> \neg(e_\gamma \prec ibd(e_\alpha) \prec e_\delta)$ $\wedge \neg(e_\gamma \prec fbd(e_\alpha) \prec e_\delta)$
Inertia	$(\forall\alpha)(open(\tau, \alpha) \wedge ND(\alpha, \beta))$ $> (\exists\alpha')(open(\tau, \alpha') \wedge DP(\tau)(\alpha', \beta))$
No Cause	$when(\alpha, \beta) > \neg cause(e_\alpha, e_\beta)$

In table 4.4, defeasible laws on discourse processes are defined. Below, the rules are discussed one by one.

In two versions of States Overlap, (a) and (b), the effect of a state in a discourse is described: if one of two clauses expresses a state, then the eventualities of both clauses overlap each other. Both (a) and (b) may give rise to a Background relation.

In Maintain Causal Trajectory, a law concerning succession of relations is formulated: if a discourse is updated with a clause γ related to β, and it is known (because it was stated in context) that the event of β was caused by the event of α, the event of γ can not be the cause for the event of β. Maintain Causal Trajectory will be illustrated by an example, in the next section (with respect to the deduction principles in table 4.5).

Conceptual Immediacy states that the $Result(\gamma, \delta)$ relation in the antecedent may not be intervened by another event α in the context of β.[13] The intervention of one event between another is given in terms of (temporal) event boundaries: the starting point (*ibd*) or the ending point (*fdb*) of α comes 'in-between' the events expressed by the clauses of Result. Conceptual Immediacy is an alternative formulation of Maintain Causal Trajectory (presented in Lascarides and Oberlander, 1993). The relation $R(\alpha, \beta) \wedge cause(e_\alpha, e_\beta)$ in the antecedent of Maintain Causal Trajectory expresses, in effect, a Result between α and β, which may not be intervened by another event γ (here located in the context, but after the R relation).

In this chapter, Maintain Causal Trajectory is used instead of Conceptual Immediacy. The main reason is, that it does not work for some of the examples analyzed in the next sections.[14] A more principled argument against replacement of Maintain Causal Trajectory with Conceptual Immediacy is that other laws are not stated in terms of *fbd* or *ibd*, so that interaction between laws and discourse relations through deduction principles is not possible.

Inertia is a defeasible law that can only be activated in succession of the application of the deduction principle 'Nixon Diamond' (table 4.5). A Nixon Diamond determines that in certain situations, it is not possible to make a proper assumption of a discourse relation. In that case, the discourse becomes incoherent. Inertia gives an alternative move to the interpretation of the discourse by assuming that in the specific case described below, a coherence relation is derived that fits in the more global discourse pattern. This is only possible in cases where attempts to shift to another level of the discourse structure fail (such attempts are called discourse pops).

The antecedent of Inertia is thus defining a situation in which there is incoherence, and a discourse pop can not solve the incoherence. $(\forall\alpha)$ $(open(\tau, \alpha) \wedge ND(\alpha, \beta)$ defines this situation: all open clauses α will get a Nixon Diamond (*ND*) with β. An open clause is a clause of τ that is (on structural grounds) available for having a relation with β. So, the antecedent for Inertia states that a Nixon Diamond will occur for every attempt to make a discourse pop.

In case of Inertia β relates to α following the Discourse Pattern (*DP*) of the discourse τ. The effect of Inertia is, that the relation that should be most likely in the global context, for instance Narration in a narrative context, is assumed.

[13]This definition contains the phrase: $\beta \rightarrow Result(\gamma, \delta)$. The $\rightarrow$ has a different meaning in Conceptual Immediacy: it means that discourse constituent β consists of the clauses γ and δ. This definition is not in agreement with the idea of clause by clause discourse incrementation in single clauses. β is a complex constituent, attached as a whole to the discourse. More is said about discourse incrementation in the next chapter. The intuition behind the idea that causal relations be attached to the discourse as a whole, will be the central topic of the next chapter.

[14]In (7), β would consist of an Explanation(γ, δ).

Unfortunately, this definition is quite vague as to which discourse patterns there are, and which effect it has on the relations it allows within its context. On the other hand, it is one of the few rules explicitly defining context restrictions on discourse relations.

No Cause is a law that restricts the use of the connective *when* with respect to the direction of the causal relation. $when(\alpha, \beta)$ reads, when the connective *when* is taken as a natural language expression: α *when* β. The law then excludes e_α to be the cause for e_β. It is interesting to notice that the impossibility for a causal relation is explicitly formulated here, whereas the possibility for a causal relation expressed by *when* (namely: e_β to be the cause for e_α) is not explicitly. This is because in DICE, it is assumed that this knowledge can be derived from the lexicon. And indeed, it is not necessary for *when* to indicate a causal relation, so it depends on the propositional contents of the clauses whether a causal relation will be assumed. The connective *because* works differently: see its definition in (15).

4.3.6 DICE: deduction principles

Having introduced the discourse relations, axioms on discourse relations, laws on world knowledge and laws on discourse processes, the interaction between the rules needs to be established. Deduction principles govern the interaction by defining and solving inconsistencies. The principles are defined in table 4.5. Defeasible Modus Ponens governs the application of the rules on the input from the text. The Penguin Principle states that the law expressing the most specific information, wins. The competing law is defeated. The Nixon Diamond defines a situation in which a certain combination of assumptions has made a discourse inconsistent. Some of the laws on discourse processes may define alternative interpretations of the discourse, but if these laws are defeated too, the discourse is considered to be incoherent.

The principles will be demonstrated using an example. It is important to keep in mind that only a few properties actually determine the principles. For instance, the Complex Penguin Principle defines that more specific information is more important than less specific information. Therefore, it is renamed 'Specificity' in Lascarides et al. (1996).

Defeasible Modus Ponens defines how discourse relations, and defeasible laws may be assumed on the basis of (lexical, world or linguistic) knowledge. When, for instance, a causal relation is assumed on the basis of text information, a causal law is needed and the condition of the law needs to be satisfied. When the Push Causal Law is part of the knowledge of the reader, and he reads: *Max fell. John pushed him*, he may consider the propositional contents of these two sentences as the satisfaction of the conditions of the Push Causal Law. The result is, that the reader may assume that there is a causal relation between the two clauses. Defeasible Modus Ponens requires in addition that there is no information that contradicts the assumption 'Max did not fall', for

Table 4.5: Deduction rules

Defeasible Modus Ponens	$(A1)\quad \phi > \psi$ $(A2)\quad \phi$ $(A3)$ (not: $\neg\psi$)	$\mid\!\approx\ \psi$
Complex Penguin Principle	$(B1)\ \phi \rightarrow \psi$ $(B2)\ \psi > \chi$ $(B3)\ \phi > \zeta$ $(B4)\ \chi \rightarrow \theta$ $(B5)\ \zeta \rightarrow \neg\theta$ $(B6)\quad \phi$	$\mid\!\approx\ \zeta$, but not: χ
Nixon Diamond	$(C1)\ \psi > \neg\chi$ $(C2)\ \phi > \chi$ $(C3)\quad \psi$ $(C4)\quad \phi$	Not: $\mid\!\approx\ \chi$ (or $\neg\chi$)

that would be inconsistent.

The propositions, indicated with Greek letters in table 4.5, may refer to complex propositions. If the Push Causal Law is taken as an example, ϕ in (A1) and (A2) would read '$\langle\tau, \alpha, \beta\rangle \ \wedge fall(m, e_\alpha) \wedge push(j, m, e_\beta)$'. ψ in (A1), (A2) and (A3) would read: '$cause(e_\beta, e_\alpha)$'. $\neg\psi$ is, of course, the negation of χ.

The assumption of ψ, made by knowing $\phi > \psi$, ϕ (and not: $\neg\psi$), is defined by $\mid\!\approx$. It makes the assumption of ψ non-monotonically valid. Given a non-monotonic logic (Asher and Morreau, 1991), ψ is defeasibly (but validly) derived from $\phi > \psi$ and ϕ.

In fact, Defeasible Modus Ponens does nothing more than allowing for any kind of assumption that can be made in the given format. Whether or not such an assumption will actually be made, is dependent on other circumstances. For the Push Causal Law, information from the lexicon must support the relation between *to push* and *to fall*. Discourse relations are restricted by indefeasible axioms. It is possible, however, to assume laws and relations that appear to be wrong. In interaction with other knowledge, these assumptions have to be ruled out. This is done by the two other principles.

A principle that may resolve a conflict between two assumed coherence relations is an extension of what is called the Penguin Principle

(Lascarides and Asher, 1991). This principle states that if two contradictory statements are partly based on the same conditions (one logically entails the other), the only conclusion that is allowed, is the one using the most specific information. The standard example is provided by a penguin called Tweety. Suppose that it is known that *Birds fly*, *Penguins are birds*, and *Tweety is a Penguin*. Then it is allowed to conclude that *Tweety flies*. However, if it is known too that *Penguins do not fly*, it is only allowed to conclude that *Tweety does not fly*. The information that Penguins do not fly is more specific than the information that birds fly. His ability to fly is derived through two other generic statements, whereas his inability to fly is derived more directly from the fact that he is a penguin. The conclusion is restricted to the one using the most specific information.

In *Max fell. John pushed him*, the Penguin Principle is not about penguins and flying, but about coherence relations, axioms and laws. The conflict is not between the two assumptions (of Explanation and Narration), but between the axioms on these assumptions: the assumptions are connected with different orders of the events of falling and pushing. The application of the Penguin Principle will be more complex, hence its name: Complex Penguin Principle (in table 4.5). In the example, the principle is applied twice to resolve the conflict.[15]

The Complex Penguin Principle resolves conflicts when two discourse relations or laws can be assumed, and the antecedent of one logically entails the other. Applied to the example, this logical entailment is expressed by the fact that Narration only has a continuation of the discourse as a condition: '$\langle \tau, \alpha, \beta \rangle$' (see table 4.1). The Push Causal Law has the same continuation in its condition, but additional information too: '$\langle \tau, \alpha, \beta \rangle \wedge fall(m, e_\alpha) \wedge push(j, m, e_\beta)$' (see table 4.3). So, the antecedent of the Push Causal Law logically entails the antecedent of Narration. In table 4.5, this is formally represented in the rule numbered (B1): $\phi \rightarrow \psi$. ϕ and ψ can be identified as conditions of defeasible rules, because these rules are given as (B2) and (B3). It does not matter that one of these rules is a law and the other a coherence relation. However, there is no conflict detected yet.

Both Narration and Push Causal Law invoke their axioms: the Axiom on Narration and Causes Precede Effects, respectively. And these axioms are in conflict, because their event orders are contrary to each other. Narration states that the event order be: 'Max fell, and then John pushed him', whereas Causes Precede Effects states that the order be: 'John pushed Max and then Max fell.' In table 4.5, the Axiom on Narration is represented by (B4) and Causes Precede Effects by (B5). The conflict is stated in their consequences: θ (in (B4)) and $\neg\theta$ (in (B5)) are identified as $e_\alpha \prec e_\beta$ and $\neg\, e_\alpha \prec e_\beta$. The conflict will only be activated if the Push Causal Law is activated by asserting its condition: this is rule

[15] This double application is reduced to one by reformulating the Push Causal Law and Explanation (Asher and Lascarides, 1995).

(B6) in table 4.5.

If all the premisses (B1)-(B6) are met (logical entailment of two conditions, the rules themselves, and their conflicting axioms), the Complex Penguin Principle states that the most specific defeasible rule wins. The outcome is the consequence of the Push Causal Law: the event of Max's falling is caused by the event of John's pushing. In table 4.5 this is represented by ζ (i.e.: $cause(\alpha, \beta)$) coming after the $\not\approx$ symbol. It is explicitly indicated that Narration is not selected in: *but not:* χ (i.e. $Narration(\alpha, \beta)$).

This outcome is used to apply the Complex Penguin Principle a second time, now between Narration and Explanation. Explanation contains, next to the discourse continuation predicate $\langle \tau, \alpha, \beta \rangle$, the causal relation that has been established by the Push Causal Law. This conjunct makes Explanation logically entail Narration. The conflict is between the axioms on Narration and Explanation: their event orders are not in agreement with each other (the Axiom on Explanation demands the same event order as Causes Precede Effects). Given the discourse at hand, ϕ is applied in (B6) and in (B1) in table 4.5, and ψ is logically implied. The rules (B2) and (B3) are entailed by (B1) and (B6), and (B4) and (B5) are entailments of the consequences of (B2) and (B3), respectively. the outcome is that the consequence of Explanation wins, since it is more specific. The establishment of the Explanation relation between the two clauses is chosen by the second application of the Penguin Principle.

This derivation may seem complicated, but the observation needed to draw the conclusion of a Penguin Principle, is quite simple: are there any conditions of laws or discourse relations that logically entail another condition? If so, the rule with the most specific condition wins. This is by definition the condition that entails the other, so once the observation is made, the right discourse relation is selected. The double application of the Penguin Principle is avoided, when the definitions of law and discourse relation are changed. With respect to this example, this is done in Asher and Lascarides (1995).

The Nixon Diamond defines incoherence by deriving a direct inconsistency between the consequences of two activated laws, axioms or discourse relations. It is exemplified by a statement about Nixon: *Nixon is a Quaker and a Republican*. If one knows that Quakers are pacifists, and Republicans are non-pacifists, the statement about Nixon is inconsistent, for he can not be both a pacifist and a non-pacifist. The Nixon Diamond forbids assumptions of laws and discourse relations in a specific situation: if the assumption of a law, discourse relation or axiom results in a contradiction with another assumption from another rule, the assumptions that Quakers are pacifists and Republicans are non-pacifists can not be made at the same time (or rather: Nixon may not be Republican and Quaker at the same time). To obtain a Nixon Diamond, a discourse has to satisfy the conditions of two defeasible rules, leading to contradicting consequents. Now that these assump-

tions may not be derived, the discourse lacks a relation between the two clauses that needed to be connected. This makes the discourse incoherent. There are some ways to make a new derivation, using other assumptions (for instance, by applying Inertia, see table 4.4). There is also the possibility that the discourse is in fact incoherent. An example of this latter possibility will be demonstrated here. In section 4.4 and 4.5, assumptions made after the application of a Nixon Diamond will be discussed.

An example may be provided by the rules Maintain Causal Trajectory and Explanation, with respect to the discourse: *# John applied a sharp blow to Max's neck. Max fell. John had pushed him*. These three clauses are represented by α, β and γ respectively. The relation between α and β is a Result, and therefore Maintain Causal Trajectory holds between β and γ.[16] But also Explanation holds between β and γ. Maintain Causal Trajectory assumes that β may not be the cause for γ, but Explanation assumes that β is the cause for γ. This activates the Nixon Diamond, and it forbids a causal relation, as well as a non-causal relation, between β and γ.

Maintain Causal Trajectory (table 4.4) is specified in (C1), in table 4.5. ψ refers (with respect to the example) to $\langle \tau, \beta, \gamma \rangle \wedge R(\alpha, \beta) \wedge cause(e_\alpha, e_\beta)$. The rule focuses on the update of τ with γ on β (the update of the clause *John had pushed him*). In the second conjunct, α is introduced as another clause from τ.[17] α is the cause for β, as the third conjunct of the condition of Maintain Causal Trajectory expresses. In (C1), $\neg\chi$ corresponds with the consequence of Maintain Causal Trajectory, $\neg cause(e_\beta, e_\gamma)$. The defeasible rule $\phi > \chi$ in (C2) of the definition of the Nixon Diamond in table 4.5 corresponds with Explanation (table 4.1): χ is $cause(e_\beta, e_\gamma)$. ψ as well as ϕ are established here, in (C3) and (C4) respectively (John did apply the blow to Max's neck, and he pushed Max). Now, the crucial observation is made: both χ and $\neg\chi$ are established, on the basis of two rules with directly contradicting consequences. The Nixon Diamond is executed, which means that neither χ nor $\neg\chi$ may be assumed. Consequently, the discourse is considered incoherent. With respect to the example, this is the correct derivation. In other examples, the Nixon Diamond will give rise to other assumptions that will not suffer from the Nixon Diamond (in the sections 4.4 and 4.5, examples will be discussed).

Summarizing, the definitions of the three principles seem complicated. The intuition behind the three principles is rather straightfor-

[16] In Lascarides and Oberlander (1993), there is no specific law formulated that support the causal relation between α and β. It is not difficult to see that it will be quite easy to derive such a law from the lexicon. Moreover, Asher and Lascarides (1995) generalize the Push Causal Law in such a way, that it is not necessary to formulate a specific rule for every causal 'physical force and fall' relation. A Result will be assumed here without formulating a new law.

[17] β is part of τ according to the first conjunct, and has a coherence relation with α, according to the second. So α must be part of τ, or β maintains coherence relations with clauses from another discourse.

ward: an automated reader makes assumptions on the basis of (world and linguistic) knowledge and the text itself (Defeasible Modus Ponens), he selects from the possible assumptions those that do not cause inconsistency, by selecting assumptions with the most specific information (Complex Penguin Principle), and in case of direct contradiction, he stops reading (the Nixon Diamond).

4.3.7 Conclusion

In this section, DICE was introduced as a system making inferences on lexical, linguistic and world knowledge. The organisation of the system is given by three principles (in table 4.5). The general idea behind the rules is, that there is an interaction between world knowledge, lexical knowledge and linguistic knowledge. This interaction is governed by the three principles. Laws containing world knowledge, are in fact context-specific rules derived from the lexicon. They may be derived only for the occasion. How their derivation works, is not shown in this section. Laws of world knowledge are the least interesting aspect of DICE: more important are laws on discourse processes, defining linguistic knowledge. This kind of knowledge does not exist just for the occasion: these laws will make it easier for a reader to make inferences, for the propositional contents of the clauses need not be taken into account. Therefore, the development of DICE is aimed at questions: like these:

- How are causal laws systematically derived from the lexicon?
- How do linguistic rules ease the processes of assuming and reasoning?

In the next two sections, presuppositions of connectives will be introduced as linguistic rules. It will be shown how knowledge is derived from the lexicon when a causal connective is used, and this process will be compared with deriving the same causal relation without the use of a causal connective.

4.4 Connectives make a difference

In this section, the example in (3), repeated here, will be analyzed in more detail, in order to show the differences between coherence with, and without a causal connective in DICE.

(3) Max fell. John pushed him.

With respect to (3), it was claimed that the relation between the two clauses was Explanation. This is not necessarily the case: given an appropriate context, the relation is rather narrative than causal, as (4) shows (taken from Lascarides et al., 1992).

(4) John and Max came to the Cliff's edge. John applied a sharp blow to the back of Max's neck. *Max fell. John pushed him.* Max rolled over the edge of the cliff.

The relation between the two italicized clauses is Narration and not Explanation. In section 4.3.6, an example similar to (4) was discussed, with one crucial difference: In (4), *John pushed him* is used, whereas the former example had *John had pushed him*. This difference is crucial, for the pluperfect turns the clause into a cause for *Max fell*.

In (5), the same two sentences are connected with *because*.

(5) Max fell, because John pushed him.

It seems that in (5), causality is expressed much in the same way as in (3). In (5), it is quite obvious that the relation between the two clauses is causal. There is a difference with (3): the causality is inescapable, for *because* is expressing that there be a causal relation. A consequence of the inescapability is shown in (6).

(6) John and Max came to the Cliff's edge. John applied a sharp blow to the back of Max's neck. ?*Max fell, because John pushed him.* Max rolled over the edge of the cliff.

In (6), the connective *because* is inserted in the discourse from (4). In this context, the sentence taken from (5) becomes unacceptable. It is unexplained what the relation is between the blow on Max's neck and his fall, or: the assumption that the blow caused the fall has become impossible. The causality expressed in (5) is acceptable, but should be avoided in (6).

The causality in (3) can be denied in specific contexts, whereas it is preferred in contextless presentation (or in suitable contexts). It is one of the aims of DICE to show that there are different derivations of coherence relations in (3) and (4). Different linguistic or world knowledge is used to derive the different coherence relations in (3) and (4). The analyses of both examples will be given below, following Lascarides et al. (1992). Next, the examples in (5) and (6) will be included, and it will appear that DICE needs an extension for the representation of connectives to discriminate between (3) and (5), and between (4) and (6).

On the basis of the Complex Penguin Principle, Explanation is assumed in (3) instead of Narration. In section 4.3.6, the Complex Penguin Principle has already been applied on the example in 3.

There is a problem with this choice: in (3), there seems to be a preference for one relation, and in (4) for the other. The decision must be context sensitive, for context determines the coherence relation here. Maintain Causal Trajectory prohibits events in new clauses to be a cause for the event of an available clause in the existing discourse, when there

is an event within the discourse, that is causing the available clause already. The application of Maintain Causal Trajectory to an example like (4) has been given already in section 4.3.6, where the Nixon Diamond has been explained.

In (7), (4) is repeated with enumerated clauses.

(7) a. John and Max came to the Cliff's edge.
b. John applied a sharp blow to the back of Max's neck.
c. Max fell.
d. John pushed him.
e. Max rolled over the edge of the cliff.

In (7), there is a Result relationship between (7b) and (7c), so the new clause (7d) can not be the cause for (7c) again. However, the Push Causal Law holds between the events of the clauses (7c) and (7d). It has no restrictions on the context of these clauses, so there is nothing that prevents the assumption of the Push Causal Law. The assumptions of Maintain Causal Trajectory (*John pushed him* may not be a cause for *Max fell*) and the Push Causal Law (*John pushed him* is a cause for *Max fell*) contradict each other. This activates the Nixon Diamond.

Because the conditions on both assumptions are satisfied in (7) (there was already a cause for *Max fell*, and someone pushed Max and Max fell, respectively), the discourse is inconsistent, according to the Nixon Diamond. More specifically, the assumption of a causal relation and the assumption of a negation of a causal relation between (7c) and (7d) are excluded. In section 4.3.6, where the clause (7d) was used in pluperfect, the discourse was indeed incoherent. In this case, there has been made some new assumption.

For instance, in order to avoid incoherence, a discourse pop could be made: another clause, higher in the discourse structure, should be found to be attached to. In this case, however, no other clauses are available, since the previous clauses are all connected through Narration. Attaching to clauses on the left hand side of the rightmost clause would give, in this case, an inconsistent result with respect to the axiom on Narration: the event orders would not be sequential anymore. It seems that a state of inertia has been reached. Lascarides et al. (1992) define such a state. A rule of 'Inertia' (see table 4.4) states that if the Nixon Diamond has occurred in such a way that the conditions of two defeasible rules will lead to an inconsistent state of the discourse, and no discourse pop is possible, the discourse pattern of the current discourse determines the relation that will be chosen, in the end. *John pushed him* can not be attached to another clause (as the discourse pattern is narrative), and Narration is derived, instead of Explanation.[18]

[18]It is unclear whether the discourse pattern has caused this choice, or the fact that the condition for the assumption of Maintain Causal Trajectory was more specific than the condition for the assumption of Explanation. Lascarides et al. (1992) give the former as a general cause, and the latter as the specific cause for this example.

This way (narrative) context prevails over (*push*) causal knowledge.

Lascarides et al. (1992) remark with respect to example (7) that Maintain Causal Trajectory does not always prevent causal laws to come about. There are cases in which Maintain Causal Trajectory is defeated. In that case, a causal law is not in conflict with Maintain Causal Trajectory. An example of such a case is (8), (taken from Lascarides et al., 1992).

(8) Max switched off the light. The room went pitch dark, since he had drawn the blinds too.

Here, there are two causes for one effect: the room went dark, both because Max switched off the light, and because the blinds were closed. The former cause is presented before the effect, and the latter after the effect. In spite of this pattern, forbidden by Maintain Causal Trajectory, the discourse is acceptable. Why is it that Maintain Causal Trajectory is defeated in this case? Is a Blinds Law (see table 4.3) less defeasible than the Push Causal Law, or is the Light Switch Law more defeasible than the law that makes (7c) the result of (7b)? These questions will not lead to satisfiable answers. Lascarides et al. (1992) suggest with respect to (8) that *(...) presentational issues will be significant in cases such as these; (...)*. Presentational information should interact with domain-specific knowledge. This presentational information is, in this case, the presence of the connective *since* and the adverb *too*.

Lascarides et al. (1992) do not work out the cited suggestion. Given the specific semantics of causal connectives, presented in chapter 3 of this thesis, it is worthwhile to investigate this interaction with respect to the connective *since*. This can be done in relation with the incoherence of the example in (6). In (7), it was Inertia that finally led to the derivation of Narration. In (6), the unacceptability may be caused because Inertia can not be executed: the presence of *because* would block the derivation of Narration. When (6) is unacceptable, due to the combination of causal connective and Maintain Causal Trajectory, (8) presents a new problem: why is this discourse acceptable, while the effect of *since* and Maintain Causal Trajectory may both be assumed? In sum, the following problems need to be solved:

1. How is the difference between the unacceptable (6), with *because*, and the acceptable (7), accounted for in DICE?

2. what is the difference between (6) and (8): when does the assumption of Maintain Causal Trajectory lead to inconsistency, and when is Maintain Causal Trajectory defeated?

A description of the way causal connectives might solve these problems, can only be given in detail after the semantics of causal connectives is defined in DICE. The explanations given in the next section will make crucial use of the proposed format for definitions of causal

connectives in chapter 3. Moreover, these definitions will prove to be of use in many other cases, and not just as ad hoc explanations of the examples (6) to (8). In the next section, these other advantages of using specific definitions for causal connectives will be discussed as well.

4.5 Enforced coherence in DICE

4.5.1 Introduction

In this section, an account of causal connectives in DICE will be given, that should solve the problems coming forth from the previous section: in order to solve these problems, DICE will be extended with only one simple rule, that makes the distinction between inference with or without connectives. To elucidate the discussion, (6) is reformulated as (9), and (8) as (10), both with their clauses enumerated.

(9) a. John and Max came to the Cliff's edge.
b. John applied a sharp blow to the back of Max's neck.
c. Max fell,
d. ? because John pushed him.
e. Max rolled over the edge of the cliff.

(10) a. Max switched off the light.
b. The room went pitch dark,
c. since he had drawn the blinds too.

In order to formulate answers to the questions from the previous section, it has to be established that definitions of presuppositions for connectives are possible in DICE. When this has been done, and the questions have been answered, the advantage of the proposal will come about. The main advantage of having rules for presuppositions of connectives is, that no laws have to be derived from the lexicon to infer causality. The use of, e.g. *since* in (10) is not made possible by the Blinds Law, derived from the lexicon: the relation expressed by *since* is given as a causal relation in a specific direction. In the lexicon, only a very specific check is needed to approve of the given relation, instead of having lexical semantics form a causal law out of two contextually related notions. It will take DICE much less 'inferential effort' when presuppositions of causal connectives are implemented.

In the next paragraph, it will be explained how presuppositions of causal connectives in DICE are made possible; in the subsequent paragraph, the problems mentioned in the previous section will be solved. In doing so, the advantages of defining presuppositions of connectives, will become clear.

4.5.2 Presuppositions of causal connectives in DICE

In DICE, there is no general account of presuppositions of connectives. However, in Lascarides and Oberlander (1993), a proposal is made to account for presuppositions of temporal subclauses. They follow the approach of Van der Sandt and Geurts (1991), and apply it to DICE.[19] Their account runs as follows. Whenever an utterance contains an expression bearing a presupposition, this presupposition has to be interpreted properly in the discourse representation that was made of the previous discourse. There are three possibilities, each with their own consequences.

1. presupposed information is present in context: presupposition is like an anaphor;
2. presupposed information is not present: presupposition is accommodated;
3. presupposed information contradicts contextual information: there is no proper interpretation.

If presupposed information is already available, the presupposition behaves like an anaphor. The order in the three possibilities reflects the order of processing: resolution of the presupposition is tried before accommodation; proper interpretation fails after these possibilities have been tried.

Lascarides and Oberlander (1993) add to this theory the inference of coherence relations, by assuming that presupposition accommodation is constrained by the rules of DICE, and must be attached to the discourse as 'normal' clauses. A clausal representation of the presupposition attaches before the utterance itself, under the constraints of DICE. This way, the contribution of the presupposition to coherence is accounted for.[20] Lascarides and Oberlander (1993) try to explain the incoherence of, e.g., (11).

(11) a. The backbenchers were in revolt.

b. ? Major launched a charm offensive before they were pacified.

The use of *before* presupposes the truth of the subclause *they were pacified*. If it is accommodated, it will appear as a constituent in a representation of the discourse. This may be visualized in the paraphrase in

[19] It is important to realize that presuppositions of temporal subclauses concern the presupposition of the subclause, not the relation between the clauses.

[20] The attachment of the presupposition complicates the story, since DICE is a theory about inference, and not specifically about attachment. In this thesis, attachment comes after establishing coherence relations. See also the next chapter.

(12).

(12) a. The backbenchers were in revolt.
b. ? They were pacified.
c. Major launched a charm offensive before that.

The explanation for the incoherent discourse has now been localized at the point at which coherence of (12a) and (12b) should have been established. The reason for the incoherence is that two rules are in conflict: States Overlap (b) and the Revolt Law (see table 4.3). States Overlap represents linguistic knowledge, applicable in every discourse; the Revolt Law is quite an ad hoc law, established by the association of two lexical items in each other's contexts. The first says that if the first clause of two related clauses expresses a state, there is an overlap in the duration of the events between the first and the second clause. However, the Revolt Law says that an event expressing a revolt, and an event expressing a pacification, can not have an overlap: they come after each other. Since the antecedents of the rules do not logically entail each other, the complex Penguin Principle is not activated. Since their consequences contradict each other, a Nixon Diamond disqualifies the attachment of (12b) to the discourse. So, the presupposition of clause (12b) explains - together with world knowledge on revolts and pacifications - the unacceptability of (11).

Presuppositions of causal connectives can not be treated in the same way as presuppositions of temporal subclauses. Presuppositions of subclauses add a clause to the discourse that has to be related with its context by inference of a coherence relation. Presuppositions of causal connectives do not add clauses, but they add causal knowledge. Is it possible in DICE to let connectives presuppose causal knowledge? There is one connective, of which a 'causal implicature' is defined: *when*. In fact, what has been defined is a non-causal implicature, called 'No Cause' (see table 4.4; taken from Lascarides and Oberlander, 1993). Used as a connective of two clauses in past tense, *when* implicates the knowledge that the temporal connective *when* may not be understood causally in one specific direction. Consider (13).

(13) Max fell, when John pushed him.

Independent of the connective, the Push Causal Law is assumed, so the *when*-clause is the cause for the effect expressed in the main clause. It is just knowledge of the world (the Push Causal Law) that invites a causal inference here. The No Cause Law prohibits a causal inference in the opposite direction: *Max fell* may not be understood as the cause for *John pushed him*. Two aspects of this law will be discussed. The first is that Lascarides & Oberlander's (1993) No Cause Law is redundant; the other is that the definition of the No Cause Law makes way for definitions of other causal implicatures. The latter aspect is, of course, relevant to the definition of presuppositions for causal connectives.

The first aspect of the No Cause Law is that it is redundant. The temporal semantics of *when* will already exclude the main clause event from being a cause for the *when* clause event. In Partee (1984) (according to Sandström, 1993), the observation is made that the reference time of the event of the main clause is 'just after' the reference time of the event in the *when* clause.[21] If the main clause were a cause of the *when* clause, the axiom 'Causes precede Effects' should hold, but the temporal meaning of *when* will not allow for the main clause to start before the *when* clause. Consider sentence (14), in which the clauses of (13) have been reversed, thus giving the Push Causal Law the opportunity to make a cause from the main clause.

(14) John pushed Max, when Max fell.

The reluctance for (14) to express a causal relation, in contrast with the causally interpreted (13), is a result of the impossibility for *Max fell* to be understood as starting before *John pushed Max*. Instead, *Max fell* is understood to begin just after *John pushed Max*. This is not in agreement with Causes precede Effects, so (14) can not be understood causally.[22] So, without the No Cause Law, the fact that (14) can not be understood causally is easily explained. In other words, the No Cause Law is redundant. An advantage of this analysis is, that *when* remains temporally defined. The No Cause Law suggests that *when* may be understood causally (in the opposite direction), although a causal definition is not provided. It is not a good idea to define a 'Cause Law' for *when*, for its causal interpretation is dependent on world knowledge, like the Push Causal Law. *When* is interpreted causally due to causal laws (world knowledge or lexical knowledge), and is restricted in that by its temporal 'just after' meaning. In this respect, *when* differs from *because*. This will be demonstrated now.

The second aspect of the No Cause Law is that it provides a way of defining causal implicatures for causal connectives. In particular, the definition shows that what is considered to be a '*causal* implicature' (Lascarides and Oberlander, 1993, p. 264) associated with a connective, can be stated in a law of DICE. Whether or not causal connectives have a presupposition is not under discussion here (see chapter 3).[23] It may simply be assumed that these presuppositions are implemented

[21] In the so called narrative interpretation of *when*, the main clause event starts before the *when* clause event has started: *Ajax was about to win when Feyenoord scored a goal.* This use of *when* is different from the meaning it is supposed to have in the No Cause Law.

[22] Perhaps, Causes precede Effects needs to be adjusted in such a way that instead of events, the initial states of events are used in the definition.

[23] The definition in (15) is supported by the classic definition of a presupposition: a proposition and its negation have the same presupposition. In this case, both $because(\beta, \alpha)$ and $\neg because(\beta, \alpha)$ should indefeasibly imply: $cause(e_\alpha, e_\beta)$. This is true, since $cause(e_\alpha, e_\beta)$ means 'normally, e_α causes e_β'. In the case of negation, the presupposition is still that in normal cases $cause(e_\alpha, e_\beta)$, only in this specific case it is different.

the same way as the causal implicature for the No Cause Law. In fact, the formulation of this rule is very simple. It is stated in the *Because* Law, in (15).

(15) *Because* Law
$because(\beta, \alpha) \rightarrow cause(e_\alpha, e_\beta)$,
where $because(\beta, \alpha)$ reads: β *because* α.

In a discourse *Max fell, because John pushed him*, the *Because* Law indefeasibly implies that the event of *John pushed him* causes the event of *Max fell*.[24]

The indefeasibility of the linguistic knowledge that *because* has a presupposition, does not mean that the knowledge itself has become indefeasible. This can be made explicit by showing that the cause predicate can be translated into the presupposition of *because* given in chapter 3. The definition in (16) states that the *cause* predicate from (15) may be translated into the defeasible implication defined for the presupposition of *because*.

(16) Definition: $cause(e_\alpha, e_\beta) \approx (e_\alpha > e_\beta)$

The translation in (16) may be regarded as equivalent to $\alpha' > \beta'$, the notation used in the previous chapter for the presupposition of *because*.[25]

Most important in (15) is that the implication is indefeasible, as is expressed by the $\rightarrow$. It means that the *cause* predicate must hold, for any occurrence of *because*. As explained with regard to (16), it does not mean that the causality itself must be a universal truth: the translation is referring to defeasible knowledge. Even if there were no defined relation between pushing and falling, the defeasible implication may be derived, and the indefeasible *Because* Law is satisfied. Epistemic interpretation is allowed too: the presupposition that was defined in the previous chapter may represent it. What is not allowed, however, is the case in which it is not possible to derive a defeasible implication at all (in section 2.4 in chapter 2, this was defined as not satisfying an INUS condition). This results in an unacceptable discourse.

[24]Lascarides & Asher (1995, p. 80) changed the Axiom on Explanation into $Explanation(\alpha, \beta) \rightarrow cause(e_\beta, e_\alpha)$. They merged the Push Causal Law (table 4.3) and the discourse relation Explanation (table 4.1) into the 'Push Explanation Law': $(\langle \tau, \alpha, \beta \rangle \wedge fall(e_\alpha, m) \wedge push(e_\beta, j, m)) > Explanation(\alpha, \beta)$. The consequent of this rule is subject to Causes Precede Effects. Other axioms on causal discourse relations may change this way too, so that constraint on temporal order of events in causal relations is provided by Causes Precede Effects only. The Because Law in (15), is almost identical to the new axiom on Explanation, although the differences between assuming Explanation and signalling *because* are significant.

[25]The equation of the main eventuality e_α of a clause and the proposition α', derived from a clause by generalization or implication need not be the same. To describe the differences and similarities between the two notions goes beyond the scope of this chapter. They are assumed to be the same, but they play different roles in their representations.

It is interesting to compare the way in which $cause(e_\alpha, e_\beta)$ is derived indefeasibly, with the Push Causal Law. The Push Causal Law is repeated here (taken from table 4.3) in (17). (α and β reversed for presentational reasons).

(17) Push Causal Law
$\langle \tau, \beta, \alpha \rangle \ \wedge \ fall(m, e_\beta) \ \wedge \ push(j, m, e_\alpha) \ > \ cause(e_\alpha, e_\beta)$

In (17), the assumption of $cause(e_\alpha, e_\beta)$ is dependent on the lexical meanings of *to fall* and *to push*, and contextual restrictions. These have to be related causally. There is no reason why the lexical meanings should relate, other than their co-occurrence, so there must be some lexical rule associating the relevant fields in the lexical meaning structures (cf. Lascarides et al., 1996, using Pustejovsky, 1991). In other words, work needs to be done in the lexicon, before the Push Causal Law is derived.

In (15), $cause(e_\alpha, e_\beta)$ is given in any circumstance, no matter what the events refer to, or what context restrictions there are (although context or word meaning may give rise to epistemic or speech act interpretation). As a consequence, *to push* and *to fall* are connected in the lexicon, with the explicit instruction to find some sense of the meanings of these lexical items that could support the causal relation. Pustejovsky (1991) analyzes the structure of lexical items in a lexicon. Words may have roles associated with them, specifying for instance the purpose of a word, or the effect it may have when they are used in a certain context. When the connection between two lexical items for a specific role can be made, a causal relation is supported. The structure of the lexical items takes care of finding more common roles before less common roles are found.

Derivation of the Push Causal Law on the basis of two sentences without causal connectives, has to be extracted from the lexical meanings of *to push* and *to fall*, without the instruction to understand it causally.[26] The only thing that can happen (if no other contextual factors play a role) is that the two lexical items each find a role that suits the other item best. Asher and Lascarides (1995) assign to the verb *push* a feature structure containing lexical meaning aspects, in a structure like Pustejovsky's. When *push* is understood in a locative sense, it may cause a patient to change its location by force (or: *loc(cause-change-force)*. In the case of (3), the patient is *Max*, and his falling is the locative change that has been made. Meaning aspects of *to push* are thus incorporated in *to fall*.

[26] Of course, there are other indicators of causality. For instance, a pluperfect in the second clause gives rise to an Explanation, Elaboration, Parallel or Contrast. The interpretation of the lexical meanings in the lexicon will be restricted by these coherence relations. And indeed, such an implicature is defined in Lascarides and Asher (1993). Pluperfect thus operates analogous to causal connectives (only choices for different interpretations are rather minimal for *because*).

The coherence relation that is obtained from this connection of the roles might be causal, but it might be something else as well. Given *to push* and *to fall*, this is a causal relation. However, when *to push* is not taken in a locative sense, for instance when it means *to encourage*, it will not be associated with *to fall* in a causal relation. Contextual factors may determine these changes, as (18) shows.

(18) Max was afraid to do a talk. John pushed him.

In (18), there is no causal relation. *John pushed him* is interpreted as Narration, as the story of Max's talk is continued.[27] The two senses of *to push* mentioned here, are both subtypes of the meaning of the word *to push*.

In a derivation with *because*, those meanings that give rise to a causal relation are determined, whether they are preferred or not. In the sentence: *John pushed Max, because he was afraid to do a talk*, the same connotation is used for *to push* as in (18). The cause-effect interpretation, which was not preferred in (18), is necessitated here.

The inference of a causal relation in discourse is obtained by different processes in the lexicon: by means of a causal connective, putting relevant senses of lexical items together, or by association of more common senses of lexical items in the lexicon, that might be causally related. These two processes have the following differences:

- Deriving a causal relation by association of common senses of lexical items is more complex than selecting senses of lexical items on the basis of a specified causal relation;
- a causal relation derived from the lexicon may be less certain than a causal relation given by a causal connective.

That a derivation is more complex means that it takes more computational effort for a system like DICE, or, mutatis mutandis, inferential effort for a reader. An example of a less certain causal relation is the relation that has to be inferred in (1): not only may the relation between beauty and marriage be interpreted ambiguously, namely as an Explanation or a Result, but the knowledge supporting the relation is also less certain.[28]

These two effects are effects that come about in DICE as well as in the observation of natural language. An extension of DICE with (15), thus means a closer connection of DICE to linguistic facts, and an explanation for the relative 'inferential effort'.

Given the assumption that causal connectives have their own laws, based on presuppositions, the *fall* and *push* examples in their different

[27] Perhaps, a causal relation could be that John pushed Max as an effect of Max being afraid. But that would be a far-fetched interpretation.

[28] Less certain knowledge does not refer to an ontological status of the knowledge: it refers to a degree of certainty that a reader will assign to its inference.

contexts can be revisited, to see if a difference between inference with or without connectives can be made. This will be done in the next section.

4.5.3 Enforced and defeated

In this section, the derivations of the examples (9) and (10) are presented, making use of the *Because* Law. The differences with their connectiveless counterparts will be discussed. It will appear that discourses with a causal connective are interpreted differently than the same discourses without such a connective. Besides, it will appear that calculating coherence using causal connectives takes the burden of deriving laws from lexical knowledge away. This will give a considerable saving on the inferential effort it takes to derive knowledge from the lexicon in order to interpret a discourse.

Given the *Because* law, the differences between example (7) and (9) can be accounted for. Due to the occurrence of *because* in (9), the *Because* Law is executed. This means, that when *Max fell* is represented as e_β and *John pushed him* as e_α, a cause predicate $cause(e_\alpha, e_\beta)$ is assumed indefeasibly. This can be done without any prior knowledge on pushing and falling: it is just the presupposition of *because*. Of course, in the lexicon, support has to be found for e_α as a cause for e_β. Since this relation between pushing and falling is more preferred in the lexicon than other relations (witness the fact that a Push Causal Law can be derived from the lexical items), this will not give any problems. Even if there were only weak support for a causal relation, it would be established as such, because it is given that the relation be causal.

The assumption of $cause(e_\alpha, e_\beta)$, creates a problem for Maintain Causal Trajectory has been executed as well. The assumption of Maintain Causal Trajectory means that $\neg cause(\alpha, \beta)$ should be the case. This contradicts the causal relation made on the basis of the *Because* Law. An irresolvable conflict is created: the consequences of two rules are in conflict. This activates the Nixon Diamond, and an irresolvable conflict is the result (see table 4.5). In (7), this caused a state of inertia, because it was not possible to find an alternative interpretation, and a discourse pop was impossible. In (9), the problem is worse: according to the Nixon Diamond, $cause(\alpha, \beta)$ may not be assumed (this is the same as with the discourse in (7)), but according to the *Because Law*, it may not be defeated. This makes the discourse inconsistent. The derivation of Narration by application of Inertia is not initiated, because there is not a situation in which no coherence is achieved, but one in which an inconsistency has occurred. Therefore, the discourse in (9) is unacceptable.

An example of a discourse quite similar to (9), with respect to the application of causal laws, is given in (10). The similarity of (9) and (10) creates a problem: the discourse in (9) is unacceptable, the discourse in (10) is not. Lascarides and Oberlander (1993) present (10) to illustrate

that Maintain Causal Trajectory is defeasible. That this law is defeasible, is undoubtedly true, and that it is defeated, is true when both the causes *draw the blinds* and *switched off the light* are assumed as a cause for *the room went pitch dark*. This seems to be the case. This raises the question why Maintain Causal Trajectory is defeated in (10), but not in (9).

In order to answer this question, the laws that are involved with (10) have to be introduced. The Light Switch Law and the Blinds Law are laws that have been derived from the lexicon, on the basis of the occurrence of the lexical items that determine the events in the clauses. That they are causal is due to the fact that the association of, e.g., switching off the light and becoming dark results in a selection of a subtype of meaning (or: a role) for each lexical item, such that a causal relation between the two events is supported. Likewise, a Blinds Law is formulated. These laws are formed within the context of (10), using lexical knowledge. There is no need to define a causal law for *since*, since it would be identical to the *Because* Law. Sharing one causal law does not mean that *since* and *because* are identical; *since* has especially different properties in an argumentative sense (Elhadad and McKeown, 1989). Differences between *since* and *because* are not relevant for the differences between (9) and (10).

It could be the case, that the difference between (9) and (10) lies in the kind of knowledge that the causal laws represent. In order to check this, it is useful to look at (10) without the connective *since* (or the particle *too*). This is done in (19).

(19) a. Max switched off the light.
b. The room went pitch dark.
c. (?) He had drawn the blinds.

The discourse in (19) is acceptable to some, but unacceptable to others.[29] This is due to individual choice: instead of defeating Maintain Causal Trajectory, the Blinds Law may be defeated in (19c). Defeating Causal Trajectory means that the discourse will be acceptable. Defeating the Blinds Law will be possible only through the Nixon Diamond: the contextual indication to withdraw the Blinds Law is given by Maintain Causal Trajectory that forbids *he had drawn the blinds* to be the (second) cause for *the room went pitch dark*. In (7), the narrative pattern caused Inertia to assume a Narration between *Max fell* and *John pushed him*; in (19), this is impossible because the pluperfect *had drawn* does not allow for Narration (cf. Lascarides and Asher, 1993). In sum, defeating Maintain Causal Trajectory results in an acceptable discourse; defeating the Blinds Law results in an unacceptable discourse; individual preferences determine the acceptability in (19).

[29] A little survey amongst five trained linguists was held, with two native speakers and three English language teachers. Fifteen trained linguists judged the Dutch translations, showing similar results.

The preferences to defeat one law or another are probably based on knowledge on darkening rooms and contextual knowledge: a room does not darken when the lights are switched off in the daylight (whether it is day or night is a matter of context, of course), but it does when the blinds are drawn. It is the incompleteness of the first cause that determines the acceptability of the second cause (see also section 2.4 in chapter 2).[30] In (7), giving someone a sharp blow in the neck is rather complete, within the circumstances, as a cause for falling, so an additional cause is not easily accepted (and the narrative discourse pattern does not encourage an additional explanation). When the observation with respect to the acceptability of (19) is correct, the conclusion may be drawn that the defeasibility of Maintain Causal Trajectory is dependent on the completeness of the cause: the less complete the first cause is, the more defeasible the Law gets. This is not worked out formally here. Judgments on the completeness of a cause are very individual, so the diverging judgments in (19) are explained this way.

In (20), the discourse is shown with *since* inserted, but *too* omitted.

(20) a. Max switched off the light.
b. The room went pitch dark,
c. (?) since he had drawn the blinds.

The acceptability judgments were mixed again: those who found (19c) unacceptable, found (20c) even worse; those who found (19c) acceptable, found (20c) even better. This outcome is expected, when the incompleteness of the first cause is taken to be individually determined: when it is judged as complete, the Nixon Diamond will ban the cause in (20c), but it is indefeasible; when Maintain Causal Trajectory is defeated, an additional cause is indefeasibly assumed without any problems. That the judgments on (20) are identical to (19), only more secure, is due to the presence of *since*. It is immediately clear what the relation between (20b) and (20c) is, and there is no possibility to defeat it. This latter property has the effect that Maintain Causal Trajectory is easier defeated, or that the Nixon Diamond results in inconsistency, rather than 'no relation possible'.

(10) is generally judged as acceptable. It seems that Maintain Causal Trajectory is defeated here in an explicit manner. The Blinds Law is not defeated here. Apparently, Maintain Causal Trajectory is defeated in order to make an acceptable discourse. The indefeasible assumption of

[30]The incompleteness of the first cause, relative to the second, predicts that the discourse in (19) will become more unacceptable (in its two causes-interpretation) when the clauses expressing the causes are reversed: it has become harder to imagine alternatives for the first cause causes. The discourse with reversed causes is given in (i).

(i) a. Max had drawn the blinds.
b. The room went pitch dark.
c. (?) He switched off the light.

a causal relation in (10), due to the *Because* Law (activated by *since*), is not involved in an irresolvable conflict through the Nixon Diamond. Apparently, the presence of *too* indicates that the second cause needs to be an additional cause for the effect in (10b). *Too* indicates that the explanation is additional to the cause in (10a). This effect is explained by the assumption that *too* presupposes an event similar to the event in the sentence in which it occurs (cf. Bos, 1994). (10a) is, due to *too*, anaphorically bound as a similar event to the explanatory (10c). This means, that Maintain Causal Trajectory is defeated, for the events in (10a) and (10c) have been linguistically indicated as causes, thereby defeating Maintain Causal Trajectory.

The explanation for the acceptability of (10) thus has two aspects: the incompleteness of the cause in the first clause makes it possible to have an additional cause, and *too* indicates that in interpreting (10c), (10a) should be taken as an additional explanation. The presence of *since* in combination with *too* defeats Maintain Causal Trajectory.

The difference with (9) is explained in three different circumstances: the narrative discourse pattern in (9), an incomplete cause in (10) and the presence of *too* in (10c). *Since* and *because* both obey the *Because* Law, and both connectives play the same role in the interpretation of the two discourses.

The introduction of an indefeasible law for causal connectives is both necessary and possible in DICE. This assumption explains why causal relations depend less on knowledge derived from the lexicon, and at the same time establish causal relations that are more certain, even with respect to the knowledge supporting the causal relation. Causal connectives are not just linguistic indicators of coherence, but they enforce coherence by means of the *Because* Law, and other laws, as will be shown below. This enforcement gives different effects for discourses with and discourses without a causal connective. Two different discourses have been shown: the discourse concerning falling and pushing ((7) and (9)), and the discourse concerning the dark room ((10) and (19/20)). The connective in (9) made the discourse that was acceptable without connective in (7) inconsistent, because a causal relation was indefeasibly assumed where two clauses could not be connected causally. In (19), the discourse without *since* was acceptable to some and unacceptable to others, depending on the valuation of the incompleteness of the first cause; adding *since* on a position banned by the Nixon Diamond, makes both valuations stronger, depending on the rejection of Maintain Causal Trajectory. In (10), addition of *too* established a reading in which Maintain Causal Trajectory is defeated. Thus, the assumption of a causal law for *because* and *since* is supported by the facts.

More generally, it is possible to connect several kinds of implicatures to the system: presuppositions of temporal subclauses (as in Lascarides and Oberlander, 1993), conversational implicatures of connectives like *when* (ibid.), presuppositions of causal connectives (e.g., (15)) and the

presupposition of *too* (cf. Bos, 1994).[31]

Inference of a causal relation without linguistic marking, through a causal law, is context dependent and derived from the lexicon. The inference of a causal relation through a presupposition of a causal connective, and to a lesser extent of implicatures of other lexical items, is independent of context, and supported in the lexicon in a specific way. The former kind of inference is using lexical and world knowledge, the second kind is implied by linguistic properties of the utterance. This means that the former kind of inference is much more expensive than the latter kind. Presuppositions thus have an important function in inferring coherence relations in DICE. More laws of linguistic knowledge means less inferential effort for DICE.

4.5.4 *Although* in DICE

In the introduction, Greta Garbo was used to exemplify the problem of deriving causal laws from propositional contents, without using laws of causal connectives. Is the assumption of a law for *although* indeed solving the problem formulated there? In (21), the Greta Garbo sentences are repeated: in (21a), without connective; in (21b), with *although*.

(21) a. Greta Garbo was called the yardstick of beauty. She never married.

b. Although Greta Garbo was called the yardstick of beauty, she never married.

Two differences between (21a) and (21b) are discussed in this section. The first difference is concerned with the ambiguity of (21a): it may be Result or Explanation in (21a), whereas in (21b) a denial of expectation is obligatory.[32] The second difference is the certainty of the lexical or world knowledge used in both sentences: although in (21a), the lexicon itself selects relations that derive causal knowledge, the knowledge supporting the relation in (21b) seems to be much more certain than the knowledge supporting (21a).

A Result is derived in (21a), when lexical knowledge is used to derive a causal law. This law should express that 'normally, if a woman is beautiful, and she does not marry, it is her beauty that causes her to be unmarried'. This law is much weaker than, e.g., the Push Causal Law and the Light Switch Law. The knowledge of the latter laws might be considered rather stable: the knowledge is shared amongst the majority of the people, and it is not difficult to derive it from the lexical meanings it consists of, given a lexicon structured like Pustejovsky's (1991): the roles of *to push* and *to fall* that need to be selected for the 'Push

[31] The presupposition is not worked out in terms of a law, but it should be, regarding its effect on the discourse.

[32] In other examples, *although* may also indicate a concession. This problem will be discussed later on in this section.

Causal Law' are easily found in each structured lexical entries. This is different for a 'beautiful women do not marry' law: only in a specific context-bound sense, this law can be derived. To associate lexical items of *to be beautiful* and *to marry* in a way such that 'beautiful women do not marry' makes sense, two roles must be selected that are not prominently available: in a substructure of the lexical item *to be beautiful*, the meaning aspect of 'to be morally or intellectually impressive' (*The concise Oxford Dictionary*, 1911) might be capable of making the right connection: 'impressive women do not marry' seems to be slightly better, although it still needs to be taken very specific in a certain context. In sum, it is not easy to derive a Result from (21a). This makes it difficult to understand why a Result is derived in the first place.

An Explanation could also be derived in (21a). In that case, a law should be derived that says that 'normally, if a woman never marries, and she is beautiful, then being unmarried causes her beauty (or: maintains her beauty)'. Also here, the relation that is expressed is very weak, and it is not imaginable that the lexicon would derive such a causal relation without specific circumstance, provided by the context, or other 'external reasons'. Here, a meaning aspect of *to marry* may be used to make two roles fit together: *to marry* includes 'to be bound'. If you're not married, you're free. And if you're free, you will be beautiful. This argumentation needs a meaning aspect of being beautiful that expresses freedom. Another meaning aspect might be that *to marry* implies 'having children'. So, the association would be that not having children keeps you beautiful. Also this relation is weak.

It is not possible to assign a preference to one of the two relations, for in neither case it is likely that the combination of the two lexical items in the lexicon will result in a causal law of significant strength. So, there must be another reason. Lascarides et al. (1996) propose to assume three default rules, when interpreting text: Narration, Result and Elaboration.[33] A Result is derived by default, and only in case of a context supporting Explanation, Explanation is chosen.

This complex interpretation process of (21a) illustrates the difficulties of letting the lexicon derive causal laws. Not only is the interpretation itself ambiguous (or underspecified), but the knowledge used to build a causal law is very insecure, and not prominently available in the lexicon.

An advantage of using connectives is that the instruction to look for a causal relation in the lexicon makes it possible to look for less prominent meaning aspects in substructures: the outcome of the derivation is already established, to a certain extent.

The causal relation that is inferred from (21b) is given by the presupposition of *although*, and might be paraphrased as 'beautiful women

[33] It is not stated in laws of DICE, but argumentative orientation makes Result more preferred in this case, since *she never married* expresses a negative connotation, more than *she was called the yardstick of beauty* expresses a connotation of the speaker - due to the distant formulation 'was called'.

marry'. A formulation of the law that makes such assumptions whenever *although* is used, is given in 22.

(22) *Although* Law
$although(\beta, \alpha) \rightarrow cause(e_\alpha, \neg e_\beta) \parallel Conc(\alpha, \beta)$
where $although(\beta, \alpha)$ reads: $\beta\ although\ \alpha$

This law says that the occurrence of the proposition $\beta\ although\ \alpha$ indefeasibly leads to the assumption that either the event of α causes the negation of the event of β, or α and β are in a Concession relation.[34] A Concession relation will not be worked out here. The indefeasible implication of the *cause* predicate is translated into the defeasible implication given in chapter 3: this translation is defined in (23).

(23) Definition: $cause(e_\alpha, \neg e_\beta) \approx (e_\alpha > \neg e_\beta)$

The causal law is now immediately given as 'normally, if a woman is beautiful, she will marry'. Because there is no lexicon involved in deriving this rule, the knowledge it represents seems to be much more certain.

Meaning aspects of *to be beautiful* and *to marry* still are involved in the interpretation of the causal law. Only this time, the relation with respect to which they select their substructures is determined beforehand. In this case, a meaning aspect of 'beauty' has to be associated with the negation of a meaning aspect of 'marry'. Because it is already decided that the relation has to be causal, the knowledge supporting it seems more certain.

An alternative explanation for the more certain relation is that two meaning aspects from the lexical items were associated that were prominently available. In that case, the connective would not be responsible for the security of the knowledge. An argument against this alternative can be given by considering (24).

(24) Although Greta Garbo never married, she was called the yardstick of beauty.

(24) is an acceptable sentence. It gives rise to, again, another prejudice: 'unmarried women are not beautiful'. As a generic sentence, it is quite untenable: there are many young women who are both unmarried and beautiful. Still, the prejudice is derived without very much ado. Readers may wonder about the writer's opinions, but they do not hesitate to derive the prejudice. This can only be done because the causal relation is given by the connective, not because the lexicon is deriving the most salient connection between two lexical items. Two lexical meaning aspects do not need to be prominent, as long as there are two meaning aspects that may support the given causal relation.

[34] The symbol $\parallel$ represents an exclusive disjunction.

It is also possible to construct other variants of the Greta Garbo sentence with *although* that need other implicatures again. This is shown in (25).

(25) a. Although Greta Garbo was very beautiful, she was married.
b. Although Greta Garbo was unmarried, she was not very beautiful.

Sentence (25a) is acceptable.[35] The implicature that 'beautiful women do not marry' is interpreted here as if beautiful women do not need marriage: it is too much fun to remain single. Other interpretations might suit just as well. Sentence (25b) is acceptable, having a presupposition 'unmarried women are beautiful'. If these four interpretations were derived from the lexicon, only on the basis of more prominent meaning aspects in substructures, it would have taken a laborious and difficult selection process to obtain these relations, if possible at all. By taking the relations as given, through the *Although* Law, and selecting meaning aspects only to support the specific causal relation, the knowledge supporting the assumed coherence relation is unambiguous, and seems certain.[36]

The differences between (21b) and (21a) can now be explained in terms of the way knowledge is derived from the lexicon to make a causal law, or to support an explicitly specified causal law. In the former case, several coherence relations may be assumed, and the knowledge deriving the causal law does not seem certain; in the latter case, the relation is given and the knowledge seems certain.

Ambiguity does occur using connectives: in chapter 2 and 3, semantic, epistemic and speech act interpretation of coherence relations were distinguished. A choice for one interpretation will be presented as explicitly specified. When the lexicon is not capable of supporting the semantic causal relation, an epistemic relation is specified again. In every of the four interpretations in (21b), (24) and (25), a semantic denial of expectation has been made. Apparently, the chosen meaning aspects were enough for accepting the relation. Epistemic interpretation is not preferred. Within one interpretation, the relation is specific, and the knowledge seems certain.

[35] In both (25a) and (25b), *was called* has been left out, because it disturbs an interpretation based on 'Garbo being beautiful': an interpretation of 'Garbo being called something' is inferred. Why this is not the case in the other interpretations is probably due to the argumentative orientation - see footnote 33.

[36] The interpretation of the presupposition itself may be ambiguous: for instance, between denial of expectation and Concession. In that case, the procedure to let meaning aspects support the causal relation may fail, and the lexicon is consulted a second time, but now to support Concession. Recall from chapter 3 that often, context already indicates which relation should be chosen. It will often be the case that a Concession is tried immediately, because it is more in line with the context. Within the context of DICE, it is difficult to represent such a derivation, because the argumentative use of language is not defined in terms of coherence relations.

4.6 Conclusion

In this chapter, it has been shown what the differences are between explicitly marked discourse relations and unmarked relations, within the framework of DICE. This framework was chosen above other frameworks because it is specifically modelling the process of making inferences. This makes it possible to make the differences between inference with and without causal connectives explicit.

Causal coherence without marking is underspecified and supported by knowledge that seems to be uncertain. Causal relations, indicated by a causal connective are specific and supported by seemingly certain knowledge. This is even so using identical clauses with and without connectives (or negation and connectives), between which some causal relation is supposed to hold.

The difference between coherence with and without causal connectives is explained by the way causality is derived from the lexicon, within the framework of DICE and a structured lexicon as described in Pustejovsky (1991). Without connectives, the causality has to be initiated by the lexical items, associated with each other by the concatenated clauses. This means that the meaning aspects of both lexical items have to be prominently present in the substructure of each lexical item. If there is no causal relation initiated by the lexicon, there is no causal coherence in the text. With a causal connective like *because* or *since*, a causal relation is given. In the lexicon, meaning aspects between the lexical items are selected that support the causal relation, whether these are prominent or not. The effect is, that a causal relation with a causal connective is specifically causal in one direction (using a **B** operator in epistemic interpretation), and the knowledge that supports it, collected in the lexicon, seems certain. Without a connective, it is dependent on the lexical items which direction the relation will have, and the knowledge supporting it looks less certain, even if it is the same knowledge.

The system that is defined by DICE can be enriched by incorporating indefeasible laws for causal connectives, for defining linguistic knowledge with respect to discourse processes will enlighten the 'inferential effort' an automated reader has when making inferences from a text.

Chapter 5

Causality in Discourse Structure

5.1 Introduction

In chapter 3, it was argued that causal connectives bear presuppositions of a conditional form. In chapter 4, a distinction was made between inference with causal connectives and inference without linguistic markers. In this chapter, the effect of causal relations on discourse structure will be investigated. The phenomenon of reference by means of propositional anaphors is used as an instrument for obtaining information about discourse structure. It will appear that propositional anaphors may have different antecedents if their context consists of causally related clauses, instead of additively related clauses.

A propositional anaphor takes as its antecedent relevant contextual information. An example of this kind of reference is given in (1).

(1) The Artist Formerly Known as Prince was married yesterday at his residence. It was a big surprise for the media.

In the second sentence of (1), *it* refers to the marriage of Prince mentioned in the first. There is no nominal phrase like *the marriage* present, however. It is the event of the marriage, conceptualized in the first sentence, that serves as an antecedent for *it*. Anaphors like *it* in (1) do not always refer to events. In fact, is not very clear how the antecedent is conceptualized. Webber (1991) calls these anaphors 'deictic pronouns', Fraurud (1992) speaks of 'situational anaphors', and Asher (1993) calls these anaphors 'abstract object anaphors'. These different names all refer to the same property of these anaphors: their antecedents are not straightforwardly determined by means of systematic rules, but contextual factors and world knowledge play an important role.

Givón (1992) takes the notion 'mental proposition' as the basic unit of discourse processing:

> The basic unit of stored information in coherent discourse

> is the mental proposition that stands for some state or event (Givón, 1992, p. 7)

In this chapter, it will be assumed that mental propositions can be related to each other in a discourse structure, and that a mental proposition can be composed out of several other mental propositions. The notion of 'some state or event' is worked out more specifically. Thus, abstract objects and situations will be analyzed as mental propositions, represented as a node in a discourse structure.

The anaphor in (1) is called a 'propositional anaphor'. An important aspect of the identification of propositional anaphors is, that their antecedent is not present as a nominal. In (1), reference is not made to 'Prince's wedding', but to 'Prince married yesterday'.

Which antecedent is selected as the actual antecedent for a specific propositional anaphor, is not completely dependent on properties of discourse structure. Many factors may influence the choice of reference: the type of anaphor, the meaning of the sentence containing the anaphor, development of the topic of the discourse, relative distance between anaphor and antecedent (cf. Givón, 1992) and argumentative orientation of the writer.[1] In spoken discourse, intonation may easily alter the choice of an antecedent.

Next to all the other factors, discourse structure is important for determination of the antecedent of a propositional anaphor. Two aspects of discourse structure play an important role. The first is, that information that subsequent clauses reveal about a topic, needs to be abstracted into information representing the meaning of a set of clauses: this explains that reference can be made to antecedents not explicitly expressing (one of) the individual clauses. The other aspect of discourse structure is that it may restrict the possibilities for an antecedent to make abstracted information accessible. Discourse structure may define a set of possible antecedents. It is not always clear which antecedent will actually be selected. If there is not enough specific information, propositional anaphors may be ambiguous with respect to their antecedents. An example of such a discourse is given in (2), a garbled version of the Greta Garbo fragment. The Dutch example is followed by its English translation.

(2) Greta Garbo was al een legende tijdens haar leven. In 1951 werd zij Amerikaans staatsburger, drie jaar later kreeg zij een ere-Oscar. Greta Garbo is nooit getrouwd geweest, hoewel zij zeer mooi was. Dat maakte haar ongenaakbaar. Zij leidde een geïsoleerd bestaan in een flat te New York.

Greta Garbo was already a legend during her life. In 1951 she became an American citizen, three years later she received an

[1] Elhadad (1993) analyzes argumentative orientation in such a way that a discourse structure can be built, in which argumentative orientation determines hierarchy. From such structures, accessibility of possible antecedents can be derived.

> Oscar of honour. Greta Garbo never married, although she was very beautiful. That made her unattainable. She led a completely isolated life in a New York apartment.

It makes a difference for the interpretation, to which antecedent *dat* (*that*) refers. There are, potentially, three possibilities: to the whole sentence *Greta Garbo is nooit getrouwd geweest, hoewel zij zeer mooi was*, to its first clause only, or to its second clause only. The choice of antecedent has consequences for the interpretation of *dat maakte haar ongenaakbaar*. Reference to the whole sentence differs from reference to the first clause only. This has, however, no consequences for the interpretation of the sentence containing *dat*: the fact that Greta Garbo never married (although she was very beautiful) made her unattainable. Reference to just the second clause gives another interpretation: the fact that Greta Garbo was beautiful, made her unattainable (as a result of which she never married). The discourse is ambiguous with respect to the choice of antecedent. Since this choice is affected by several distinct factors, individual preferences for one or the other interpretation may arise.[2]

With respect to the analysis of (2), several processes are important. First, the identification of antecedents and the establishment of coherence relations are dependent of each other. Secondly, the representation of the whole *although* sentence in discourse structure when it serves as an antecedent for *dat* is a more abstract representation than the connection of the propositional contents of the two clauses. And thirdly, it has to be described how an anaphor identifies its antecedent.

Relational and referential coherence Relational coherence is established by identification of coherence relations in a discourse. Referential coherence is established by coreference of antecedents and anaphors in a discourse. In an overview of the literature on coherence in discourse, Noordman and Maes (1993) describe how referential coherence and relational coherence interact (see also Hobbs, 1979; Givón, 1992). Coreference is dependent of relational coherence, in cases such as (3a) and (3b) (adapted from Noordman and Maes, 1993).

(3) a. John met Pete, and he went to the bank.

b. John met Pete, because he went to the bank.

The parallel construction of the two conjoined clauses in (3a) yields a preference for the interpretation of *he* as *John* and *him* as *Pete*. In (3b), the identification of *he* is ambiguous: *Pete* or *John* is antecedent. The main difference between (3a) and (3b) is the coherence between the clauses of these sentences. Coherence relations influence referential coherence. The choice of antecedent may determine the coherence

[2] In the case at hand, the connotation of *unattainable* is crucial: is unattainability easily associated with beauty, or is it rather associated with being alone?

relation, in case of an underspecified or ambiguous relation between clauses.

The interactions between referential and relational coherence will be studied with respect to propositional anaphors. The effect is not as immediate as with the nominal anaphors in (3). If (1) is changed into (4), the antecedent of *it* does not change.

(4) The Artist Formerly Known as Prince was married yesterday at his residence, for it had to be a big surprise for the media.

Although the second sentence explains the first, instead of continuing it as a narration or a result, *it* still refers to 'Prince married yesterday'. In this chapter, it will appear that some other effects of relational coherence do influence reference of propositional anaphors.

Making abstract antecedents Besides the interaction of relational and referential coherence, the problem of the creation of an antecedent representing contextual information expressed in several clauses must be analyzed. Given the assumption that it should be possible to identify the antecedent of a propositional anaphor as a simple proposition, a more abstract meaning of this sentence must be identified as the antecedent.[3] Several discourse analysts have studied how this abstracted meaning is a result of combining the propositional contents of two clauses, restricted by the coherence relation that holds between the two clauses (e.g. Polanyi, 1988; Prüst, 1992; Asher, 1993). In Rhetorical Structure Theory (RST, e.g. Mann and Thompson, 1988), abstracted meaning of a group of clauses is represented as a proposition when a coherence relation connects this group to another group of clauses. Theories that will be discussed in this chapter differ from RST on some important points. The most important difference is, that in this chapter, abstracted meaning will be calculated from the coherence relation and propositional contents of the connected clauses.

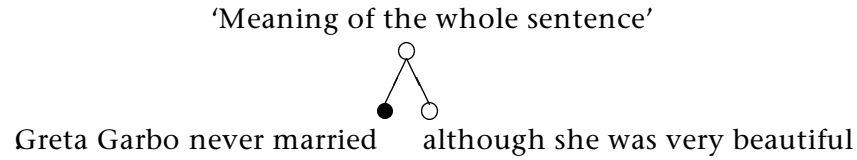
One way to build a discourse structure that forms and restricts antecedents for propositional anaphors, is by extending already formed structure with one clause at a time, while parsing a discourse. Adding a clause always happens under restriction of a coherence relation. The resulting representation is an incremental structure of propositions connected by means of coherence relations. On the basis of the constructing rules, abstracted meaning may be calculated. This discourse structure should then be capable of identifying antecedents of (propositional) anaphors.

A short introduction of the formation of the kind of structures used in this chapter will be given here. Suppose that all positions in a struc-

[3] It is not a condition on propositional anaphors that they only have a single proposition as antecedent. It can not be denied, however, that *that* does not refer to series of propositions: it will always abstract the meaning of several clauses into a single statement, or pick a specific clause.

ture are called constituents, and that their meaning is represented by a proposition. The structure in (5) contains three constituents.

(5)



The complex *although* sentence, taken as a whole, is then represented as a constituent. It dominates two other constituents, namely the clauses it consists of. Clauses are constituents in a terminal position: they represent the actual text. Reference to the sentence as a whole in (5) is defined as reference to the top constituent. The meaning that is represented in this top constituent is not necessarily the concatenation of the two propositions. Dependent of the coherence relation, the top constituent will contain meaning abstracted from the two clauses. In the case of (5), it is not immediately clear what the contents of the abstracted meaning should be. The coherence relation is a denial of expectation, but it has not been established yet to which extent the subordinative, causal or contrastive aspect of this relation contributes to the abstracted meaning.

Polanyi (1988) has defined the incremental structures that will be used in this chapter. The discourse structure represents the clauses in such a way, that they retain the order in which they occurred in the discourse. To make sure this order is preserved, clauses may be added to the structure only on the right hand side. With respect to the tree diagram in (5): the blank circles may be used to connect to a new clause; the black circle may not be used to connect to a new clause. In a larger tree, all the constituents that would occur on the branch from the top constituent to the right hand bottom constituent, can be used to connect to a new clause; none of the other constituents can be used for that purpose. Constituents on the branch from top to right hand bottom form together the 'right frontier'. The right frontier is by definition a restriction on extension of the incremental structure with newly added clauses. This kind of extension is called attachment.[4]

Identifying antecedents In order to analyze causal relations as a factor in the identification of antecedents of propositional anaphors, some restrictions must be applied on the discourse structures to be studied. The research will focus on pieces of discourse that are about one

[4]Attachment in the sense of adding clauses to an incremental discourse structure is not the same as the syntactic parsing strategy that is called 'minimal attachment' (Frazier, 1987), which amounts to assume as little clausal nodes as possible, when creating a syntactic structure of a sentence. Here, nodes in the discourse structure are minimally clauses, or else representations of several clauses.

topic, contain no push or pop markers that may shift pieces of discourse to larger structures, and do not tell stories (generating episodic structures). Givón (1992, p. 7) states that, from a text analyst's perspective, *(...) coherent discourse tends to maintain (...) (a) the same referent ("topic"); (b) the same or contiguous time; (c) the same or contiguous location; (d) sequential action.* This perspective on discourse will be adopted here.

The identification of antecedents of propositional anaphors in discourse structure is, according to Webber (1991), bound to a restriction. She claims that *(...) only segments of the discourse and regions of the discourse model that retain their identity are those that correspond to nodes on the right frontier* (Webber, 1991, p. 123/4). From the examples Webber (1991) presents, it may be inferred that the phrase 'retain their identity' implies 'may serve as antecedent for a propositional anaphor'. Information that is not represented on the right frontier does not retain its identity, and is not accessible for propositional reference anymore. In other words, only constituents on the right frontier are accessible, or 'open'. This restriction will be called here the 'right frontier restriction'. The right frontier restriction thus restrains relational coherence as well as coherence established by reference of propositional anaphors.

Questions Given the examples in 1, 2, and the discourse structure as it has been presented in this introduction, four questions will be formulated, to be answered in this chapter.

From the three possible antecedents for *that* in the English version of (2), only two are predicted by the right frontier restriction. The blank circles in (5) represent possible antecedents, as defined by Webber's (1991) interpretation of the right frontier restriction. The black circle (defined as 'closed' by the right frontier restriction) does not represent a possible antecedent. This is not corresponding with the intuition that it should be possible to refer to *Greta Garbo never married* with *that*.

Although the observation in (2) does not provide evidence in favor of the right frontier restriction, it can not be said that the right frontier restriction must be rejected. In Polanyi's (1988) grammar, construction rules determine the calculation of abstracted meaning. These rules determine which part of the propositional contents of a clause will be represented in the top constituent. Given the construction rule of 'Rhetorical Subordination', as defined in Prüst (1992), information from the main clause is represented in the top constituent.[5] Making reference to the top constituent in (5) thus boils down to making reference to the main clause. This might solve the problem of making

[5]Prüst (1992) does not define denial of expectation. Interpreting his rules, *although* indicates either Rhetorical Subordination or Contrast Pairs. With the latter rule, the top constituent would not get the desired interpretation. So, for the moment, Rhetorical Subordination is chosen.

reference to the main clause, but it does not seem to be possible to distinguish between reference to the main clause and reference to the whole sentence. With respect to examples like (2), one may ask: how can three interpretations be represented by two possible antecedents in the structure in (5)?

In (5), a discourse structure was taken to be the relevant representation for identification of the antecedents of *dat*. But according to Maes (1997), the antecedent of *dat* is to a large extent determined by two other factors: its own properties as an anaphor, and the meaning of the sentence containing *dat*. Anaphors like *dat*, and *het*, used as propositional anaphor, may or may not refer specifically to one clause. This is partly determined by their own nature: *het* is referring non-specifically in its common usage as a propositional anaphor; *dat* is usually referring to one specific clause. Applied to the tree in (5), *dat* refers preferably to one of the bottom circles, and rather not to the top circle. *Het* refers preferably to the top node, representing the least specific meaning. However, the meaning of the sentence containing *dat* may cause that *dat* refers non-specifically, and the meaning of a sentence containing *het* may cause that *het* refers specifically. In case of non-specific reference, the most obvious referent will be chosen. The most obvious referent can be defined as the antecedent that is most vague and closest to the anaphor. The antecedent will be, in terms of the structure in (5), a clause from the right frontier; the vaguest antecedent will be an antecedent with abstracted meaning (not a constituent on a terminal level). Little is known about the behaviour of these marked (specific) and unmarked (non-specific) anaphors. The question of interest for this chapter is: do marked anaphors refer to clauses (i.e., terminal constituents), even if a violation of the right frontier is involved?

The right frontier restriction holds by definition for attachment. As a restriction on antecedents of propositional anaphors, it is based on Webber's (1991) observation. If evidence can be given that the right frontier restriction does not hold for possible antecedents, an important question is: what are characteristic properties of right frontier restriction violations?

In making discourse structure, relational coherence is crucial for the calculation of abstracted meaning. With respect to (5), it was already suggested that assuming Rhetorical Subordination as a construction rule, made it possible to refer to the main clause via the top constituent. In the construction rules of Prüst (1992), coherence relations play an important role, but the notion of causality is not associated with one of these rules. However, connectives like *because* are typically associated with Rhetorical Subordination, and connectives like *therefore* with Rhetorical Coordination. What is the role of causality in these construction rules? In more general terms: what is the role of causal connectives in abstracted meaning?

In sum, the questions are listed here.

1. how can different interpretations of a discourse be represented by structures like (5)?

2. do marked anaphors refer to specific clauses, irrespective of their position in a tree structure?

3. what are characteristic properties of right frontier restriction violations?

4. what is the role of causal connectives in abstracted meaning?

The answers to these questions will lead to the claim that causality affects the availability of antecedents for propositional anaphors in discourse structure. Available antecedents are defined as open constituents in discourse structure; other factors (e.g., the markedness of the anaphor) determine the actual antecedent.

The first three questions will receive an answer in section 5.2, based on facts from English and Dutch, that show that reference to a clause in the discourse, but not on the right frontier, is possible. These facts appear to have in common that the antecedent is always part of a causal relation.

Question four will be answered in section 5.3, where the Linguistic Discourse Model (LDM Polanyi, 1988; Prüst, 1992) is introduced. LDM is designed to make calculations of abstracted meaning. Some improvements of the model will be proposed, in order to give a better account of the phenomena studied in section 5.2.

In section 5.4, a crucial example will be analyzed in the framework of LDM, in order to show that the changes made in section 5.3 give a better account of the phenomena.

5.2 Open constituents in discourse structure

5.2.1 Introduction

In this section, phenomena will be discussed that give an answer to the first three questions formulated in the introduction of this chapter. More specifically, the relation between causality and open constituents in discourse structure will be investigated. First, literature is discussed that presents apparent violations of the right frontier restriction (section 5.2.2). Then, complex antecedents of a VP anaphor are discussed, using rebuttals to identify the antecedent (section 5.2.3). To corroborate the phenomena presented in English, a specific Dutch propositional anaphor, *er* (*there*), is taken to examine the effects of causal relations on antecedent choice (section 5.2.4) in Dutch.

5.2.2 Propositional anaphors in discourse structure

Webber's (1991) observation has been attacked in a few publications. Maes (1997), Fraurud (1992) and Hellman and Dahl (1994) give counterexamples to the restriction that propositional anaphors may refer only to discourse constituents that occur on the right frontier. The most important claim they make is, that reference of an anaphor is determined by the propositional contents of the sentence containing the anaphor. An example of this kind of determination is given in (6) (adapted from Maes, 1997).

(6) a. Don't hit other kids. It is not a nice thing to do.
b. Don't hit other kids. It will make you more popular.

The antecedent of *it* in (6a) differs from the antecedent in (6b). The event *it* refers to, is a hitting event in (6a), whereas *it* refers to a property of non-hitting, attributed to *you* in (6b). It is not difficult to collect many examples of propositional anaphors, in which the predication of the anaphor determines to a large extent the antecedent.

In this section, the claim will be made that besides the fact that propositional anaphors select antecedents on the basis of other information than found in the preceding context, it is the structure of discourse that restricts the possibilities for these antecedents (and causality has an effect on this restriction). Discourse structure defines open constituents; other factors determine the actual antecedent.

The identification of *it* in (6a) or (6b) is not dependent on discourse structure. In both sentences, the antecedent is the same open constituent: the rightmost clause, before attachment of the second clause in the discourses in (6) took place. Why the anaphor in (6a) is allowed to extract its antecedent from the scope of negation, is a question that will not be answered in this chapter.

Before the data in Hellman and Dahl (1994) and Fraurud (1992) are discussed, the difference between marked and unmarked anaphors will be discussed in more detail. It is important to distinguish between these two types of anaphors, because they make use of the preceding context in different ways, according to Maes (1997).

Marked and unmarked propositional anaphors

In Maes (1997), differences between the use of Dutch *het* (*it*) and Dutch *dat* (*that*) as propositional anaphors are discussed. In many cases, *dat* and *het* can be substituted for each other, but in some cases they can not. In (7a), it is possible to substitute one for the other; in (7b), *dat* in the second sentence needs to preceed *het* in the third; in (7c) and (7d), it is impossible to substitute one for the other (examples taken from Maes, 1997).

(7) a. Zou Jan thuis zijn? Het/dat valt te betwijfelen.
Would John at home be? It/that is doubtful.

b. Burt Lancaster is gisteren gestorven. Dat was het belangrijkste nieuws vanmorgen. Het pakte me.
Burt Lancaster yesterday died. That was the most important news this morning. It struck me.

c. Hij vroeg me geld, en dat/*het terwijl hij stinkend rijk is.
He asked me for money, and that/it while he stinking rich is.

d. Het/*dat is bekend dat politici liegen.
It/that is well-known that politicians lie.

In (7a), *het* and *dat* may be substituted for each other, with hardly any difference in meaning. In both cases, an affirmative answer to the question is the antecedent of the anaphor. The occurrences of *het* and *dat* in the discourse of (7b) should be in this order: first *dat*, then *het*. In (7c), it is impossible to use *het* as an anaphor for the previous clause, and in (7d), it is impossible to use *dat* cataphorically, referring to the subject clause *dat politici liegen*.

Het and *dat* can be substituted in (7a). The antecedent is a hypothetical affirmative answer to the question in the first clause. A paraphrase of the second clause could read: *dat Jan thuis is valt te betwijfelen*. ('that John is at home is doubtful'). In this case, the antecedent needs to be inferred from the context, c.q. the question in the first clause, since there are no other possible antecedents. There is no difference between *het* and *dat* in this respect.

In (7b), the context does contain a clause that might serve as an antecedent for a propositional antecedent. *Dat* refers to the previous clause. *Het* in the third sentence does not refer to the previous clause: *dat was het belangrijkste nieuws vanmorgen*. *Het* refers to the situation that 'it was made public that Burt Lancaster died.' It is not a specific clause that represents the antecedent, but a proposition representing information abstracted from the context as a whole. *Het* and *dat* can not be exchanged in (7b). In the discourse *Burt Lancaster is gisteren gestorven. Het was het belangrijkste nieuws vanmorgen*, *het* refers to the preceding clause, because it is the only context available. One can not continue this discourse with *dat pakte me*, because the anaphor *dat* preferably takes a specific clause as an antecedent. However, it would not make sense to refer to *het was het belangrijkste nieuws vanmorgen*. The predicate *pakte me* dictates that the antecedent must be an event having some impact, and from the two sentences in the context of *dat*, it is surely the first that has more impact than the second. There is no good reason, other than the right frontier restriction, that keeps *dat* from referring to the first clause. From this analysis of (7b), three

conclusions may be drawn: *Het* just takes what it gets as an antecedent; *dat* refers to a specific clause; this specific clause must be part of the right frontier (which means that it will be always the directly preceding clause to which *dat* refers).[6]

In (7c), the construction *en dat (...)* gives the anaphor *dat* a focus position in the sentence. The connective *terwijl* introduces a subordinate clause that modifies a main clause. This causes *dat* to represent a clause as a linguistic element rather than a semantic object. A literal substitution of the main clause for *en dat* renders the same interpretation (but without the focal effect): *Hij vroeg me geld terwijl hij stinkend rijk is* ('he asked me for money, while he is stinking rich'). *Het* can not occur on this focus position, regardless of the antecedent. At the same time, the anaphor *dat*, in focus position, is required to have a specific antecedent.

In (7d), *het* can be used cataphorically, but *dat* can not. In other words: *dat* is in need for an antecedent, be it deictic or in context, but it can not have a 'postcedent'. On the other hand, *het* is free to take an antecedent or a postcedent, or a deictic element. Again, the conclusion is that *het* takes what it gets, but *dat* is more specific in its choice.

Maes (1997) analyzes the use of *het* as depending on the anaphor-context: if the context gives rise to a satisfying antecedent, *het* will use it as such. The use of *dat* is depending on the recognition of a specific antecedent. *Dat* needs an antecedent, that is preferably recognized on the grounds of its linguistic properties. *Het* may be called an unmarked anaphor, for it does not really need an antecedent. The antecedent may be anything that fits. *Dat* is called a marked anaphor, for it needs a specified antecedent in its context.[7] If it is present, *dat* makes a connection with it. In the analysis of Maes (1997), it is not only the type of anaphor that determines the antecedent: other factors, like the availability of suitable antecedents in the context, or specification of the contents of the anaphor in the sentence that contains it, play an important role.

Unmarked anaphors are in fact underspecified anaphors: there are no specific constraints on the semantic content of the anaphor. Therefore, the anaphor takes antecedents that are highly accessible. These antecedents should be close to the anaphor, and may represent less specific meaning than propositional contents of clauses. In terms of discourse structure, antecedents of unmarked anaphors can be found

[6] Exceptions to this conclusion are formed by cases like (7b). As will be argued in this chapter, the causal relation in (7b) (and similar cases) is responsible for this exceptional behaviour.

[7] In Givón (1992, p. 24) the notions of marked and unmarked are used with respect to the way nominal anaphors activate their referent. Unmarked means 'take the default referent'; marked means 'take a non-default referent', from the set of referents available from context. Here, an unmarked anaphor takes the default antecedent, which is the proposition that most saliently represents a relevant part of the discourse. Marked anaphors are non-default in that they prefer a specific antecedent, i.e. a proposition that is recognized as a linguistic element, e.g. a clause in context.

on the right frontier. These antecedents are less specific (when they represent abstractions of clauses), and they are always close to the anaphor (there are no specific clauses between the antecedent and anaphor).

Marked anaphors prefer specific antecedents, recognizable as a clause in context. On the right frontier, only the rightmost (terminal) node represents such a specific antecedent. There may, of course, be other clauses in context to which a marked anaphor could refer. The right frontier restriction forbids such reference, however.

From Maes's (1997) analysis, a test can be derived to check whether or not the right frontier restriction is empirically adequate. If the predication of a marked anaphor is specifying reference to an antecedent in the previous context that does not occur on the right frontier, the right frontier restriction predicts that the discourse is unacceptable. An acceptable discourse, in this configuration, means that the right frontier restriction is making a wrong prediction.

The distinction between marked and unmarked propositional anaphors also exists in English. *That* may be regarded as marked, and *it* as unmarked, but these anaphors sometimes behave differently in specific contexts, compared to Dutch *dat* and *het*.

An example of the use of *that* is provided in (8) (taken from Givón, 1992, p. 40).

(8) So I told him all about it and at the end he too agreed with me. So we parted as friends. And *that*, believe it or not, was all that happened.

Givón (1992, p.40) claims that the reference of this use of *that* is a wide and hard to delimit thematic chunk of the stored text. Indeed, *that* refers here to its context as a whole. This is not because *that* is an unmarked anaphor, however. In (8), *that* is the subject of the sentence: *... that, ..., was all that happened*. The use of *all* is crucial here for the determination of the antecedent: *that* must refer to all that happened, not a part of what has happened. If the last sentence were: *and that was a great relief*, *that* would refer to *so we parted as friends*. The example in (8) is thus an example of how the predication of the anaphor may alter the antecedent of a propositional anaphor.

One may ask what referents may be assigned to the two occurrences of *it* in (8) (Givón, 1992 does not discuss them). The first refers to a situation that the reader is supposed to have knowledge about (but a lack of context does not give us this referent). The second occurrence refers cataphorically to *[And that] was all that happened*. Cataphoric use of Dutch *het* was taken to be an indication of its unmarkedness. Likewise, cataphoric use of English *it* indicates its unmarkedness. (9) is a translation of (7d).

(9) It/*that is a well-known fact that politicians lie.

The acceptability of using *it*, but not *that* in (9) leads to the assumption that the English propositional anaphor *it* is unmarked. Compared to *that*, *it* appears to be an unmarked anaphor, that just takes what it gets.

The propositional anaphor *this* seems to have the same properties as *that*. A difference is that the antecedent's referent is expected to be closer (in space or time) to the antecedent (Swan, 1980, p. 603). Another difference between *this* and *that* is, that it can be used cataphorically, as the discourse in (10) shows (taken from Givón, 1992, p. 40).

(10) ...*That* is all I'm going to tell you. Now *this* is what I want you to do...

The cataphoric use of *this* (referring to what comes next in (10)) does not mean directly that the anaphor is unmarked. There is however, a typical distinction between the determiners *this* and *that*. This is shown in (11) (taken from Givón, 1989, p. 189).

(11) a. I saw this girl yesterday.
b. I saw that girl yesterday.

In (11a), *this girl* may be used in two different ways: it may refer to a specific girl, identified with deictic or anaphoric reference; or it may introduce a girl as a discourse referent. For the latter interpretation, the determiner *a* could have been used instead, but the use of *this* introduces one specific girl, where *a* is more indeterminate in its introduction of a discourse referent. In sentence (11), *that* can not be used to introduce a discourse referent, but it can only be used deictic or anaphoric.

Taken the three differences between *this* and *that* together: *this* wants an antecedent that is semantically closer, may be used cataphoric, and as a determiner, it may be used to introduce a discourse referent, it is clear that *this* has properties of unmarked anaphors. There is no need to determine the reference of *this* in detail; *this* may take just what it gets as an antecedent. On the other hand, this property is not as articulate as it is with *it*. One can not say: *?this is a well-known fact that politicians lie*. The predication of *this* is expected to play an important role in the determination of its type.

The difference between marked and unmarked anaphors will play a role with almost any example that will be discussed in this chapter. Besides examples with the propositional anaphors *it*, *this* and *that*, two other anaphors will be used: in section 5.2.3, VP anaphors are used in English examples. VP anaphors are unmarked, but they may be specified afterwards. In Dutch examples, the anaphor *er* ('there') is used. This anaphor is also unmarked, and may be specified afterwards, as will be shown in section 5.2.4.

In the next sections, the right frontier restriction will be tested, using specification of propositional anaphors towards antecedents that do not occur on the right frontier.

Violations of the right frontier restriction?

Hellman and Dahl (1994) present evidence against the right frontier restriction. They show four different types of evidence, only two of which are aimed at the right frontier restriction specifically. The other two problems are aimed at the construction of antecedents, given meaning restrictions of the clause containing the anaphor. Here, only the first two problems will be discussed.[8]

Hellman and Dahl (1994) claim that situational (or propositional) anaphors may structure the discourse in retrospect, when looking for an antecedent. They regard (12) as a problem for the right frontier restriction (example taken from Hellman and Dahl, 1994, p. 468).

(12) Interest rates have gone up. The recession may reduce inflation. Capital taxation is lower due to the tax reform. **This** means brighter times for those who have money to save.

The problem is, that the meaning of *Interest rates have gone up* is part of the meaning of the antecedent, while this clause does not occur on the right frontier. According to Hellman and Dahl (1994), the anaphor forces the reader to structure the text. They do not discuss how this structure comes about.

In combination with the verb *mean*, *this* refers to what the context provides.[9] *This* refers to an abstracted meaning that can be paraphrased as: 'economic processes show good developments'. In LDM, this meaning can be calculated by a construction rule 'List Extension' (Prüst, 1992), that generalizes over the three clauses in the context of *this* (how this meaning is calculated in terms of LDM is demonstrated in section 5.3.3).

Given an abstract antecedent for *this*, (12) is not violating the right frontier restriction. In Webber (1991), LDM was not worked out in detail, but forming structures with List Extension is characteristic for LDM. It creates a coordinative discourse structure, dominated by only one top constituent: a constituent representing the abstracted meaning 'economic processes show good developments'. This is represented in the tree in (13).

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[8] One problem is the use of matrix verbs:

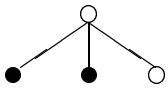
(i) The newspapers say that the dollar is falling. This does not astonish me at all.

The anaphor *this* is ambiguous between *The newspapers say that the dollar is falling* and *the dollar is falling*. This problem is the same as the problem formulated with respect to (6).

Hellman and Dahl (1994) have called the other problem 'split antecedents', meaning that the antecedent has to be constructed from different parts of the previous context. Within the scope of this chapter, no solutions will be presented for this problem.

[9] It is not necessary that the verb *to mean* predicates over one specific state, event, or property: a complex antecedent is allowed. This turns *this* into an unmarked anaphor. See the discussion on *this* with respect to example (11).

(13)



The tree in (13) represents the structure of the preceding context of *this* in (12), and is made conform Webber (1991) and LDM. See section 5.3 for a demonstration of the formation of this tree by the LDM rules. The blank circles in (13) form the right frontier; the antecedent of *this* in (12), is represented by the top constituent of (13). The tree is made by application of the rule of List Construction on the first two clauses, and then the List Extension rule. Besides making a tree, these rules specify the change of the topic in a list structure. This change is a generalization of topic and comment. This generalization (i.e., 'economic processes show good developments') is represented in the top constituent. Because the antecedent finds what it looks for in the top constituent, which is on the right frontier, the right frontier restriction has not been violated.

The second piece of evidence against the right frontier Hellman and Dahl (1994) present, is a genuine violation of the right frontier restriction. The example is given in (14) (taken from Hellman and Dahl, 1994, p. 472).

(14) John must have left. His room is empty. It probably happened a while ago.

It refers to *John must have left. His room is empty* is not represented in the antecedent. This is strange, for one expects that as an unmarked anaphor, *it* would take the abstracted meaning of its context as antecedent. An unmarked anaphor takes what it gets as antecedent. Apparently, the clause *John must have left* has a property which makes it more salient as an antecedent than *his room is empty* or some abstraction of both clauses. This might be argumentative orientation: the modality of *must have* turns the first clause into a conclusion for which evidence is provided. The evidence might be considered as less important information. Another possible explanation might be the predication of *it* with *happened*: the situation 'his room is empty' is not a possible antecedent, for *happen* can only take an event, and not a state as its subject.

Whatever explanation counts for *it* having a specific antecedent, one conclusion must be drawn: (14) is a violation of the right frontier, for the proposition representing the first clause in (14) does not occur on the right frontier.

The relation between the first two clauses in (14) is causal: the second clause is evidence for the first. Hellman and Dahl (1994) do not suggest that this relation might explain their observations. Nevertheless, it will appear to be the pattern that returns in violations of the right frontier: causal relations allow for specific antecedents that do not occur on the right frontier (in this case, even with an unmarked anaphor).

Hellman and Dahl (1994) acknowledge that it is not only the predication of the anaphor that structures the context, as they claimed with respect to (12). A change of the predication of *it*, as in (15), does not take away the possibility to refer to the first clause of the discourse (taken from Hellman and Dahl, 1994, p. 472).

(15) John must have left. His room is empty. It is a shame.

In (15), *it* should be allowed to take the second clause as antecedent: '(the fact that) his room is empty is a shame' is a possible paraphrase. This is a difference, caused by the predication of *it*. Notice that reference to the first clause is still possible in (15), although it is not preferred. It is the abstracted meaning, representing both clauses, that provides the most preferred antecedent for the unmarked anaphor (9).

Hellman and Dahl (1994) conclude that discourse structure plays a role in determining the antecedent in (14) and (15). It is not the case, however, that the right frontier restriction makes correct predictions here. So, a change in restrictions on discourse structure is needed. In this respect it is an important observation that in (14) and (15), the first two clauses are causally related.

In sum, Hellman and Dahl (1994) formulated four types of problems, providing evidence against the Webber's right frontier restriction. Two problem types were not directly aimed at the right frontier.[10] Two other problem types were relevant for the right frontier restriction. The formulation of the first problem presupposed that the antecedent was created by the anaphor. In LDM, however, rules forming the trees provide abstracted meaning, thus forming the abstracted meaning that suits the anaphor. So, the right frontier restriction was not violated. The second type of problem was indeed problematic for the right frontier restriction. In the light of this chapter, it is worthwhile to note that in the context of the anaphor, the antecedent was part of a causal relation.

Other violations of the right frontier restriction

Fraurud (1992) discusses properties of situational anaphors. Besides differences between kinds of anaphors, and types of antecedents, she

[10] Accidentally, Hellman and Dahl (1994) do cite a genuine counterexample in their discussion of matrix verbs (taken from Asher, 1993, p. 244).

(i) If Al believes that Pedro beats donkeys, he will yell at him. But Al doesn't believe that, so Pedro will escape with hearing intact.

That refers to *Pedro beats donkeys*. It is embedded in a *belief* context, but that is not a problem for the right frontier restriction. *That* is referring specifically to *Pedro beats donkeys*, a clause that does not occur on the right frontier. In this case, it is not the causal relation, but the Parallel relation that causes the violation. The Parallel (contrast) relation is extensively studied in Asher (1993). Asher's Parallel is a structure assigned to discourse after incrementation. In section 5.4, an example of a Parallel structure will be given.

includes discourse structure as crucial for identification of the antecedent. She analyzes Webber's (1991) claim, and concludes that a tree structure alone is not sufficient for a correct representation of the antecedent. Specifically, she claims that an incremental tree structure like Webber's can not account for facts of discourse subordination. Below, Fraurud's (1992) standpoint will be explained, and her examples will be discussed, in order to argue that what has been regarded as the effect of discourse subordination, is in fact the effect of causal coherence.

The example Fraurud (1992) discusses first, is taken from Webber (1991), and given here as (16).

(16) a. For his part in their joint project, John built a two-armed robot.
b. He had learned about robotics in CSE391.
c. For her part, Mary taught it how to play the saxophone.
d. *That* took her six months.
d′ *That* earned them both A's.

The sentences (16d) and (16d′) are alternative continuations of the discourse. *That* in (16d) refers to (16c) only, and (16d′) refers to the representation of (16a-c) together. Webber (1991) argues that the structure of (16a-c) determines these two possibilities: there are only two right frontier positions. The impossibility of other antecedents for *that* in the continuations of (16a-c) confirms the right frontier restriction.

Fraurud (1992) comments on Webber's (1991) observation with respect to the antecedent of (16d′) in the following way.

> What might be questioned here is whether or not the fact that John had learned about robotics, expressed by sentence (b), is included in the reference of the pronoun. What earned John and Mary's A's was presumably the tasks they performed described by the sentences (a) and (c). Possibly, one could argue that, since John's learning about robotics serves to explain his ability to perform his task, it constitutes at least an indirect cause of earning him an A. (Fraurud, 1992, p. 56)

It is interesting to note that Fraurud (1992) takes the omittance of (16b) in the antecedent of *that* in (16d′), as corresponding to the causal relation between (16a) and (16b). However, it is not certain that it was Webber's (1991) observation that (16b) should be included in the interpretation of the antecedent (16a-c). Given a discourse structure created by attaching (16c) to the top constituent (16a+b) (and not to (16b)), there are two rightmost constituents, one representing (16c), and one representing (16(a+b)+c). In the latter structure, (16b) is embedded, and it is dependent on the information flow within the tree whether or not (16b) belongs to the antecedent. In fact, it is possible to create the structure (16(a+b)+c) by assuming a subordination relation between (16a) and (16b).

Fraurud (1992) takes the observation that John's learning is an indirect cause of earning him an A, as an argument to abandon (16b) from the antecedent of *that* in (16d′). Subordination of (16b) means for her that this clause is neglected as part of the antecedent of a propositional anaphor.

Fraurud (1992) tries to explain why (16b) may be left out of the (split) antecedent of (16d′). She discusses two kinds of discourse subordination, namely Mann and Thompson's (1988) nucleus and satellite, and Hobbs's (1985) subordination. In both cases, subordination is a property of coherence relations, making one of two connected clauses (Mann and Thompson's satellite) less 'important' than the other. She argues that this kind of subordination has to be incorporated in the tree structure, in order to account for the observation that some part of the meaning is left out of the abstracted meaning in the top constituent. At the same time, she acknowledges that the notion of subordination as defined by Mann and Thompson (1988) or Hobbs (1985) is not a clear and well-defined notion. Two remarks can be made with respect to Fraurud's (1992) analysis.

First, the notion of subordination has already been worked out with respect to the tree structures, because LDM provides a rule for Rhetorical Subordinations (see table 1.3 in the appendix of this chapter). The effect of this rule is, that the meaning of the subclause is left out of the abstracted meaning of (16a+b) (this will be discussed in section 5.2.3 and 5.3). This means that leaving out the meaning of (16b) is not a problem for Webber's restriction on antecedents; but making reference to the conjunction of the specific constituents representing (16a) and (16c) is, for this is violating the right frontier restriction (that is, split antecedents as such are a problem, but making reference to (16a) is a violation of the right frontier restriction).[11]

Secondly, a notion that has not been mentioned by Webber (1991) nor Fraurud (1992), is the parallel interpretation of (16a) and (16c). According to Asher (1993), parallel relations may be defined on existing structure, and relate two constituents in similar positions in the subtrees assigned as parallel. The phrase *for her part* in (16c) indicates that the clause is parallel to another clause in the discourse. The occurrence of *both* in (16d′) indicates a split antecedent. This split antecedent can be made through the parallel relation between (16a) and (16c). The only problem is, that in LDM, no construction rule will create a structure that gives (16a) and (16c) similar positions in parallel subtrees. So, it is still a problem how (16a) is part of the antecedent.

Fraurud (1992) claims that discourse subordination is responsible for the effects discussed here. However, as long as explanations are analyzed, it can be claimed just as well that it is causality that causes

[11]Making reference to (16(a+b)+c) and suppressing (16b) in this representation is in agreement with the right frontier restriction, but it raises the question why and how (16b) is suppressed. Fraurud (1992) does not address this problem. In section 5.2.3 and sections thereafter, a theory will be discussed that does address this problem.

these effects. Is it possible to decide between these two claims?

Fraurud (1992) presents another example where a clause may be neglected in a complex antecedent.

(17) a. John didn't turn up at the meeting.
b. He never keeps a promise.
c. Charlie was also absent.
d. *That*'s why we cancelled the meeting.

That in (17d) has possibly a split antecedent of (17a) and (17c). It seems that (17b) can not be part of the antecedent. Fraurud (1992) analyzes (17b) as a comment on (17a), which makes (17b) subordinative to (17a).

Reference to (17a) is a problem for the right frontier restriction. Fraurud's (1992) solution is, that (17b) is subordinate. It may therefore be overlooked in the complex antecedent of the whole context. Reference is made to (17a+b+c), but (17b) does not count in the abstracted meaning.

At first sight, this analysis would be in line with the claim in this chapter, if the relation between (17a) and (17b) were causal. One could claim that this relation is an explanation, but this is not really convincing. It is more a comment on John as a person, than an explanation of his absence. Is this a problem for the claim that causality may dodge the right frontier restriction? A closer look at the example will learn that in this case, it is not necessary to have (17a) in the antecedent.

The anaphor *that* in (17d) is not looking for an antecedent that can be applied to two persons, such as *that* in (16d′): the presence of *both* in *that earned them both A's*, as well as the parallel relation between (16a) and (16c), indicates a split antecedent. In (17), one reason for cancelling the meeting could suffice. The reason that besides (17c), a second reason is considered, is the presence of *also* in (17c). As a marked anaphor, *that* takes preferably a specific clause as an antecedent (i.e., just (17c)). In (17c), *also* is used to incorporate given (presupposed) information: next to *Charlie*, there was someone else absent (cf. Bos, 1994). The information that more people than just *Charlie* (namely, *John*) were absent, is provided by (17c) on its own.

In (18), the reason why the meeting should be cancelled has been made more significant (with respect to real world reasons of cancelling meetings). It is unlikely that only (18c) is the antecedent of *that* in (18d).

(18) a. John didn't turn up at the meeting.
b. He would bring the input for the discussion.
c. Charlie was also absent.
d. ?*That*'s why we cancelled the meeting.

In (18), the absence of John has become more relevant than the absence of Charlie, for (18b) makes John's presence crucial for the meeting (or at least, more important than Charlie's presence). The presence of the marked anaphor *that* in (18d), now results in unacceptability.[12] *That* refers to a specific constituent that gives a good reason for cancelling the meeting, namely the rightmost clause (18c). But the best reason would be provided by the context as a whole. This is not in accordance with the markedness of *that*, so the discourse is unacceptable.

An additional argument against the idea that the antecedent of *that* in (17d) incorporates (17a+b), is given by another variant of this discourse (taken from Maes, 1997, p. 169), presented in (19).

(19) a. John didn't turn up at the meeting.
b. Charlie was also absent.
c. He never keeps a promise.
d. ?*That*'s why we cancelled the meeting.

The marked anaphor *that* in (19d) wants a specific constituent as antecedent, representing a good reason for the cancellation of the meeting. The unacceptability of (19d) means that no such constituent is available as antecedent.

Fraurud's (1992) claim that it is subordination that allows clauses to be left out of complex antecedents, is not correct. If comments were discourse subordinate, (18b) would be discourse subordinate to (18a), just as (17b) was to (17a), and both discourses should be acceptable. But the discourse in (18) is unacceptable (if (18b) is considered to make the presence of John crucial). In (19), the marked anaphor *that* looks for a specific clause as an antecedent, but it can not overlook the subordinate clause (19c). The problem to be solved then, is not that subordinate clauses can be disregarded, but that some clauses can serve as antecedent while they do not occur on the right frontier (also like (16a)). This problem will now be discussed.

Until now, the meeting examples did not provide a genuine violation of the right frontier restriction. It is, however, easy to create one. In (20), the antecedent is not part of the right frontier.

(20) a. John didn't turn up at the meeting.
b. Charlie was also absent.
c. He was ill.
d. *That*'s why we cancelled the meeting.

[12]The only way to make the discourse acceptable with additional inferences, is to assume that someone else has brought the key of the meeting room, or the meeting was held somewhere else. Of course, this makes the (18b) less important, giving way for *that* to refer to (18c) only.

Clearly, the illness of *Charlie* was not the reason to cancel the meeting. The absence of *Charlie*, and through *also* the absence of *John*, are good reasons for cancelling the meeting. So, (20b) is the antecedent of *that* in (20d). (20b) does not occur on the right frontier in the structure of (20). This is possible, because the relation between (20c) and (20b) is causal. (20c) is an explanation for (20b). So, the difference between (19) and (20) confirms the idea that the antecedent of propositional anaphors is affected by causality, instead of subordination.

In order to show that it is causality, and not only the specific coherence relation Explanation that is crucial here, a last variant of the meeting examples is constructed in (21).

(21) a. John didn't turn up at the meeting.
b. Charlie was also absent,
c. so he had other priorities.
d. *That*'s why we cancelled the meeting.

Taking (21b) as antecedent, while omitting (21c) from the antecedent, does not lead to unacceptability. (21c) is a result for (21b), and at the same time, it is not a good reason for cancelling the meeting.[13] The acceptability of the discourse shows that Result behaves like Explanation. This supports the thought that it is causality that makes a violation of the right frontier restriction possible.

The discussion of Fraurud (1992) made more clear that constituents in a discourse may be available as antecedent, even when they do not occur on the right frontier. A closer look at some of her examples learned, that this effect is not due to subordinate clauses that may be overlooked, but by causal relations keeping clauses available as an antecedent, when they do not occur on the right frontier. Evidence is provided for the idea that causality affects the availability of antecedents in discourse structure.

A survey of examples used against the right frontier restriction of Webber (1991) learned, that some of the examples could be reanalyzed in such a way that they appear to be in agreement with the right frontier restriction. In those cases that may count as real counter examples, the context is characterized by a causal coherence relation between antecedent and a right frontier constituent.

In the next section, the phenomena will be analyzed within the framework of LDM. Prüst (1992) analyzes VP anaphors in discourse structure. VP anaphor may be considered as propositional anaphors (predicates form the antecedent; the subject of the antecedent is exchanged with the subject of the anaphoric VP). Therefore, the right frontier restriction will be investigated by using VP anaphors.

[13]Notice that this result is epistemic: from the fact that Charlie is absent, I conclude that he had other priorities.

5.2.3 VP anaphors and rebuttals

In this section, the right frontier restriction will be investigated within the framework of LDM, using some of Prüst's (1992) examples of antecedents of VP anaphors. More specifically, an analysis will be given of a VP anaphor, followed by a *but* clause. The identification of the antecedent of the VP anaphor is strongly determined by this rebuttal. At the same time, it appears that properties of the context containing the antecedent, are crucial too.

In the LDM analysis, these examples were considered to represent an exceptional non-incremental parse of the discourse, which means that the right frontier restriction has been abandoned to analyze this example. In the next section, it will be argued that it is possible to stick to an incremental approach, if it is assumed that causal relations keep antecedents available in the context of anaphors.

The discourse in (22) is ambiguous. The VP anaphor in (22c) is referring to (22a+b) as a whole, or to (22b) (example and judgments are taken from Prüst et al., 1994, p.266).

(22) a. Fred went to the dentist
b. because he needed a checkup.
c. Sara did too.

To show that their intuitions with respect to the antecedent of the VP anaphor are correct, they continue the discourse in (22) with a rebuttal, namely (22d).

(22) d. but she had to have her wisdom tooth removed.

Prüst et al. (1994) claim that (22d) excludes an interpretation of the VP anaphor in (22c) as: 'Sara needed a checkup'. This would give the inappropriate interpretation: '#Sara needed a checkup as well, but she needed a root treatment'. As a result, (22a) is taken to be a proper antecedent of the VP anaphor in the context of (22d).

Prüst et al. (1994) argue for having the whole sentence (22a+b) as an antecedent, as long as (22d) has not been added. On the other hand, if the antecedent of (22d) were (22a+b) in the context of (22d), then a paraphrase of the VP anaphor and its rebuttal would be: '#Mary went, like John, to the dentist because she needed a checkup, but she had to have her wisdom tooth removed'.

Prüst et al. (1994) claim that the change of the discourse structure, due to the addition of the rebuttal, has had an impact on the interpretation. (22a+b) coordinates with (22c+d), resulting in an antecedent for the VP anaphor of only (22a) and not (22a+b). In section 5.4, this structure and its impact will be discussed. Here, it will be analyzed which characterizations of the discourse in (22a-d) are crucial for the identification of the antecedent of the VP anaphor.

It seems obvious that the rebuttal is restructuring the discourse, but it is less obvious how the new structure is obtained. The real contrast is between Fred needing a checkup, and Sara having to have her wisdom teeth removed. (22b) and (22d), however, are not connected to each other by *but*. Prüst et al. (1994, p. 321) claim, that parallelism of (22a+b) and (22c+d) determines the interpretation. In this case, parallelism is invoked by using *but* as a semantic opposition. *But* is used as a semantic opposition, when its clauses are built up parallel (cf. chapter 2, section 2.3). Asher (1993) analyzes structures of more than two clauses to show that parallel structures can be interpreted contrastive.

The example in (22a-d) is an example in which the right frontier restriction is violated. Moreover, according to Prüst et al. (1994, p. 321), it is an example of a structure that has been built non-incrementally. The discourse of (22c+d) is formed, before it is attached to (22a+b).

Adding the rebuttal to (22a-c), changes the whole structure, according to Prüst et al. (1994). The possibility that (22a) is an antecedent for the VP anaphor on its own, is a result of this non-incremental change of structure. It is an atypical example of a violation of the right frontier restriction, for the non-incremental formation of the structure results in a temporal disappearance of the right frontiers (two trees have been formed, as will be shown in section 5.3).

The most important aspects of the discourse in (22) have been introduced. The VP anaphor is unmarked at first, the rebuttal restructures the discourse and the context in which the antecedent is to be found contains a causal relation. In the analysis of Prüst et al. (1994), this causal relation does not seem to be crucial. It is the restructuring of the rebuttal that isolates the first clause as the antecedent. However, the causal relation is crucial in the examples. Three arguments will be given to support the claim that causality affects the availability of the antecedents.

First, Prüst et al. (1994) claim that in discourses like (23), the VP anaphor in (23c) can only refer to (23b) or (23a+b), but not to (23a) only (taken from Prüst et al., 1994, p. 279).

(23) a. John went to the library.
b. He borrowed a book on computer science.
c. Bill did too.

They claim that:

> This third interpretation [reference to (23a) only] may become relevant if the context makes (23b) subordinate to (23a). For instance, (23a) and (23b) form an answer to the question *Who went to the library?*. (Prüst et al., 1994, p. 279)

A rebuttal is not the only context in which the VP anaphor may refer to the first clause. Prüst et al. (1994) claim that in those cases, (23b) is

subordinate to (23a).[14] In fact, the first clause is available in any context, but the unmarked VP anaphor does not refer specifically enough to select it. The question *who went to the library?* is doing exactly what is needed to select the antecedent, namely making the VP anaphor specific.

The relation between (23a) and (23b) is a relation of purpose, which is a causal relation.[15] Prüst et al. (1994) claim that the discourse in (24) has the same relation between (24a) and (24b) as between (22a) and (22b).

(24) a. Fred went to the dentist.
b. He needed a checkup.
c. Sara did too,
d. but she had to have her wisdom tooth removed.

Like Prüst et al. (1994), the claim in this chapter is that the relation between (24a) and (24b) is the same as between (22a) and (22b). So, Rhetorical Subordination seems to be a construction rule based on the causal relation Explanation.

Is it possible that without the rebuttal, the VP anaphor in (22c) refers to (22a) only? In the introduction of this chapter, an example of an *although* sentence was given in (2), in which three possible antecedents were found for *that*. The most important difference between these two discourses is the anaphor that is used. In (2), *that* may refer specifically, as it is a marked anaphor. In (22), the VP anaphor is unmarked without the rebuttal, so specific reference to (22a) is not preferred.

In sum, the first argument that causality is affecting discourse structure in (22), is that contrary to the claims of Prüst et al. (1994), the first clause of the discourse in (22a-c) is available as antecedent, due to the causal relation it has with (22b). It is only for the unmarked VP anaphor, that (22a) is not used as an anaphor: the discourse (2) shows that a marked anaphor may take the first clause of a causal relation as its antecedent.

The second argument is that the relation between (22a) and (22b), in the structure formed with VP anaphor and rebuttal, should be taken to be relevant in the analysis of (22a-d). It is the parallel structure, invoked by the rebuttal, that makes (22a) the antecedent of the VP anaphor, according to Prüst et al. (1994). There are two observations that

[14] It may safely be assumed that Prüst et al. (1994) mean rhetorical subordination here, which is in its assumed effects the same as Fraurud's (1992) discourse subordination.

[15] Sanders et al. (1993) describe what they call Goal-Instrument relations as expressing two causal relations. In Renkema (1993), it is the real world connection between the execution of the instrument and the achievement of the purpose (whether it is actually realized or not) that is regarded as causal. Readers might assume a narrative relation in (23a+b) as well. Narrative relations may be understood as consequential (cf. Caenepeel, 1989, p. 77).

provide arguments against this idea. First, it will be shown that when the relation between the first two clauses is not causal, the VP anaphor can not refer to the first clause only; second, it will be shown that the parallel relation is created by virtue of the identification of the antecedent, and not the other way around (parallel structure identifies the antecedent).

If the relation between the first two clauses is a list, it is not possible to make the VP anaphor refer to the first clause. This is shown in (25).

(25) a. John loves trains.
b. Peter loves cars.
c. Mary does too,
d. ?but she hates cars.

In (25d), the rebuttal excludes (25b) as an antecedent for (25c). The discourse is unacceptable, so (25a) is not an antecedent for (25c). According to their List construction rule, connecting (25a) and (25b) (and conform the intuitions for the discourse in (25a-c)), the VP anaphor should refer to an abstraction of (25a) and (25b), for instance 'Mary loves vehicles' (see section 5.3). The rebuttal does not allow the VP anaphor to behave as an unmarked anaphor, so clause (25a) or (25b) must be specifically selected, which leads to an unacceptable discourse.

In the framework of LDM, the propositional contents of (25a) and (25b) are taken together by a topic update rule (25b) (the List construction rule). It has become impossible to refer to (25a), for its context dependent meaning has merged into the abstracted meaning. The construction rule Rhetorical Subordinations, used to form a structure for (22a+b), copies the propositional contents of only (22a) into the abstracted meaning, so reference to the abstracted meaning yields only (22a) as an antecedent.[16] The relation between the first two clauses is therefore crucial in the analysis of Prüst et al. (1994). This relation might be characterized by *because* (Rhetorical Subordinations or, in other frameworks, Explanation), but not by a List.

Do other relations provide a proper antecedent in this construction? In (26a+b), an elaborative relation is expressed.

(26) a. John went to the library.
b. He went there by car.
c. Bill did too,
d. ?but he went there by bike.

The unacceptability of (26) is caused by the impossibility for (26a) to be an antecedent for the VP anaphor, while (26b) and (26a+b) are

[16]Although the intuitions in Prüst et al. (1994) on (22) are that the VP anaphor makes reference to both (22a) and (22b), the rule of Rhetorical Subordination only specifies the main clause as the contextual dependent semantics of their conjunction.

excluded by the rebuttal. The relation between (26a) and (26b) is not causal. This is an important observation: the coherence relation Elaboration is considered to be subordinative in Polanyi (1988), and a nucleus-satellite relation in Mann and Thompson (1988). However, using an Elaboration in the VP anaphor and rebuttal construction does not result in an acceptable discourse. This means that the causality of the relation does play a crucial role in the identification of the antecedent of the VP anaphor with rebuttal.

Not all Elaborations result in unacceptable discourses, however. Consider (27), where an elaborative relation is used between (27a) and (27b).

(27) a. John went to the reception desk.
b. He made a telephone call.
c. Mary did too,
d. (?)but she sent a fax.

In its most straightforward explanation, the discourse is unacceptable. The VP anaphor takes (27b) as an antecedent, and it is not possible to change it to (27a). However, it might be possible to interpret (27b) as a purpose: 'John went to the reception in order to make a telephone call.' Relations expressing a purpose are causal. In this interpretation, (27a) might serve as an antecedent. Such an interpretation is blocked in (28), because *then* is used in (28b). The relation between (28a) and (28b) becomes narrative, this way.

(28) a. John went to the reception desk
b. and then he made a telephone call.
c. Mary did too,
d. ?but she sent a fax.

In (28d), the rebuttal excludes (28b) as an antecedent for (28c). The discourse is unacceptable, so (28a) can not be an antecedent for (28c), evidently.

The relations used in (25a+b), (26a+b), (27a+b) in the narrative interpretation, and (28a+b) are non-causal. When a VP anaphor is forced by a rebuttal to refer to the first clause of these conjunctions, the discourse becomes unacceptable. There is one exception: in (27), it is possible to interpret the elaborative relation as causal. As a result of this interpretation, the discourse becomes acceptable. In other words: causal, but not additive relations, allow these discourses to be acceptable. It is not just the parallel structure that explains the relation.

The third argument supporting the idea that causality is crucial for the availability of (24a) as the antecedent of the VP anaphor, is that it may prevent non-incremental parsing. Not every rebuttal invokes parallel structure. In (29), no parallel structure is formed.

(29) a. John went to the dentist.
b. He needed a checkup.
c. Mary did too,
d. but she went to a dental hygienist.

In (29), (29b) serves as an antecedent on its own. The rebuttal in (29d) excludes (29a) as an antecedent.

Prüst et al. (1994) state that in (22), a parallel structure is created by postponing the interpretation of the VP anaphor. The incremental parsing strategy is left, and (22c) and (22d) are connected first, in order to create the parallel structure between (22a+b) and (22c+d).

In the analysis of Prüst et al. (1994), the presence of the rebuttal is needed to invoke the parallel structure. Their claim that interpretation of the VP anaphor is postponed, can only be made true by virtue of the presence of the rebuttal, for omitting the rebuttal means that the VP anaphor will be interpreted regularly (referring to both preceding clauses in the discourse). However, not every rebuttal invokes parallel structure, as (29) shows. As a consequence, the contents of the rebuttal must be known, before the non-incremental procedure of creating parallel structure can begin. In other words, the whole discourse must be parsed incrementally first, and then reparsed to build parallel structure in a non-incremental way. This is not an ideal procedure. Another way of creating parallel structure may provide better results, for instance the way like Asher (1993) describes it.

In Asher (1993), the relations Parallel and Contrast are based on structure that has already been formed. A Parallel structure is formed when isomorphic subtrees can be recognized in an existing structure. Contrast is realized when isomorphic subtrees that form a Parallel relation have two corresponding branches that are negatively polar. In other words, according to Asher (1993), the discourse structure comes first, and the parallel interpretation comes next.

An alternative analysis of the combination of VP anaphors and rebuttals might run as follows. The rebuttal turns the VP anaphor, used as an unmarked anaphor in (22a-c), into a marked anaphor, specifying one particular clause. The VP anaphor is specified, given the structure that has already been formed. It depends on the abstracted meaning given by the construction rules that built the existing discourse structure, whether or not a specification of the VP anaphor is possible.[17] If it is possible, and if it is the first clause that is specified as the antecedent, a parallel structure is formed, and a Contrast will be created between the first two clauses and the VP anaphor with rebuttal. This analysis will be worked out in detail in section 5.3.

[17]Another way of looking at the VP anaphor as changing from unmarked to marked is, to regard the VP anaphor as underspecified, and specified later by the rebuttal within the same representation.

An analysis of discourses with a VP anaphor followed by a rebuttal, shows that causal relations have a different impact on the accessibility of antecedents of VP anaphors than List or narrative relations do. A VP anaphor refers preferably as an unmarked anaphor, but it is specified by a rebuttal. When forced to refer to the first of two related clauses, discourses are acceptable only when the relation between these two clauses is causal. Such cases dodge the right frontier restriction. The way in which causal relations affect discourse structure is thus, that causally related constituents remain available as antecedents for propositional anaphors.

Not all possible causal relations were used in the context of VP anaphors and rebuttals. In the previous section, and the next, other causal relations show similar effects in other contexts. It is not always possible to exchange coherence relations freely in every context, because there are many different factors that may influence the choice of antecedent. In the next section additional evidence from Dutch will strengthen the observations concerning causal relations in discourse structure.

5.2.4 Evidence from Dutch *er*

In section 5.2.3, the combination of a VP anaphor, followed by a rebuttal inconsistent with a clause in the preceding context, appeared to be a good way to single out one specific constituent that needed to be the antecedent of the VP anaphor. In Dutch, there are no VP anaphors with the same form and meaning as in English. It is not possible to translate an example like (22), retaining its effect. A Dutch translation of *Mary does too* would be *Dat doet Marie ook* ('That does Mary too'). In this translation, the marked anaphor *dat* is used. As a consequence, a preferred antecedent of *dat* is one specific clause, rather than the abstracted meaning of the preceding context. In English, the rebuttal has the effect of specifying the antecedent. Instead of the abstracted meaning of an antecedent, a specific constituent is chosen. In Dutch, the antecedent is already specific. A rebuttal, given a specific content, may force the anaphor to switch from one specific antecedent to the other specific antecedent. This gives a strange effect. Such an effect is unwanted, for unacceptabilities may come forth from the switching effect, which makes it impossible to test the properties of the context of the anaphor.

There is a possibility to check for Dutch in which way causality affects discourse structure. There is an anaphor that is used unmarked: *er* ('there'). *There* is not a correct translation for the use of *er* that is meant here. In its use as an anaphor, it refers to an antecedent, abstracted from the preceding context. In the examples that will be presented below, parts of the context will be unsuited as antecedent. This way, specific clauses are isolated as the only possible antecedent. The acceptability judgments will tell us more about constituents that may occur

in the antecedent, or: which constituents are open.

Analyzing Dutch *er* does not only provide evidence from another language, but also from another anaphor. Besides, an alternative for the rebuttal will be presented. This will exclude the possibility that it is only the rebuttal that is responsible for the antecedent choice. Before relevant discourses are presented, a short introduction into Dutch *er* will be given.

There are two well-described other usages of *er*: the use of *er* as existential *there* (as described in Milsark, 1977), and the use of *er* as a partitive particle 'kwantitatief er' (De Jong, 1983).[18] Besides these two, there is a usage of *er* as the clitic of the adverb *daar* (*there*, in a locative sense) when it is in unstressed position.

The usage of *er* to be discussed here is its use as a particle in a prepositional phrase. This is described in traditional grammars like Van Bart and Sturm (1987); Geerts et al. (1984). *Er* refers to a nominal constituent, but also to clauses and abstracted meaning from several clauses, and sometimes it is used in an absolute sense, without an antecedent. This may be defined as pronominal reference in the sense of (Chomsky, 1981, p.188): a pronominal anaphor may have its antecedent only outside its governing category. In effect, this means that *er* is allowed to refer to anything outside the clause in which *er* occurs. Klein (1987) suggests that we might consider *er* as an 'adverbial pronomen'.

An example of the use of *er* as a propositional anaphor is given in (30).

(30) Marie geeft Jan misschien de baan.
Mary offers John perhaps the job.

Hij hoopt erop.
He hopes it for.

In Geerts et al. (1984), this use of *er* is exemplified without context and the construction is called 'absolute'. *Er* is not referring to anything 'concrete'. This analysis corresponds with Maes's (1997) analysis of the unmarked anaphor.

[18] *There* is used existential, in the sense that it quantifies existentially over the NP that is understood as the subject of the sentence. This NP may not be quantified itself, as shown in the following pair.

(i) a. There are people on the street.
b. ?There is everyone on the street.

In (ib), *there* quantifies over what is referred to by *everyone*, but the NP *everyone* is quantifies itself over its referents. This double quantification is excluded in English. For Dutch, a similar restriction holds, as the translation of the sentences (i) in (ii) shows.

(ii) a. Er zijn mensen op straat
b. ?Er is iedereen op straat.

How can these anaphorical properties of *er* be used for determination of open constituents in discourse structure? The unmarked anaphor makes it possible to identify the abstracted meaning of a context as antecedent. Consider the discourse in (31).

(31) a. Jan verhuist naar een sfeervolle stad,
John moves to an attractive city,

b. en hij krijgt daar een tuin.
and he gets there a garden.

c. Hij verheugt zich erop.
John is looking forward to it.

(31c) can be paraphrased with: 'Jan verheugt zich op de sfeervolle stad en de tuin' ('John is looking forward to the attractive city and the garden'). An interpretation in which Jan is looking forward to just the attractive city or just the garden, is not preferred.

It is possible to exclude the meaning of one constituent from the meaning abstracted from the constituents that form the antecedent by using negative and positive attitude (cf. Sidiropoulou, 1992). Clauses like *Jan zorgt ervoor* 'John takes care of it', *Jan verheugt zich erop* 'John is looking forward to it' or *Jan hoopt erop* 'John hopes for it', express a positive attitude of *Jan* towards the state of affairs the anaphor refers to. The antecedent, stating this state of affairs, has to express a positive attitude, or none. An antecedent with negative attitude will be unacceptable for the interpretation of anaphoric *er*. An example is given in (32).

(32) a. Jan verhuist naar een saaie stad.
John moves to a dull city.

b. ?Hij verheugt zich erop.
He is looking forward to it

In (32b), the clause containing *er* is unacceptable, because one is not supposed to enjoy a removal to a dull city. Now look what happens with (33), when two constituents are used in the preceding context of *erop*.

(33) a. Jan verhuist naar een saaie stad,
John moves to a dull city,

b. en hij krijgt daar een tuin.
and he gets there a garden.

c. Hij verheugt zich erop.
He is looking forward to it

In (33b), *en hij krijgt daar een tuin* has come in-between the negative attitude clause in (33a), and the positive attitude anaphor in (33c). In (32),

the only possible antecedent was the unacceptable (32a). In (33), the unacceptable (33a) may be disregarded as antecedent. Because (33b) is an acceptable antecedent, the anaphor in (33c) is properly resolved.

What happens in (33), is in line with the right frontier restriction: instead of the top constituent of (33a+b), the rightmost clause (33b) is taken as antecedent. Both the top constituent and the rightmost clause occur on the right frontier, so it is predicted that the impossibility to refer to the top constituent (33a+b) still allows the possibility to refer to (33b).

In (33), the first clause did not need to be antecedent. In (34), it is shown that it is not possible to take the first clause as an antecedent, disregarding the second clause.

(34) a. Jan verhuist naar een sfeervolle stad,
John moves to an attractive city,

b. en hij moet daar veel huur betalen.
and he has there much rent to pay.

c. ?Hij verheugt zich erop.
He is looking forward to it.

(If (34a+b) does not seem to be acceptable, read an additive *maar* instead of *en* in (34b).) In (34), it is impossible to disregard (34b) as part of the antecedent, for its occurrence as a negative attitude clause causes (34c) to be unacceptable.[19] (34) agrees with the right frontier restriction, since the unacceptability shows that (34b) can not be discarded. In both the top constituent and the rightmost clause, the contents of (34b) is represented.

In the examples dealt with so far, no causal relations were involved. The demands of the right frontier restriction were obeyed. Now, contexts will be given that contain a causal relation.

(35) a. Jan verhuist naar een saaie stad,
John moves to a dull city,

b. omdat hij daar een tuin krijgt.
because he there a garden gets.

c. ?Hij verheugt zich erop.
He is looking forward to it.

In (35), (35a) is given a negative attitude, which makes it an unacceptable antecedent. The unacceptability of (35c) shows, that (35a) can not be left out of the antecedent of *erop*. In (36), the attitudes in the antecedent are switched.

[19]In one interpretation, it is possible to make the interpretation acceptable, namely to give the discourse an ironic interpretation. In that case, the antecedent is (34b), and its unacceptable interpretation is repaired via violation of a Gricean maxim.

(36) a. Jan verhuist naar een sfeervolle stad,
John moves to an attractive city,

b. omdat hij verhuisplicht heeft.
because he obligation to move house has.

c. Hij verheugt zich erop.
He is looking forward to it.

Example (36) is acceptable, whereas (36b) can not be read as (part of) the antecedent of *erop*. In (34), the preceding context could not provide a suitable antecedent for *erop*, but in (36), it does provide a suitable antecedent. This means, that the constituent representing (36a) must be open, and that the reason for this seems its occurrence in a causal relation. Another causal relation is given in (37), this time presented with *so* instead of *because*.

(37) a. Marie is bang voor insecten,
Mary is afraid of insects,

b. dus ze maakt altijd goed schoon.
so she keeps it always very well clean.

c. Ze schaamt zich ervoor.
She is ashamed for it.

This time, a negative attitude is attributed to the anaphor in (37c). This negative attitude can only be combined with (37a), not with the positive attitude expressed in (37b). The acceptability of (37b) shows that (37b) may be disregarded as a part of the antecedent, and that (37a) is represented by an open constituent in discourse structure.[20]

The examples using Dutch *er* corroborate the claim that causal relations keep their constituents open in discourse structure, even when they do not occur on the right frontier.

5.2.5 Conclusion

In three sections, different pieces of evidence have been collected to support the conjecture that causal relations keep their constituents open in discourse structure, even when they do not occur on the right frontier.

Earlier attempts to present evidence against the right frontier restriction were made in Maes (1997), Hellman and Dahl (1994) and Fraurud (1992). These proposals were discussed in section 5.2.2. Properties of

[20]It is quite difficult to make sentences expressing an argument and a claim, while the anaphor refers to the argument. Argumentative orientation assigns a prominent role to the claim and not to the argument. However, argumentative orientation is not what is studied in this chapter. Perhaps, argumentative orientation can be identified with Fraurud's (1992) discourse subordination (a directive act has been identified as a nucleus in McKeown and Elhadad (1991)). What is studied in this chapter, is availability rather than prominence, although these notions often coincide.

the anaphor, especially its markedness and the sentence containing the anaphor, determine to a large extent the antecedent in the preceding context. However, the structure of the context is important too, as Hellman and Dahl (1994) showed. Contrary to Fraurud (1992), the claim was made that it is causality in the context of an anaphor, rather than discourse subordination, that provides genuine counterexamples to the right frontier restriction.

In section 5.2.3, a test used by Prüst et al. (1994) was discussed. It involved VP anaphors and rebuttals. The antecedent, formed by the two clauses preceding the VP anaphor was antecedent, was specified to the first clause, due to the rebuttal. Some remarks on the analysis of Prüst et al. (1994) led to the conclusion that the causal relation is involved in the interpretation. Example (22) thus gave evidence for the idea that (22a) was antecedent on its own, due to the causal relation between (22a) and (22b), whereas the rebuttal specified the anaphor in such a way that this interpretation was enforced. This possibility provides evidence against the right frontier restriction.

More evidence for the claim that causal relations keep their constituents open, even when they do not occur on the right frontier, was given by the effects of Dutch *er*, used as an anaphor in section 5.2.4. By toggling positive and negative attitude of clauses in the preceding context, while the anaphor was used in a positive attitude clause, antecedents of *er* could be excluded from the most preferred antecedent (namely, the abstracted meaning of the whole context). The results showed, that constituents in non-causal relations behaved according to the right frontier restriction. Causal relations did not: it appeared to be possible to have the first of two causally related clauses as an antecedent on its own for the propositional anaphor.

Taking the evidence together, the claim that causal relations keep their constituents open in discourse structure is established.

In section 5.1, four questions were asked. The first three have been answered:

1. how can different interpretations of a discourse be represented by structures like (5)?

   > Possible antecedents are open constituents, even when they do not occur on the right frontier. The structure in (5) should be changed: instead of two, all three constituents should be open, each one corresponding with an interpretation.

2. do marked anaphors refer to specific clauses, irrespective of their position in a tree structure?

   > Marked anaphors like *that* do not violate the right frontier restriction in order to refer to a specific clause, unless this clause is causally related with the right frontier. Unmarked

anaphors, like the English VP anaphor or Dutch *er*, may refer to a specific clause, if other possible antecedents are excluded by certain specific continuations of the discourse.

3. what are characteristic properties of right frontier restriction violations?

   The right frontier may be violated in case of reference of a propositional anaphor to a clause, causally related with the right frontier.

The fourth question has not been answered yet:

4. What is the role of causal connectives in abstracted meaning?

Since causality plays a distinctive role in the context of propositional anaphors, this question has become very relevant, for it has only been established that causal relations keep their clauses open. What this means for the distribution of information, restricted by the construction rules, has not been answered. This question can be answered precisely within LDM. Therefore, LDM will be introduced in more detail. A more formal account of calculation of abstracted meaning is given in the appendix to this chapter. Besides abstracted meaning, the tree construction is defined in LDM.

5.3 The Linguistic Discourse Model

5.3.1 Introduction

In this section, the Linguistic Discourse Model (LDM) will be introduced in more detail, and some of the insights gained in this chapter and chapter 2, will be implemented in LDM. The changes proposed in this section, are not radical, but will improve the descriptive accuracy of the model. In section 5.4, it will be shown that the proposed changes really are improvements. Prüst's (1992) analysis of the VP anaphor with rebuttal will be revisited on the basis of the revisions made in LDM.

In order to describe the role of causal connectives in abstracted meaning, the construction rules that calculate abstracted meaning, and create discourse structure at the same time, must be introduced. In order to specify exactly how tree structure and the calculation work, construction rules are given in a very simplified form. The formal definitions of Prüst et al. (1994) will be given and explained in the appendix to this chapter.

In order to make the introduction of the construction rules relevant for a discussion of the role of causal connectives and causal relations in discourse structure, the following questions will be answered:

1. How is abstracted meaning of constituents calculated in LDM?

2. What is the effect of causal relations on the calculation of abstracted meaning in LDM?

3. What is the definition of open constituents in discourse structure?

The answer to the first question provides the semantics of the constituents in discourse structure that represent more than one simple clause. The answer on the second question may explain a difference in the effect of different coherence relations in the calculation of abstracted meaning on the availability of clauses in a discourse structure. This effect can be formulated only after the answer on the third question has been given, for the availability of constituents for coreference and attachment is defined in terms of open constituents (it will become clear that attachment is not applying to all open constituents). Before it is possible to analyze precisely the role of causal relations in discourse structure, the answers on all three questions must be given.

The answers to the questions will be provided by introducing LDM in three sections: 5.3.3 (first question), 5.3.4 (second question) and 5.3.5 (third question). After that, a VP anaphor and rebuttal example of Prüst (1992) will be examined in detail in section 5.4, in order to show that the proposed changes to LDM are really improvements. Before this will be done, a short overview will be given of other theories of discourse structure, and it will be indicated for which theories the right frontier phenomena are relevant. Readers who are familiar with these theories, and readers who do not want to know about them, may skip section 5.3.2. Knowledge of this section is not needed for understanding the remainder of this chapter.

5.3.2 Different theories on discourse structure

In this chapter, the framework of LDM is chosen. This choice is motivated by the fact that the notions of 'right frontier' and 'open constituent' have been developed within this framework. However, a lot of other discourse structure theories exist, that might have something to say about these notions. In a short overview, these theories will be classified, and the relevance of the notions 'right frontier', 'open constituent' and 'causal relation' will be indicated for each theory. In table 5.1, names of theories, and characteristic publications are given, and in table 5.2, these theories are characterized by features of discourse structure.[21]

The main goal of most discourse theories is to explain why a text is more than an arbitrary set of sentences. The 'extra' meaning that arises from a text is judged in different ways. When text is taken as a linguistic object, the study of coherence is most important; when discourse is viewed as the result of realising goals of participants, the study of

[21]The list is not complete. For instance, work on dialogue representation (e.g. Bunt, 1987) and Super Structure (e.g. Van Dijk, 1986) is discarded.

intention (and argumentation) is most important. Causal relations are defined in all theories that study coherence. Causality may be defined in other theories, but not as a property of a relation between clauses (as Sanders et al., 1992, define it).

A definition of the right frontier is only relevant in theories of incremental discourse structure. The right frontier restriction defines to which constituents a new clause may be attached. This is not directly useful for a theory that builds a discourse structure using information from the complete discourse. However, the insights that are gained by the restrictions on, for instance, reference of propositional anaphors, may be relevant for non-incremental theories as well.

Another important difference between discourse structure theories is the difference between writing and reading, or, in more computational terms, of text generation or text parsing. In text generation, attention is paid to the problem of arriving at linguistic expressions from abstract thought. Selection of relevant linguistic material, on the basis of conceptual criteria, is the most important task. The concepts of right frontier and open constituents are not directly useful for generation, since identification of antecedents of propositional anaphors is not a direct problem for generation. However, defining selection restrictions for propositional anaphors might be useful. Parsing theories have the problem of coming to an interpretation of a discourse, on the basis of linguistic and world knowledge, without prior knowledge of the conceptualizations of the speaker or writer. In such theories, identification of propositional anaphors is important, so the concepts of open constituent, right frontier and causality are central in parsing discourse.

By classifying theories of discourse structure, it is possible to make a short inventory of theories that are relevant in this chapter, and theories that are not. In table (5.2), they are classified with respect to the properties that were just introduced. Theories that score a + for the features Parsing, Coherence and Incrementation in table 5.2, may profit from the findings in this chapter. These theories are LDM, SDRT and PISA. But other theories may also profit from the analysis of accessibility that was given in section 5.2. In order to indicate these profits more precisely, all theories will be discussed shortly, in order of their appearance in the two tables.

RST *(...) is a linguistically useful method for describing natural texts, characterizing their structure primarily in terms of relations that hold between parts of texts* (Mann and Thompson, 1988, p. 243). This descriptive aim has as a result that the structures are not incremental: an expert makes overall decisions about the structure. Still, the notion of causality plays an important role in their coherence relations. Implementation of a right frontier restriction will be difficult, but perhaps some notion of accessibility may be defined for RST.

The notions of open constituent, right frontier and causality are relevant notions in LDM. This will be shown in the next sections.

Discourse Structure Theories

Rhetorical Structure Theory (Mann and Thompson, 1988)	RST
Linguistic Discourse Model (Polanyi, 1988; Prüst, 1992)	LDM
Procedural Incremental Structure Analysis (Sanders & Van Wijk, 1996)	PISA
Segmented Discourse Representation Theory (Asher, 1993)	SDRT
Discourse Representation Theory (Kamp and Reyle, 1993)	DRT
Dynamic Predicate Logic (Muskens, 1996)	DPL
Generation in Functional Grammar (Bateman and Matthiessen, 1990)	GFG
Intentional Structure (Grosz and Sidner, 1986)	IS
Argumentation in Text Generation (Elhadad, 1993)	ATG

Table 5.1: Names of Discourse Structure Theories, their abbreviations used in this chapter and significant references.

PISA parses a text in several rounds. In each round, discourse structure may be altered. The first two rounds are incremental. First, a clause by clause hierarchical structure is built (INSPECT) on the basis of linguistic indication. These structures, consisting of several clauses, are connected into structures of text segments (CONNECT). Finally, an overall structure is formed by reconsidering the whole structure (INTEGRATE). In all three rounds, causality and open constituents play a role. The right frontier may be important in the first two rounds. Schilperoord (1996) studies accessibility in PISA structures: he recognizes LDM as closely related to PISA, in this respect.

SDRT is an extension of DRT (see below) that tries to incorporate reader's belief and coherence between propositions. To obtain coherence relations, DICE is used (see the previous chapter). DRT-conditions (and some additional devices) represent these extensions. In SDRT, an account is given of topic update phenomena and Parallel structures. Attachment of clauses is such, that it affects the attached constituents (Asher, 1993, p. 272). Asher (1993) does not describe in detail how these tree constituents are affected (as he describes SDRSs instead). As a result, it is not possible to determine the interaction between his tree representations and the SDRSs that are formed incrementally. All the

Theories classified on discourse properties

	Parsing	Coherence	Incrementation
RST	±	+	-
LDM	+	+	+
PISA	+	+	+
SDRT	+	+	+
DRT	+	-	+
DPL	+	-	+
GFG	-	+	-
IS	+	-	±
ATG	-	-	-

Table 5.2: Discourse Structure Theories classified on three general properties, mentioned in the head row. + = theory has mentioned property; - = theory does not have mentioned property; ± theory can not be classified with respect to mentioned property.

constituents dominating the currently attached constituents, are defined as open in SDRT (definitions of 'open' and 'discourse subordinate' in Asher, 1993, p. 271). This definition of openness might be regarded as a definition of right frontier, since the currently attached constituent is also the rightmost constituent. However, the application of openness to a SDRS works out differently. All concepts studied in this chapter play a central, but differently defined role in SDRT. It falls outside the scope of this thesis to work out all the connections between SDRT and LDM.

DRT is a theory of semantic representation, originally developed to account for the scope of quantifiers over more than one sentence. Semantic or syntactic properties of linguistic items are represented in semantic representations of discourse fragments; accessibility of anaphors, and event and temporal information are represented. This is done in terms of logical conjunctions and conditional relations in predicate logic; embedding of discourse representation structures is possible in the scope of quantifiers and using conditionals. Causality might be implemented. In fact, SDRT is the result of the implementation of such notions. Within DRT, it is not possible to incorporate the notions of right frontier and open constituent in the representations of DRT.

DPL aims at maintaining the compositionality principle of meaning as formulated for Montague semantics and other logical approaches (Gamut, 1982b, p. 140-150), in representations of discourse (instead of single sentences). Although DRT does have a well-defined semantics, it has no one-to-one mapping between syntax and semantics (according to DPL). Only a subset of the phenomena that DRT covers, is addressed

by DPL. Therefore, none of the concepts discussed here, is important for DPL.

GFG is using linguistic knowledge from Systemic Functional Grammar (Halliday, 1985; Martin, 1992) to generate sentences. Selection of lexical items on the basis of their (interrelational) lexical semantic properties is crucial to generation. In Hovy et al. (1992), coherence relations are used to make generation possible from a more abstract level of expression of thought. Causality is an important notion in GFG, but the notions of right frontier and open constituents are not relevant.

In IS, segments in a discourse are defined as the satisfaction of a speaker's purpose, which is often a participant's task in a dialogue. The order of satisfactions in the real world determines the hierarchy of the segments. Used as a parsing tool, the hierarchy is supposed to predict the accessibility of text segments in a discourse. The insights gained in section 5.2 contain interesting observations for IS, but the analysis of these observations will be different for IS. The concepts of causality, right frontier and open constituents will be worked out differently.

Starting from an argumentative orientation (or standpoint) of some speaker or writer, the planning mechanism of ATG creates a global argumentative structure, and makes lexical choices on a local level, supporting the orientation. Causality and argumentative orientation are closely related, but the concept of argumentative orientation differs from the concept of what causality is assumed to establish: argumentative orientation may define constituents as more or less prominent. Causality defines its constituents as being available as an antecedent, in other words as open constituents. The theories of discourse structure and argumentative orientation should be related to each other, for they are complementary.

From this short overview, it appears that to LDM, but also to SDRT and PISA, the findings in this chapter may be relevant. In the remainder of this chapter, the focus will be on LDM. In the previous section, three questions are formulated. The first is: how is abstracted meaning of constituents calculated? This question will be answered in the next section.

5.3.3 Calculation of abstracted meaning in LDM

Building trees is quite simple in LDM, if it were only for making the branches and the nodes. Two rewrite rule schema's are capable of making tree structure. These are given in (38).

(38) 1. a+b $\rightarrow$ a b
2. x_1 + ... x_i + ...x_n $\Rightarrow$ x_1 ... x_i ... x_n

Rule 1. in (38) rewrites a constituent consisting of a+b into two constituents a and b. Rule 2. rewrites a constituent, consisting of the sum-

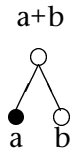
mation of *n* constituents, into a concatenation of *n* constituents.[22] The rules must be read as follows: in rule (38.1), constituent a and b form together a+b, and in rule (38.2), a sequence of coordinated constituents $x_1 ... x_i ... x_n$ together form the concatenation of *n* constituents.[23] The $\rightarrow$ and the $\Rightarrow$ each indicate the type of rule. The former makes binary trees and creates a top constituent; the latter makes coordinated structures consisting of more than two constituents, and replaces the former top constituent by a new one. In table (1.3), in the appendix, the rules are given in their full blown unification grammar format. The way the tree structure is formed can easily be read from the type of arrow used in the rules. What the rules in (38) do not express is the way semantic content is added to a+b in (38.1) and to x_1 + ... x_i + ...x_n in (38.2). These additions are very meaningful, for they organize the flow of information in the constituents of the tree.

To introduce tree structure building, and the way information is finding its way in the tree, a structure will be built for the example in (12), discussed in section 5.2. First, rule (38.1) will be discussed, and then rule (38.2). (12) is repeated here as (39).

(39) a. Interest rates have gone up.
b. The recession may reduce inflation.
c. Capital taxation is lower due to the tax reform.
d. **This** means brighter times for those who have money to save.

The first two clauses, (39a) and (39b), are taken together by applying rule (38.1). A binary tree structure is formed, as shown in (40).

(40)



This is very straightforward, but the tree structure does not give us any information about the semantics of this discourse. Two aspects are very important: what does (40a+b) represent semantically, and what closes constituent (40a)?

[22]The rule List Extension in table 1.3 does not imply rule (38.2). Instead of x_1 + ...x_i + ...x_n, a constituent (DCU_K) is defined that could be represented here as x_1 +... x_i + ...x_{n-1}. This would be the former top constituent. The semantics of the former top constituent remains the same when x_n is added to the discourse by List Extension. It is a semantic condition on x_n to fit in semantically in the former top constituent. In the tree, a concatenation of clauses is formed, and the former top constituent is transformed into the new top constituent. In other words, Prüst's (1992) List Extension rule does the semantics but not the tree; rule (38.2) does the tree but not the semantics.

[23]Because the tree is a result from parsing the discourse, the rules must be read from bottom to top (or from right to left), whereas the discourse tree would be generated from top to bottom. In (38.1), b is added to the discourse; in (38.2), x_n is added.

The meaning of (40a+b) is formed by the rules in table 1.3 in the appendix. While most of the rules have the format of rule (38.1), c.q. make binary trees, the way in which a rule calculates (40a+b) distinguishes it from other rules. In the case of the discourse in (39), the List Construction rule is used to make constituents like (40a+b). Essential for the List Construction rule is that a generalization takes place over the propositional contents of both clauses. (39a) says that *interest rates have gone up*. In Prüst's (1992) analysis, *interest rates* would be the topic and *have gone up* the comment. In (39b), *the recession may reduce inflation*, *the recession* is topic and *may reduce inflation* is comment. The two sentences are interpreted in a parallel way.[24] This means that the two topics are unified, as well as the two comments. Unification in list structures always involves application of the Most Specific Common Denominator (MSCD). Informally, one could say that a MSCD produces a meaning that generalizes over the meaning of (40a) and (40b), but as little as possible. Definitions of the MSCD are given in the appendix of this chapter. A MSCD must be found for the topics and the comments. The MSCD represents the abstracted meaning of (40a+b), when they are connected by the List Construction rule.

A MSCD is taking two meanings together and purges them into one abstracted meaning. This is done by making reference to a domain, in which entities of the world are organized into sets and subsets of each other. For instance, coffee and tea are both entities (or sorts), that both occur in a set of hot drinks, while the set of hot drinks occurs in the set of drinks. A common denominator of coffee and tea may be hot drinks or drinks; the most specific denominator of coffee and tea is only hot drinks, in a world that contains no other set including coffee and tea. The MSCD is both a condition for, and a result of the application of the List Construction and List Extension rule. In Grover et al. (1994), it is argued that requiring only generalization of topics and of comments (i.e., finding a common denominator, but not necessarily the most specific one) is sufficient for obtaining the appropriate abstracted meaning.

What does the MSCD produce for (39a+b)? This is dependent of a knowledge domain that organizes entities in sets and subsets of each other. This domain should cover all (concrete and abstract) entities in the world. Of course, such a domain does not exist, so it will be assumed that there is a partial domain that is sufficiently organized to handle knowledge of economics.[25] In the discourse of (39a) and (39b),

[24]The notion of parallel interpretation is central in Prüst (1992), but it can not be identified with e.g., Asher's (1993) notion of parallel. In Prüst's eyes, any sequence of two sentences is parallel, if they have the same topic and comment pattern. In this chapter, list structures will be regarded as parallel, but other relations do not have to be parallel for getting the right interpretation.

[25]Even if there were a knowledge of economics domain, it would not be able to represent what an individual speaker makes of the utterances in (39). Still, every speaker seems to have the tendency to generalize over the three utterances. Therefore, it is not

interest rates and *the recession* have most specifically in common that they are (part of) economic processes; *have gone up* and *may reduce inflation* do not refer to entities, but to sets, and they may have most specifically in common that they are both subsets of a set of good economic developments. Because the clauses (39a) and (39b) form a List, the abstracted meaning of the top constituent (40a+b) is represented by its MSCD: 'economic processes show good developments'.[26] In LDM, the MSCD represents context-dependent meaning: clauses that need to be attached, can only attach to a constituent with the appropriate context-dependent meaning (defined in the construction rules), and propositional anaphors take the context-dependent meaning of some constituent in the discourse structure as their antecedent.

Constituent (40a) is closed. This means that the semantic representation of constituent (40a) is not accessible for attachment, or propositional anaphors. Its semantic representation is only indirectly represented in (40a+b), namely in the MSCD. Making specific reference to the propositional contents of the clause that (40a) represents is therefore impossible. The application of the construction rule 'closes' (40a). Specific reference of a propositional anaphor to (40b) is possible, because this constituent is part of the right frontier. In order to make reference to (40b) only, the clause containing the anaphor should be attached to (40b) and not to (40a+b). The definition of open constituents is thus connected with the right frontier: only right frontier constituents are open, and the other constituents are closed. As a consequence, open constituents may serve two functions: they are a possible antecedent for propositional anaphors, and they are positions on which a new clause may be attached. In section 5.3.5, a proposal will be formulated to modify the definition of open constituents as antecedents.

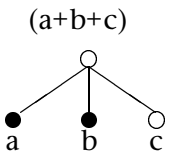
Now, suppose that clause (39c) is added to the discourse tree in (40). The clause *capital taxation is lower due to the tax reform* may be related to its context as a list again, mainly because of the parallelism between the clauses (39b) and (39c). When a list is extended to more than two clauses, rule (38.2) is used. In that case, the constituents (40a) and (40b) are identified as x_1 and x_i (this is what happens in the tree). Constituent (40a+b) and the new constituent then form a MSCD that has

the knowledge domain that makes a speaker decide to infer a List. Instead, linguistic clues like the parallel formation of the clauses are decisive.

[26] With the 'abstracted meaning' is meant here the context-dependent meaning that is represented in the **schema** of the rules in table 1.3, which contains the MSCD (cf. Prüst, 1992, p. 50). In the **sem** of the top constituent, the context-independent meaning is represented: the conjunction of the two **consem** contents (ibid.). The context-dependent meaning of a constituent restricts attachment (ibid.) and the possibility to be available as an antecedent: Prüst et al. (1994, p. 312) require that the MSCD that is contained in the context-dependent meaning of the constituent that serves as an antecedent, and the MSCD that results from the attachment of the VP anaphor to the antecedent, has to be non-trivial. This way, the **schema** values of open constituents are crucial for attachment, and anaphoric relations.

to contain the same information as the old one, according to the condition on the rule of List Extension (this is what happens semantically). The new top constituent is shown in (41).

(41)



The former top constituent (40a+b) has disappeared from the tree. List Extension thus coordinates more than two clauses under one top constituent, which represents the MSCD of all three clauses. The attachment of (41c) closes (41b). (41a) and (41b) can not be used as antecedents for a propositional anaphor, since they are closed. (41c) can be used specifically as an antecedent when attachment is made to (41c) and not to (41a+b+c).

In order to make a tree like (41), two conditions have to be met: the MSCD for (39a+b) must be the same for (39a+b+c), and the resulting tree consists of more than two coordinated constituents. Indeed, the List Extension rule has abstracted meaning from three clauses into a MSCD in the top constituent. Attachment of clause (39d) to the top constituent (41a+b+c) (probably by Rhetorical Coordinations: see the next section) results in resolution of the anaphor *this*: the antecedent is the MSCD of (41a+b+c).

In this section, it has been shown how List Construction and List Extension make a discourse tree structure, and provide abstracted meaning for the resulting higher nodes. These two rules are regarded as basic in LDM. However, these rules do not account for causality. The second question raised in the introduction of this section was: what is the effect of causal relations on discourse structure? In the next section, the answer will be given by introducing the rules of Rhetorical Subordinations and Rhetorical Coordinations. These rules are the only candidates to account for causal relations in LDM. In fact, a reformulation of these rules will be proposed, merging them together into one rule of causal relations. Furthermore, a new rule will be formulated: Denial of Expectation.

5.3.4 Coherence in LDM

In the previous sections, the basic rules of List Construction and List Extension have been introduced. In this section, two other rules will be discussed: Rhetorical Coordinations and Rhetorical Subordination. Prüst (1992) has formulated a few other rules (Enumerations, Question-Answer Pairs, and Interruptions), but they do not play a role in the phenomena under discussion in this chapter.

Every rule has the same format as the List Construction rule, namely (38.1). The difference is the abstracted meaning of the top constituent

in the tree. And this is, at the same time, the most important property of LDM: its rules determine the information flow of the semantic contents of the clauses to the top constituents. The differences between the rules, as Prüst et al. (1994) formulate them, are very small.

The rule of Rhetorical Coordinations is almost the same as the List Construction rule in their formulation in Prüst et al. (1994). The only difference is in the conditions on the application of the rules. This difference will become clear, with the help of simple versions of the rules in table 1.3, together with their conditions (at the same time, these rules are different extensions of the rule in (38.1)). They are given in (42). To make clear that the rules differ with respect to the coherence relation, and (so) in abstracted meaning, the top constituents will not be represented by a+b, but by **list**(a,b) or **coo**(a,b).

(42)

Simple List Construction	**list**(a,b)→ a b
• Conditions:	Common Denominator is non-trivial; relation indicated by: {*and, or, ...* }
Simple Rhetorical Coordinations	**coo**(a,b)→ a b
• Conditions:	relation indicated by: {*therefore, so, thus, accordingly, ...* }

In the Simple List Construction Rule, **list**(a,b) might be read as the total semantic contents of the constituents a and b. This contents is split up in a context-dependent and a context-independent semantics, in the formulation of the rules in table 1.3. Whenever such a distinction becomes relevant in this section, it will be mentioned explicitly. There are two conditions on the application of Simple List Construction: a non-trivial common denominator has to be found, and the relation must be indicated by a connective from the set { *and, or, ...* }.

The calculation of a non-trivial common denominator was already demonstrated with respect to (39). *Economic processes show good developments* is non-trivial, in the sense that this statement means something different than the concatenation of the three clauses that formed it. A non-trivial MSCD of two entities a and b refers to an entity that includes the set { a,b }. This latter entity must be defined, i.e. it must exist in the speaker's knowledge of all sorts and entities.[27]

The second rule formulated in (42) is Simple Rhetorical Coordinations. In this rule, a non-trivial common denominator is not required. It is not really clear, however, what this means. Prüst (1992, p. 55) observes that Rhetorical Coordinations almost always occur without a

[27]The non-triviality condition distinguishes the List Construction rule from other additive structure rules that have been formulated in the literature. It can be related to Asher's (1993, Ch. 7) topic based updating through the rules of Continuation or Elaboration, in his formulation. However, Asher (1993) does not work out a notion of topic update as generalization.

parallel relation. He explains that the lack of a parallel relation may result in an empty MSCD. If the abstracted meaning of Rhetorical Coordinations is empty, attachment can only take place on the rightmost clause, and not on the top constituent (for it has no context-dependent semantics). But it seems more appropriate to assume that the MSCD may be trivial: only the propositional contents of the two clauses are taken together as exactly the set that consists of just the meanings of these two clauses. There is no generalization in terms of the events or referents expressed in the contents of the clauses. Reference to the top constituents, in such cases, means reference to the meaning of the whole sentence. It is not possible to specify the meaning of one of the two clauses with reference to the top constituent.[28]

A simplified version of Rhetorical Subordinations is given in (43).[29]

(43) Simple Rhetorical Subordinations
- Conditions: **sub**(a,_) → a b
  relation indicated by:
  { *because, since*, ... }

In Rhetorical Subordinations, no common denominator is calculated. Only the semantics of the main clause is represented, as a whole, in the abstracted meaning of the top constituent. From the condition on connectives, it may be inferred that Rhetorical Subordinations is called Explanation in other theories. The rule will be exemplified below.

In section (5.2.3), the dentist example (22) was discussed. The relation between the first two clauses, *Fred went to the dentist because he needed a checkup*, is captured by Rhetorical Subordinations. Because the semantics of the first clause is represented in the top constituent, Rhetorical Subordinations explains why a VP anaphor *Mary does too*, followed by a rebuttal denying the second clause, may take the first clause as antecedent: the abstracted meaning is in fact the context-dependent meaning of the top constituent. Reference to the second clause can be made only by attaching to it directly, as it is the rightmost clause.[30]

[28] Prüst (1992) does not claim that there is something like a trivial update. However, it seems reasonable to assume one, since the meaning of the relation expressed by non-parallel relations is often the concatenation of the two clauses.

[29] The top constituent has been given a context dependent semantics represented as **sub**(a,_). This can be inferred from the rule of Rhetorical Subordinations formulated in table 1.3. The **schema** of the rule before the arrow, beginning with sub, has a schema C_1. This is identical to the **consem** of DCU_1. The context dependent meaning is thus characterized by the main clause, and only the main clause is a condition on attachment or anaphoric relation. An interesting question is what this means for the analysis of (22) without the rebuttal, where the VP should be referring to an antecedent in which both clauses are represented. Prüst (1992) and Prüst et al. (1994) only give a formal account of (22) including the rebuttal, where it should be only the main clause representing the antecedent.

[30] Surprisingly, Prüst et al. (1994) do not seem to use this property of Rhetorical Subordinations to analyze (22): they invoke non-incrementally formed parallel structure

Prüst et al. (1994, p. 310) claim that Rhetorical Coordinations and Rhetorical Subordinations are each other's mirror image in some senses. However: there is a structural difference between the two relations: *in Rhetorical Coordinations, it is not the case that one part 'dominates' the other*. This mirror image can be formulated in terms of abstracted meaning: the context-dependent semantics of the left clause is taken as the context-dependent semantics of the whole relation in Rhetorical Subordinations; the context-dependent semantics of the right clause is taken as the context-dependent semantics of the whole relation in Rhetorical Coordinations. The difference is, that the relevant context-dependent semantics can not be expressed by the leftmost clause in Rhetorical Subordinations, for this has to be done through the top constituent **sub**(a,b).

The construction rules that are most relevant to this chapter have been introduced. The rules are presented in a simplified form. As a result, two problems with the construction rules can be made more visible. Before these problems are discussed, it has to be acknowledged first, that a lot of the properties of LDM, focussing on List relations, topic continuity and generalization, are not discussed here. In fact, the problems that will be mentioned exist because the main development of LDM has been in that direction. Causality and its discourse structural effects have not been worked out specifically. Therefore, the modifications that will be proposed may count as an extension of LDM, rather than corrections of LDM.

Modifications The first modification of LDM will be a reformulation of the Rhetorical rules. It will be argued first, why it makes sense to reformulate these rules.

The phenomena that the rule of Rhetorical Subordinations is supposed to solve are associated with causal relationship, rather than subordination. Specific properties of the rule Rhetorical Subordinations in its present formulation are used to explain the phenomena discussed in section 5.2.3. It is argued there, that not subordination, but causality is the relevant property. Likewise, Fraurud's (1992) analysis of discourse subordination, in section 5.2.2, appeared to concern causality rather than subordination.

The fact that some clauses appear to be more salient than others in discourse, certainly plays a role in the degree of accessibility they have in discourse structure: nuclei are more accessible than satellites. With regard to the assignment of this property of constituents, argumentative orientation is decisive, according to McKeown and Elhadad (1991) (they call it 'directive act'). This assignment is partly a property of causal relations, for they play an important role in argumentation, but many other factors determine argumentation too (cf. Elhadad, 1993):

in order to identify (22a) as the antecedent. This procedure has nothing to do with the subordinative nature of the relation between (22a) and (22b).

for instance, expressing the attitude of the speaker by using positive and negative connotated lexical items. In other words, the construction rules do not need to express saliency of constituents. Discourse structure defines whether or not constituents are open (available); argumentative orientation whether or not they are salient (more less accessible). Only open constituents may be more or less accessible: closed constituents are always inaccessible.

If the rule of Rhetorical Subordinations is changed in such a way, that the subordinate clause is also represented in the abstracted meaning, Prüst's (1992) analysis of the VP anaphors and rebuttals is not in danger: parallel structure is supposed to identify the antecedent. However, in the analysis proposed in this chapter, availability of the first clause should be possible without the rebuttal too, which means that parallel structure on its own can not be the complete explanation. Therefore, the availability of the first clause has to be arranged in another way. This will be done after the reformulation of the Rhetorical Sub- and Coordinations, in section 5.3.5.

One aspect of the formulation of the Rhetorical rules in table 1.3 is, that the condition on the application of the rules concerns causal connectives only. Prüst et al. (1994) acknowledge that presence of the connective is not obligatory. There are relations that can be recognized as Rhetorical Subordinations while they are not marked by a causal connective expressing explanation (see, for instance, (24) and (23)). These relations do express causality. From this observation, two remarks may follow.

The first remark is that the conditions on the Rhetorical rules are formed by lists of explicitly mentioned causal connectives, concerning causal relations.[31] Moreover, the observed effects of these rules are due to their causality (see the sections 15 and 5.2.3). Therefore, the condition on the new rule of Causal Relations, defined in (44) below, is that the relation must be recognized as causal.

The second remark is based on the discrepancy in stating an explicit condition on connectives, while admitting that the same relation is found without connectives (Prüst et al., 1994, p. 279). In chapter 4 of this thesis, the inference of the causal relation, with or without connectives, was treated. A causal relation is inferred through DICE, creating a predicate cause(a,b). If it is assumed that DICE is executed before the construction rule is applied, the relations are given already. The difficulties of recognizing a causal relation have shifted to DICE. In chapter 4, it was shown how DICE deals with these problems. If the condition of a construction rule refers to a relevant coherence relation

[31]There are of course, other kinds of subordination in discourse structure: temporal subordination, or conditional subordination. The fact that only causal connectives are mentioned in the conditions of Rhetorical rules, is therefore meaningful: precisely their causal property is what defines the Rhetorical rules. In order to define temporal relations or conditional relations, other construction rules are needed, not formulated by Prüst (1992) or Prüst et al. (1994).

inferred by DICE, the treatment of, for example, the difference between explicit connectives and coherence without explicit markers has been accounted for before the tree is built.

The rule of Rhetorical Subordinations may simply be identified with the rule of Rhetorical Coordinations. The only real difference between Rhetorical Subordinations and Rhetorical Coordinations was the representation of the subordinate clause in the abstracted meaning. It has been argued that not a subordinate clause, but a causal relation was essential for what these rules express. This argument counts even more for Dutch, where Rhetorical Coordinations may be expressed by subordinate clauses, for instance by using the Dutch subordinative connectives *waardoor* 'through by' and *zodat* 'so that'. In those cases, the meaning of the subordinate clause will be represented in the abstracted meaning too. Of course, rhetorical subordination is not a reflection of syntactic subordination alone. It could be possible that something like argumentative orientation is represented by the rule. In section 5.2.4, however, it appeared that causal relations in context and argumentative orientation reflected different effects on antecedents. Therefore, causal relations and argumentative orientation should not be expressed at the same time in one construction rule. Argumentative orientation could be represented as the assignment of a directive act, after a discourse structure has been formed.

Given the decision that a subordinate clause should be represented in the abstracted meaning, the real difference between Rhetorical Subordinations and Coordinations can be represented in the formulation of a rule of Causal Relations (in (44)): the direction of the causal relation. The rules are each other's mirror image, because they each represent a causal relation, but in different directions. This difference will be expressed in the conditions of Causal Relations. And given these conditions, the rule itself may be identical for both Rhetorical Coordinations and Subordinations. The rule of Causal Relations, formulated in (44), may replace the Rhetorical rules.

(44) Causal Relations **caus**(a,b) → a b
- Conditions: Cause(a,b) or Cause(b,a)

The mirror image of Rhetorical Subordinations and Rhetorical Coordinations has now become the difference in the direction of the relation in the condition of the rule. In the rule, it is not expressed how the abstracted meaning is calculated (but it is shown in table 1.3). It is the most free application of the MSCD possible: the MSCD may be empty, non-trivial, or trivial. In case of an empty MSCD, reference can be made only to the rightmost clause of the relation: reference to a unified meaning of the two clauses is impossible (cf. Prüst, 1992, p. 55). In case of a parallel causal relation, the MSCD is non-trivial. Examples of parallel causal relations are found in gapping constructions, such as the examples in chapter 3, section 3.9 (and also in Prüst, 1992, chapter 4). The most common situation is the trivial MSCD, although Prüst (1992)

does not mention this explicitly: the set of just the two meanings of the clauses taken together, without generalization. Reference has to be made to this set as an undivided unit. This is the case in (22a-c), where *Sara did too* means, within the context of (22a-b): 'Sara went to the dentist, because she needed a checkup'.

One thing is not governed by this rule: keeping the first clause, a, open in case of application of Rhetorical Subordinations.[32] The first clause is not represented in the top constituent (at least, not as a specific constituent), and it is closed after application of the rule. So, in addition to this rule, something must be arranged for the first clause. This will be explained in 5.3.5.

The second modification is an improvement of the treatment of contrastive relations in LDM. The only construction rule that Prüst et al. (1994) mention, is the rule of Contrast Pairs. As argued in chapter 2, section 2.3, there are more contrastive coherence relations: semantic opposition, concession and denial of expectation. The rule of Contrast Pairs has to be identified with semantic opposition, for it needs to be interpreted as a pair of parallel clauses. Concession and denial of expectation have not been defined. Given the rule of Causal Relations, however, it will not be difficult to derive a construction rule for denial of expectation, since denial of expectation is also a causal coherence relation. In simplified version, this rule is formulated in (45).

(45) Denial of Expectation **den**(a,b) → a b
- Conditions: Cause(a,¬b) or Cause(b,¬a)

The condition of the rule is a recognition of a causal relation, of which the consequence is a negation of the semantics of the clause it is associated with. **den**(a,b) does not contain a negation. The violation of the expectation is realized by recognizing the negation in Cause predicate. The difference in order of the clauses in the Cause predicate are needed because expressed by *although*, a denial of expectation can be used in two orders: '*although* a, b' (Cause(a,¬b)) and 'a, *although* b' (Cause(b,¬a)). The condition therefore contains two possible Cause predicates for a and b. In section 5.4, the rules of Denial of Expectation and Causal Relations will be demonstrated.

In this section, it is explained which role coherence plays in abstracted meaning. The rules of Rhetorical Sub- and Coordinations have been merged into one rule of Causal Relations. Causality is a condition on the construction rule of Causal Relations. The definition of Causal Relations made it easy to formulate a construction rule that was not defined before: Denial of Expectation. As a causal rule, its formulation

[32]Notice that the possibility for the VP anaphor to refer to (22a+b) as a whole, contradicts the fact that in Rhetorical Subordinations only (22a) is represented in the context-dependent meaning.

is similar to Causal Relations, only the effect of contrast has to be incorporated. The effect of causality in these construction rules is, that abstracted meaning is not calculated with a non-trivial MSCD, giving a minimal generalization of the meanings of the two clauses, but by a trivial MSCD.

In the rule of Rhetorical Subordinations, the subordinate clause has disappeared from the abstracted meaning. In section 5.2, it has been argued that it is not the disappearance of the subordinate clause, but the causal relation that makes it possible to change the set of available anaphors. Construction rules create the constituents that may serve as antecedent. It is therefore important that the construction rules represent the relations that affect discourse structure. In other words: Causal Relations give a better representation of the relevant relations and conditions in the discourse structure.

A consequence of the rule of Causal Relations is, that the definition of open constituents has to be changed (for the left hand clause of Causal Relations must be open). Open constituents are defined on the tree structure: only right frontier constituents are open. The third question raised in the introduction of this section was: what is the effect of open constituents in discourse structure? This question will be answered in the next section, and a new definition of open constituents will be provided.

5.3.5 Open constituents in causal relations

The rule of Causal Relations creates a tree, that allows an anaphor to refer to two constituents in the tree: the top constituent **caus**(a,b), when a trivial MSCD is assumed, and the constituent representing b only. Reference of an unmarked anaphor in its context is by default represented by reference to the top constituent. Reference of a marked anaphor in its context is by default represented by reference to the rightmost constituent b. If a marked anaphor is referring (guided by the meaning of the anaphor's predication or context) to the leftmost clause a, the discourse structure creates a problem: the right frontier restriction does not allow it.

The facts and discussions in section 5.2 have shown that it should be possible to choose the left hand constituent as a specific antecedent. The rule of Causal Relations does not provide this possibility in the context-dependent semantics of the top constituent. And this is correct, for the top constituent provides the meaning of the whole sentence and not specific reference to one clause. Instead, reference to the left hand constituent must be similar to reference to the rightmost constituent: its context-dependent semantics represents the antecedent. Therefore, this constituent should be open, although it is not on the right frontier.

In order adjust the effects of the right frontier restriction, a difference must be made between attachment and coreference. Attachment

is an expression of relational coherence. Given an incremental model like LDM, it must preserve the string order of clauses represented in the discourse structure. Therefore, attachment is necessarily constrained by the right frontier restriction (violating the right frontier restriction results in a change of the order of the clauses in the representation of the discourse).

Coreference is an expression of referential coherence. The antecedent of a propositional anaphor must be an open constituent. There is no need, to preserve string order of clauses here, for coreference has no consequences for the order in which clauses are represented in a discourse structure.

Open constituents are used in two different ways: for attachment and for coreference. Open constituents can be defined as clauses that have their context-dependent meaning available. So, both attachment and coreference need open constituents. There is a difference between both processes with respect to the open constituents they may actually use. All open constituents are available as an antecedent, but only open constituents that occur on the right frontier are available for attachment. This difference can be expressed by defining the positions in discourse structure that are occupied by open constituents. This is done in the following way:

Open constituents

Constituents are open in a discourse tree structure:

1. when they are on the right frontier;

2. when they are connected with the right frontier through Causal Relations or Denial of Expectation.

The reason why Denial of Expectation is incorporated in this definition is, that it is not the construction rule as such, but its condition that a causal relation holds between the constituents. Denial of Expectation is characterized by the condition of a causal relation, so it has the same effect on constituents as Causal Relations, according to the definition (and according to the facts, as example (2) already showed).

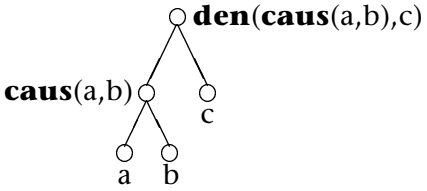
All open constituents are possible antecedents: the cases 1. and 2. make constituents available for coreference. Attachment still is allowed only to right frontier constituents. Only case 1. is allowed for attachment. These two aspects of tree structure are clarified below.

The right frontier of a discourse tree consists of the set of the context-dependent semantics of each constituent on the right frontier. The context-dependent semantics is needed to attach to the tree, or to refer to an antecedent (see footnote 26). Without changing the right frontier, there is no problem with extending the set with the context-dependent semantics of other constituents in the tree. In agreement

with the definition of open constituents, the context-dependent semantics of a constituent is percolated to the right frontier, only if it is connected with the right frontier through a causal relation.[33]

In (46), a discourse tree is made by connecting (46a) with (46b) by **caus**(a,b), and this constituent with (46c) by **den**(**caus**(a,b),c). An example of a discourse this structure could represent, would be: *(a) Cecil married Greta (b) because she was beautiful, (c) but he didn't love her.*

(46)



Two constituents in (46) are both open and ready to be attached to by a new clause: **den**(**caus**(a,b),c) and c. Five constituents are open, and ready to be antecedent for a propositional anaphor: **den**(**caus**(a,b),c), **caus**(a,b), c, a and b. Which of these antecedents is identified by the propositional anaphor is dependent on other factors, such as the predication of the anaphor, or the saliency of certain antecedents (for instance: right frontier constituents are closer to the anaphor than constituent a and b, and the argumentative orientation of constituent c is stronger than that of a and b). The tree structure does not predict that there should be five propositional anaphors that all take a different antecedent. It only predicts that five constituents might be antecedents, in the right contextual circumstances. This way, the (old) right frontier restriction still counts for attachment, while open constituents are restricted by the new definition.

What happens if a non-causal relation was used instead of **den**, to create (46), for instance in the structure representing the example of the insects in (37)? In that case, the relation between (a,b) and c in (46) would be a **list**. **caus**(a,b), a and b would be closed, and only the right frontier constituents **list**(**caus**(a,b),c) and c would be open. Constituents representing a non-causal relation close every constituent in reach of their left hand branch. Closed constituents can not be represented with their context-dependent semantics on the right frontier.

It has been made clear how constituents in discourse trees may be open and closed, independent of the right frontier restriction. A definition of open constituents defines which constituents are open; the right frontier still restricts attachment; and constituents are closed on the left branches of constituents representing non-causal relations.

[33] In Gardent (1994), it is described how the right frontier provides the information that is available on a certain parsing stage. She does not claim that information is percolated from within the tree; this is just a matter of definition, however.

5.3.6 Conclusion

In the introduction of this section, three questions were formulated.

1. How is abstracted meaning of constituents calculated?
2. What is the effect of causal relations on discourse structure?
3. What is the effect of open constituents in discourse structure?

The answer to the first question is that the calculation of the MSCD results in the abstracted meaning of a constituent representing two connected clauses. This calculation is different in different construction rules. It must be non-trivial for lists, which means that it is the minimal generalization of the meanings of two clauses. The answer to the second question is, that the MSCD may be trivial with causal relations. This is not strictly conform LDM: it is argued that their rules of Rhetorical Sub- and Coordinations should be replaced by one rule of Causal Relations. The condition on this rule is that a causal relation be recognized. Output from DICE may thus deliver input for LDM. The answer to the third question is that open constituents are available as antecedent for propositional anaphors. They may be more or less accessible, dependent on other factors of discourse, such as distance and argumentative orientation. Open constituents are right frontier constituents and constituents connected with the right frontier through a causal relation. Attachment is still restricted by the (old) right frontier restriction. This restriction is concerned with a subset of the open constituents.

In section 5.4, it will be shown that the new definition and the new rules give better results than those given in Prüst (1992).

5.4 Anaphors, contrast and discourse trees

5.4.1 Introduction

In this section, the construction of VP anaphor and rebuttal, already discussed in section 5.2.3, will be revisited within the framework of LDM. Prüst's (1992), and Prüst et. al.'s (1994) analysis of this construction is not justified by the observations made in this chapter, and it is damaging one of the main features of LDM itself: the incremental procedure. In section 5.2.3, three objections were made against the LDM analysis of the VP anaphors and rebuttals combination. First, why is it impossible to refer to (47a) without the rebuttal? This is only because the VP anaphor is unmarked. But if a marked anaphor is used, it should be possible. Second, the relation between (47a) and (47b) is crucial to the analysis: whether or not the rebuttal is invoking a parallel relation, the first two clauses ought to contain a causal relation. The fact that

Prüst (1992) assumes a List between (47a) and (47b) (whereas a purpose is expressed in (47b)) underlines that it is not considered a crucial property in his analysis. Third, the idea that the parallel structure is invoked by the rebuttal, and derived by non-incremental parsing, is not attractive and not necessary.

In the previous section, some improvements of LDM were proposed: new construction rules of Causal Relations and Denial of Expectation, and a new definition of open constituents. In this section, it will be shown that the improvements make it possible to give a reanalysis of the VP anaphor with rebuttal construction that does not suffer from the disadvantages of the analysis in Prüst (1992) or Prüst et al. (1994).

Prüst (1992) does not give a detailed derivation of the dentist example in (22), but he uses (47) instead.

(47) a. John went to the library.
b. He borrowed a book on computer science.
c. Bill did too,
d. but he borrowed two books on French.

It seems obvious that this example should have an analysis similar to (22) in section 5.2.3. However, there is a difference between (47) and (22) from section 5.2.3: Prüst (1992) claims that the relation between (47a) and (47b) is taken to be a **list**, instead of a **sub**.

To make the analysis and the improvements on the analysis more precise, Prüst's (1992) derivation of example (23), discussed in section 5.2.3, will be demonstrated in section 5.4.2. After a discussion of Prüst's (1992) derivation, an alternative will be demonstrated in 5.4.4, conform the open constituents definition and the new construction rules.

5.4.2 Looking ahead with VP anaphors

Prüst (1992) tries to account for the observation that in (47a-d), (47a) is chosen as the antecedent for the VP anaphor. In Prüst's analysis of the first three clauses of (47), there were two possible antecedents for the VP anaphor in (47c): (47b), or (47a+b). When (47d) is added to the discourse, (47b) is not a possible antecedent anymore. (47a+b) (or: **list**(a,b)) is the only possible antecedent. A parallel interpretation is formed between (47a+b) and (47c+d), so that (47a) is an antecedent for (47c).

The sequence of four clauses is parsed in three steps: first (47a+b), then (47c+d), and then the attachment of these two conjunctions to each other. The second and the third step are non-incremental.

(47a) and (47b) form a **list**, generalizing over the activities of *John*: he is 'borrowing books from the library'. (47c) and (47d) form a tree, but since there is no contrast between these clauses, no semantic interpretation is realized. The rule of Contrast Pairs is the same as Prüst's

formulation of List Construction. The element of contrast is assumed to be present in the rule (cf. Prüst, 1992, p. 54), but this is not worked out explicitly. The rule of Contrast Pairs forms a relation **con**(c,d), without resolution of the VP anaphor, and without a specification of contrastive elements between the clauses c and d (which is needed to use Contrast Pairs properly).

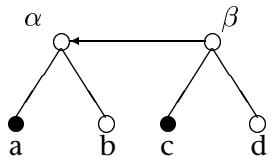
The last step is that (47a+b) and (47c+d) are connected. These complex constituents are put together by List Construction. This rule requires parallel interpretation, which means, in this case, that the VP anaphor in (47c) is resolved as the predicate of (47a) ('went to the library'), with *Bill* as a new subject. The contrast in (47d) is realized with (47b) ('John borrowed a book on computer science, but Bill two books on French'). Given these resolutions, common denominators are found on the higher level of **list**((47a+b),(47c+d)): 'boys go to the library and borrow books'.

The last step of merging the two trees is shown in (48). In (48i), two trees have been created. The arrow in (48i) is indicating the attachment that is about to take place. For reasons of presentation, the identification of constituents formed by a construction rule is done by assigning a Greek letter to the nodes in the tree, corresponding with their semantic representations outside the tree.[34]

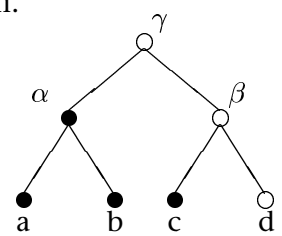
(48)

α=**list**(a,b);
β=**con**(c,d);
γ=**list**(α, β)

i.



ii.



The attachment of (48iβ) to (48iα) results in the construction of the constituent (48iiγ) through a **list** relation.

Prüst (1992) calls the procedure of making a tree before attaching it to the main structure 'looking ahead'. Such a procedure is not incremental anymore: forming the Contrast Pair first in order to resolve the VP anaphor, is not an incremental step. Especially the postponement of resolution of the VP anaphor, and the assumption of a **con**(c,d) without a realized contrast between these clauses, are violating incrementality. Prüst (1992) acknowledges this violation, but claims that this is the only way to arrive at a correct representation.

The three problems already mentioned in the introduction of this section, will be discussed in the next section.

[34]These representations may contain Greek letters again: in (48), γ=**list**(α, β) is read, by substitution of α and β, as: γ=**list**(**list**(a,b),**con**(c,d)).

5.4.3 Discussion

Three problems were mentioned in the introduction: the first clause must be available as constituent, the relation between the first two clauses must be causal, and the non-incremental procedure should be avoided. These problems will be discussed in detail in this section, within the framework of LDM.

The analysis of the VP anaphor is not accurate. Prüst (1992, p. 107) takes (47a+b) or (47b)as possible antecedents of the VP anaphor, in the case of absence of the rebuttal. Since the rebuttal is inconsistent with (47b), and both antecedents contain (47b), the resolution of the VP anaphor is withdrawn, incremental parsing is stopped, and a non-incremental parsing of a parallel structure is started. This is a rather bold solution, that should be avoided, if possible. It is easier, and more according to the facts, to assume a third possible antecedent, namely (47a). The rebuttal is selecting from three possibilities, and the only thing that happens is that the underspecified reference of the unmarked anaphor, (47a+b), is replaced by a specified reference, (47a), due to the marked combination of VP anaphor and rebuttal. This makes a generalization possible between the VP anaphor and other anaphors, like *that*: these anaphors are also capable of referring to the first clause without rebuttal. The change that is needed to obtain this solution, is to claim that (47a) is an open constituent.

The causality between the first two clauses (the second problem) is not an essential part of the analysis in Prüst et al. (1994). In the analysis of Prüst (1992), it is even a list. According to intuitions on causal relations, the relation between (47a) and (47b) is not a list. It can be understood causally without any problems: *John went to the library in order to borrow a book on computer science* might reflect a correct interpretation of the sentence.[35] In (47b), a purpose is expressed. Purposes, or Goal-Instrument relations, are considered to be causal (Renkema, 1993; Sanders et al., 1993, cf. footnote 15)

The third problem is that the process Prüst (1992) calls looking ahead, is not necessary. The assumption that (47a) is not a possible antecedent for the VP anaphor on the moment that the rebuttal has not been attached, is crucial for the non-incremental parsing strategy: if it were a possible antecedent, there would be no need to restructure the discourse with a non-incremental parse. In this chapter, evidence has been presented that (47a) is a possible antecedent, and as a consequence, there is no need for a non-incremental parse. The parallel structure, needed for the parallel interpretation can be created with incremental parsing. In their analysis of the parallel Contrast between the two pairs of clauses, Prüst et al. (1994) refer to Asher (1993). He defines Contrast relations on Parallel structures, but the way parallel structures are derived, differ from the non-incremental approach.

[35] It is hard to imagine that John did not go to the library to borrow a book, while he in fact did borrow one.

Asher's (1993) approach will be used in the next section.

Rebuttals that exclude another antecedent than the first clause do not create a parallel structure. In (49), a rebuttal is not denying the second, but the first clause.

(49) a. John went to the library.
b. He borrowed a book on computer science.
c. Bill did too,
d. but he went to another library.

Providing a structure for (49) is not problematic for Prust (1992), for (49b) is taken to be the antecedent of the VP anaphor, and a non-parallel structure is derived. However, a parallel structure is needed for the interpretation of *but* in Contrast Pairs. Prüst (1992) refers to Asher (1993) for his definition of Contrast, but this definition is defined on Parallel relations. The definition of Contrast Pairs given in Prüst (1992), is identical to the List relation except for a negative element in one of the related constituents. This means that Prüst (1992) regards Contrast Pairs as Parallel. This analysis of (49) gives a fourth problem for Prüst's (1992) analysis, for the relation between (49c) and (49d) is not a semantic opposition, in terms of chapter 2 of this thesis, but a denial of expectation. *Bill did too* takes (49b) as its antecedent, and the result of that is paraphrased as: 'Bill borrowed some books too, but he went to another library'. There is a causal relation 'normally, if you borrow books, you go to a library', that may serve as an expectation. The denial *he went to another library* does not seem strong enough, but the context in (49a) gives us the library Bill is expected to go to.[36] Whereas the interpretation of the rebuttal is both crucial and problematic in (47), Prüst (1992) does not analyze contrast at all:

> (...) the relation of contrast [between (47c) and (47d)] cannot be justified. (As indicated before, I shall not attempt to spell this relation out in detail). (Prüst, 1992, p. 107)

Four problems are discussed with Prüst's (1992) analysis of VP anaphors, specified by rebuttals. The first three problems were already addressed in the introduction of this section: the first clause must be available as constituent, the relation between the first two clauses must be causal, and the non-incremental procedure should be avoided. In a more detailed analysis, it appeared that the discourse in (47), which seemed unproblematic at first sight, poses a fourth problem: the relation between VP anaphor and rebuttal is a denial of expectation, and not a semantic opposition.

In the next section, it will be shown that an alternative analysis can solve these problems.

[36] There must be some referential link between *the library* in (49a) and in (49d). How this link is established, is not relevant for the discussion, for it is not an aspect of the propositional anaphors studied here.

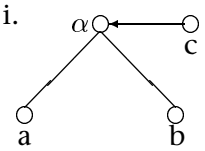
5.4.4 Looking back with rebuttals

In this section, an alternative analysis is given for (47), in which the four problems discussed in the previous section are solved. The first problem is solved if it is assumed that the VP anaphor is unmarked, and later specified by the rebuttal: in fact, there are three possible referents, and the rebuttal excludes two of them. An unmarked anaphor just takes the obvious antecedent; a marked anaphor takes a specific clause. The second problem is solved by the assumption of a causal relation between (47a) and (47b): instead of a List, Causal Relations is assumed (defined in section 5.3.4). The third problem is solved by dropping the looking ahead strategy, replacing it with a strategy of looking back, when the interpretation of Contrast is applied. The fourth problem is solved by analysing the relation between the VP anaphor and the rebuttal as a Denial of Expectation in cases where this relation is most likely.

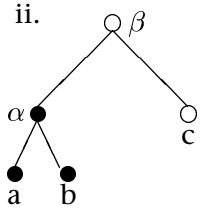
The structure leading to the interpretation of (47) will be built incrementally. The **caus** relation joins (47a) and (47b). According to the definition of open constituents, no constituent will be closed at this point. To this structure, (47c) is added at the level of the top constituent. This means that the interpretation of the VP anaphor is determined by **caus**(a,b). This way, the structure in (50ii) arises.

(50) α=**caus**(a,b);
β=**list**(α,c)

i.



ii.

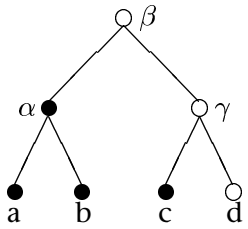


Bill did too has been attached to (50iα). This attachment corresponds with two possible interpretations of the VP anaphor: the context-dependent semantics of (50iα) or (50ia). (50ic) could have been attached to (50ib). This corresponds with the interpretation of the VP anaphor in (50ib). It is only at the moment of attachment of the rebuttal that this possible structure is in fact excluded, but to keep the presentation simple, only the possibility in (50)is presented here. Because (50ia) is still open, its context-dependent semantics is available at the right frontier through the left branch of (50iα). The VP anaphor is unmarked, so it will prefer to take (50iα) as an antecedent. However, two other antecedents are possible too: (50ia) and (50ib). Given the tree structure, the context-dependent semantics of (50ia) can only be reached by (50iα), since its left branch is connected with (50ia) (and (50iα) expresses a causal relation).

In (50ii), the constituent (50iiα) and its daughters below are closed. As (50iiβ) is an additive relation, it will close all of the constituents under its left branch.

The attachment of the rebuttal is shown in (51). The rebuttal is connected with the VP anaphor in (51c), so it is attached at the level of (51c).

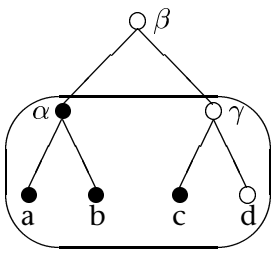
(51) α=**caus**(a,b); β=**list**(α,c); γ=**den**(c,d)



Attaching (51d) to (51c) gives (51γ). The VP anaphor is interpreted as (51a) or (51a+b) (on the basis of its attachment in (50i)), but the latter interpretation is inconsistent with the rebuttal. So, the VP anaphor is interpreted specifically as (51a). This gives the following interpretation: 'Bill went to the library as well, but he borrowed two books on French'. In this interpretation, the contrast may be seen as a denial of expectation. The expectation is: 'if Bill does the same as John, he borrows a book on computer science'. This denial of expectation in (51c+d) is based on an expectation just formulated in (51a+b). These pairs of clauses form a semantic contrast on a higher level, where they are recognized as parallel in discourse structure.

In Asher (1993), a parallel relation is always dependent of isomorphic subtrees. In the structure in (51), such subtrees can be found: (51α) and (51γ) have isomorphic subtrees.[37] Following Asher (1993), this is graphically represented by drawing a rounded square around the isomorphic subtrees.

(52) α=**caus**(a,b); β=**list**(α,c); γ=**den**(c,d); Parallel(α,γ)



The constituents (52α) and (52γ) form isomorphic structures, so they may be interpreted as parallel. This is not expressed in an extra constituent, but in a condition on a SDRS: Parallel(α, γ). Parallel interpretation is not establishing coherence between clauses, but rather ordering structures (notice that the relation is not involved with terminal constituents, i.e. clauses).

[37] The fact that α and γ express different coherence relations, is not crucial in Asher (1993). And yet, these relations do express exactly the Parallel on which the Contrast is based: what was a denial first (namely, (52d)), has become a semantic opposition with respect to the clause on which the expectation was based (namely, (51b)).

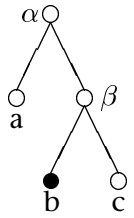
According to Asher (1993), two constituents that take the same position in two isomorphic subtrees, may be assigned opposite connotative values. In this case, (52b) and (52d) express Contrast this way.

Interestingly, the Contrast relation is using a closed constituent, namely (52b). This is possible because Contrast is defined on a Parallel structure. In Asher (1993), more examples of Parallel and Contrast relations are analyzed, in which clauses occurring in a closed position, may be re-used in interpretations with isomorphic subtrees.

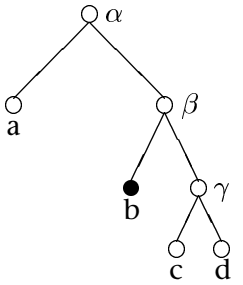
The other rebuttal, in (49), will render another discourse structure, because another antecedent is chosen: from the three possible antecedents, both (49a+b) and (49a) are excluded. If (49b) is taken as an antecedent, attachment of the VP anaphor takes place at rightmost clause (i.e.,(49b)), and not a higher level (i.e., the top constituent of (49a) and (49b)). This is shown in (53).

(53) α=**caus**(a,b); β=**list**(b,c); γ=**den**(c,d)

i.



ii.



In (53i), the clause containing the VP anaphor is attached to the lower level of (53ib), which has as a consequence that the VP anaphor unambiguously takes (53ib) as an antecedent, before (53ib) is closed. The other possibility, attachment to (53iα), would result in two possible antecedents for the VP anaphor, namely (53ia) or (53iα). The rebuttal is inconsistent with these antecedents of the VP anaphor, so attachment of the rebuttal will exclude these two possibilities (but until then, the other discourse structure is possible: it is the structure that leads to (52)). The structure in (53i) is not underspecified with respect to the reference of the VP anaphor. In (53ii), the rebuttal is attached to (53iic) as a denial of expectation. The expectation is paraphrased by: 'if Bill does the same as John, he'll do this in the library.' The first clause, (49a), is used in the interpretation by making an identification possible for a nominal referent *the library*: the use of *another library* in (49d) presupposes the existence of a library. This nominal reference is not represented in the discourse trees discussed in this chapter. Notice that the denial of expectation does not result in a Contrast. No semantic opposition is expressed between (53iia) and (53iid).

Denials of expectation are causal and contrastive, which means that (53iic) remains open. As a remarkable result of the analysis, also (53iia) remains open. This does not affect the interpretation. It should be a possible antecedent for another propositional anaphor. However, the

topic shift of *John* to *Bill* in (49c) makes it difficult, if not impossible, to present an acceptable example.

The difference between Prüst's (1992) analysis and this revisited analysis is minimal. The difference is, that the relation in (53γ) is not Contrast Pairs, but Denial of Expectation.

The advantages of the analysis in (52), compared to Prüst's (1992) analysis, are significant. The structure in (52) is made possible by the assumption that a causal relation between the first two clauses made the first clause a possible antecedent for the unmarked VP anaphor, referring to the first two clauses without the rebuttal. The rebuttal enforces a specification to the first clause, which can be achieved within the same structure (percolation of the context-dependent semantics of the first clause). This takes away the need for a non-incremental procedure. The rebuttal is connected with the VP anaphor. The interpretation is a denial of expectation. But at the same time, isomorphic subtrees are recognized, forming a parallel relation between the first and the second pair of clauses. Then, a semantic opposition between the second clause and the rebuttal is created. This way, a parallel structure expressing Contrast is formed with incremental parsing. Instead of VP anaphors looking ahead, rebuttals are looking back.

The proposed changes in LDM, done in section 5.3.4, make it possible to provide a better analysis of VP anaphors with their rebuttals. A new definition of open constituents, together with the formulation of **caus** and **den**, give a more accurate derivation of (47). In general, the idea to let the conditions on connectives be conditions on the output of DICE, takes away the difficulty of making the construction rules work without connectives. Moreover, the condition that a Cause predicate must be found for **caus** and **den** provides the right condition for the cases in which the rules are supposed to work.

5.5 Conclusion

Propositional anaphors may refer to meaning abstracted from several preceding clauses. This phenomenon plays a central role in a theory of discourse structure: the Linguistic Discourse Model. Calculation of abstracted meaning creates proper antecedents for a propositional anaphor. In LDM, it is assumed that the right frontier restriction holds. Maes (1997) distinguishes between marked and unmarked propositional anaphors. Unmarked propositional anaphors take just what they get; marked anaphors refer to a specific clause. Some observations in the literature, e.g. Fraurud (1992) and Hellman and Dahl (1994), seem to provide counterevidence for the right frontier restriction. Several examples are re-analyzed as examples of reference of unmarked reference; other examples were indeed violations of the right frontier restriction. Contrary to Fraurud (1992) (and later, to Prüst et al., 1994), it was claimed that the causality of the relations was crucial, and not a

notion of discourse (or: rhetorical) subordination.

The observation that propositional anaphors may refer to specific constituents that do not occur on the right frontier, has been represented in LDM. LDM's construction rules were changed slightly, and extended. Conditions on construction rules may refer directly to DICE predicates. This way, the inferences made by DICE are the input for making discourse structure. Rhetorical Coordinations and Rhetorical Subordinations can be merged into one rule of Causal Relations. The characteristic property of these two rules is causality. A new construction rule, for Denial of Expectation, has been formulated. Given these changes, an example that Prüst (1992) has used for his analysis of VP anaphors, is revisited. It appears that given the proposed changes, the role of the rebuttals, as well as open constituents in the preceding discourse, can be represented more accurately. There is no need to introduce a non-incremental 'looking ahead' strategy, since a 'looking back'-strategy (based on Asher, 1993) gives the right result.

Appendix: Construction rules in LDM

Discourse Constituent Unit

In LDM, constituents of a parse tree are called Discourse Constituent Units (DCUs). Construction rules analyze semantic and pragmatic interpretation of every clause and construct a new DCU out of two coherently connected DCUs. While clauses are interpreted truth-conditionally, DCUs in trees do not have truth conditions.

Topic/Comment pattern

Clauses are not analyzed as predicate-argument patterns, but as Topic/-Comment patterns.

Unification

The algorithm used to make the trees, is based on the unification of certain properties of the clauses in their Topic/Comment representation. In order to make a (binary) tree, the value for **consem** in DCU_1 is unified with the value for **consem** in DCU_2. The result of this unification is the value of **sem** in the top constituent. In **schema**, the common semantics of the two DCU's are represented.

consem

The value of **consem** defines the context-dependent semantics of each constituent.

sem

The value for **sem** defines the internal semantics of each constituent.

schema

Schema introduces a value that represents common properties of the constituting constituents DCU_1 and DCU_2. The value for **schema** functions as the new **consem** value of this constituent. *Applicability of the [construction] rule depends on the value of the* **schema** *attribute, the MSCD [(in a List Construction)]* (Prüst, 1992, p. 49). *(...) Important aspects of context-dependence (such as anaphoric links and dependence of lexical items) are detected by MSCD calculation* (ibid.).

MSCD

The Most Specific Common Denominator (MSCD) is a characteristic generalization of two topics (or comments), represented in the constituting DCUs. The MSCD is represented as: $C_1 \not\subset S_2$. What this means

exactly, is defined in table 1.4. The calculation is defined in the section 'Calculation'.

Non-trivial MSCD

There is a condition on Lists that the common denominator be non-trivial. With respect to this example, this means that the characteristic generalization is defined in the knowledge base that is used to calculate the MSCD. A common denominator is not always represented as an object in the knowledge base. This is, of course, dependent of individual knowledge of speakers.

If a speaker were supposed to make an MSCD of the topics coffee and cat, he would have problems to find an object that generalizes over these entities. It is, of course, always possible to define a set {coffee,cat}, but that would be trivial.

Construction rules

Table 1.3 consists of two parts: rules defined by Prüst et al. (1994), and rules defined for chapter 5 of this thesis.[38] The rules work as follows: always combine the **consem** values of DCU_1 and DCU_2, and unify them into the **sem** value of the constituent preceded by the list, coo or sub predicate. **schema** represents the common meaning of the two DCUs. **R** represents the relation that binds the two constituents, often expressed as a connective.

List Construction

Under the conditions that the MSCD is non-trivial and that **R** can be expressed by *and* or *or*, DCU_1 and DCU_2 form a binary tree, with a top constituent of which the internal semantics is the context-dependent semantics of DCU_1, related with the MSCD of both constituents, and the internal semantics of DCU_2. The common meaning of both DCUs consists of the MSCD.

List Extension

Under the conditions that the MSCD of the top constituent of DCU_K and the internal semantics of DCU_n is incorporated in the MSCD of the top constituent of DCU_K, and that **R** can be expressed by *and* or *or*, DCU_K and DCU_n ($K \geq 2$, n = K+1) form a top constituent of which

[38] In Prüst (1992), rules are more specified: a **consem** and **schema** have to occur in every DCU. In Prüst et al. (1994), given in table 1.3, the simplified Rhetorical Coordinations rule looks exactly like the List Construction rule. Only a condition on the rule, stating that the List-MSCD may not be trivial, makes them different. In Prüst (1992), not given in table 1.3, this difference is represented within the rule, by specifying the **consem** of DCU_2 differently in both rules.

Rules defined in Prüst et al. (1994)

List Construction

list [**sem** : C_1 **R** (($C_1 \not\subset S_2$) $\sqcap$ S_2), **schema** : ($C_1 \not\subset S_2$)]
$\rightarrow$
DCU_1 [**sem** : S_1, **consem** : C_1]
+ DCU_2 [**sem** : **R** S_2, **consem** : (($C_1 \not\subset S_2$) $\sqcap$ S_2)]
Conditions : $C_1 \not\subset S_2$ is non-trivial, **R** $\in$ {*and, or, ...*}

List Extension

list DCU_K [**sem** : S_1 **R** (($S \not\subset S_n$) $\sqcap$ S_n), **schema** : S]
$\Rightarrow$
DCU_K[**sem** : S_1, **schema** : S]
+ DCU_n [**sem** : **R** S_n, **consem** : (($S \not\subset S_n$) $\sqcap$ S_n)]
Conditions : $S \not\subset S_n \preccurlyeq S$, **R** $\in$ {*and,or...*}

Rhetorical Coordinations

coo [**sem** : C_1 **R** (($C_1 \not\subset S_2$) $\sqcap$ S_2), **schema** : ($C_1 \not\subset S_2$)]
$\rightarrow$
DCU_1 [**sem** : S_1, **consem** : C_1]
+ DCU_2 [**sem** : **R** S_2, **consem** : (($C_1 \not\subset S_2$) $\sqcap$ S_2)]
Condition : **R** $\in$ {*therefore,so,thus,accordingly,...*}

Rhetorical Subordinations

sub [$f_1 : v_1, ..., f_i : v_i$, index : K,
sem : C_1 **R** (($C_1 \not\subset S_2$) $\sqcap$ S_2), **schema** : C_1]
$\rightarrow$
DCU_1 [$f_1 : v_1, ..., f_i : v_i$, index : K, **sem** : S_1, **consem** : C_1]
+ DCU_2 [**sem** : **R** S_2, **consem** : (($C_1 \not\subset S_2$) $\sqcap$ S_2)]
(pop-marker)
Condition : **R** $\in$ {because,since, ...}

Rules defined in chapter 5
Causal Relations

caus [**sem** : C_1 **R** (($C_1 \not\in S_2$) $\sqcap$ S_2), **schema** : ($C_1 \not\in S_2$)]
$\rightarrow$
DCU_1 [**sem** : S_1, **consem** : C_1]
+ DCU_2 [**sem** : **R** S_2, **consem** : (($C_1 \not\in S_2$) $\sqcap$ S_2)]
Condition : C_1 **R** S_2 $\approx cause(C_1, S_2)$ $\parallel$ $cause(S_2, C_1)$

Denial of Expectation

den [**sem** : C_1 **R** (($C_1 \not\in S_2$) $\sqcap$ S_2), **schema** : ($C_1 \not\in S_2$)]
$\rightarrow$
DCU_1 [**sem** : S_1, **consem** : C_1]
+ DCU_2 [**sem** : **R** S_2, **consem** : (($C_1 \not\in S_2$) $\sqcap$ S_2)]
Condition : C_1 **R** S_2 $\approx cause(C_1, \neg S_2)$ $\parallel$ $cause(S_2, \neg C_1)$

Table 1.3: Construction rules of discourse trees in LDM. $C_1 \not\in S_2$ = common denominator of C_1 and S_2; $C \sqcap S$ = C unifies with S; **R** $\in \{...\}$ = the coherence relation **R** is marked by the set of connectives ...; **R** $\approx$ cause(C,S) = the coherence relation between C and S is causal; X $\parallel$ Y = either X or Y.

the context-dependent meaning remains the same, and the internal semantics represents one DCU more. In the tree, one DCU is added to a set of coordinated DCUs.

Rhetorical Coordinations

The rule of Rhetorical Coordinations is similar to the List Construction rule, except for the Condition: lexicalization of **R** concerns other connectives than the connectives of **R** in the List Construction rule. From the omittance of any condition on the MSCD, it can be inferred that the MSCD may be trivial.

Rhetorical Subordinations

Under the conditions that **R** can be expressed by *because* or *since*, DCU_1 and DCU_2 form a binary tree, with a top constituent of which the internal semantics is the context-dependent semantics of DCU_1, related with the MSCD of both constituents, and the internal semantics of DCU_2. The common meaning of both DCUs consists of only the context-dependent meaning of DCU_1. The rule of Rhetorical Subordinations further contains the features *f* and *v* in the top constituent and DCU_1. The indexes refer to knowledge specified as K, specifying

knowledge of the world, that determines causality and makes it possible to make inferences from the propositional contents of clauses (cf. Prüst, 1992) .[39]

Causal Relations

Under the conditions that **R** reflects a causal relation, DCU_1 and DCU_2 form a binary tree, with a top constituent of which the internal semantics is the context-dependent semantics of DCU_1, related with the MSCD of both constituents, and the internal semantics of DCU_2. The common meaning of both DCUs consists of the MSCD, which may be trivial.

Denial of Expectation

Under the conditions that **R** reflects a causal relation between one DCU and the negation of the other, DCU_1 and DCU_2 form a binary tree, with a top constituent of which the internal semantics is the context-dependent semantics of DCU_1, related with the MSCD of both constituents, and the internal semantics of DCU_2. The common meaning of both DCUs consists of the MSCD, which may be trivial.

Calculation

The calculation of the unification of the two DCUs, using the MSCD, will be defined more specifically below. C_1 in DCU_1 and S_2 in DCU_2 are unified by the algorithm $((C_1 \not\in S_2) \sqcap S_2)$. This default unification is made by finding the Most Specific Common Denominator (MSCD) of the topics or comments. A MSCD is built up out of two other mechanisms, one for the (ontological) generalization, and the other for the (computational) unification. If the two topics were *cat* and *dog*, their MSCD would be: *pet*, for this is both the Most Specific Generalization (MSG) and the Most General Unification (MGU), given a domain of entities with a structured ordering of sorts.

ϕ, ψ, χ and σ are variables referring to objects. Those objects may be represented as sets or entities. For instance, a *dog* is on the one hand an object, for it may refer to a specific *dog*, but it also may refer to a set of different kinds of dogs, in an appropriate context. In the definitions, the predicates 'at least as general as' and 'at least as specific as' are best understood in set-theoretic terms.

[39]The role of these features in the construction rule is not explained. These features are probably associated with the coherence relation Explanation, as the lexical choices for **R** in the condition suggest. Rhetorical Coordinations is, just like Rhetorical Subordinations, restricted by causal connectives. This raises the question why Rhetorical Coordinations does not have features like *f* and *v*. In Causal Relations and Denial of Expectation, the whole problem has disappeared, for causality is supposed to be inferred in DICE.

Most Specific Generalization	The MSG of ϕ and ψ, written as $\phi \sqcup \psi$, is an object χ that is at least as general as both ϕ and ψ, such that any σ that is at least as general as both ϕ and ψ is not more specific than χ.
Most General Unification	The MGU of ϕ and ψ, written as $\phi \sqcap \psi$, is an object χ that is at least as specific as both ϕ and ψ, such that any σ that is at least as specific as both ϕ and ψ is not more general than χ.
Most Specific Common Denominator	The MSCD of ϕ relative to ψ, written as $\phi \not\in \psi$, is an object χ such that χ is at least as general as ϕ, and unifies with ψ, and such that any σ which is also at least as general as ϕ and unifies with ψ is not more specific than χ.

Table 1.4: Calculation of MSCD, split up in calculations of MGU and MSG.

MSG

Suppose there is a set of 'domestic animals' that consists of the elements dog, sheep, horse and cat. There is another set of 'pets' that consists of a cat and a dog.

The MSG of dog (ϕ) and cat (ψ) must be an object (or a set) that is at least as general as cat and dog. This is true for domestic animals as well as for pets, because both sets are more general. But only pets can be the MSG, because for domestic animals (in the definition χ), there is a δ, namely pets, that is more specific. So, dog $\sqcup$ cat gives pets.

MGU

The MGU of dog and cat is an object (or a set) that is at least as specific as both dog and cat. This is a pet, since it is the smallest set of which both dog and cat are a member. It is not a domestic animal, since that set contains also other members, i.e. it is more general. So, dog $\sqcap$ cat gives a pet.

MSCD

The MSCD of dog and cat is a pet, since both the MSG and MGU of cat and dog are pets. So, dog $\not\in$ cat gives pets.

Information state

Determination of the information state (As described in Gardent, 1994) can be done by reading off the tree the information at any moment in the incrementation process. In the original version of LDM, only information from right frontier constituents, and read their semantic contents (the **sem** and **schema** or **consem** values) from the top of the tree to the bottom. These contents represent together (in conjunction with each other) the information state of the discourse. The constituents that do not take part in the right frontier, are not part of the information state of the discourse in that moment. This effect is what may be called being closed.

Open constituent

In the revised LDM, causal relations may keep their constituents open. This means that reading the **sem** and **schema** or **consem** values is extended to constituents that have a connection with a constituent on the right frontier through a causal relation. It is at this right frontier constituent that the information is read off the tree. So, the information is read from bottom to top, and at some constituents (marked by caus or den), an extra set of variable values is added.

Attachment and coreference

There is a difference in the information that is used by propositional anaphors, and by clauses that want to attach. The value of **sem** is not used by a propositional anaphor. Attachment uses the **sem** value, for it forms the new C_1 from this information. A propositional anaphor just takes the **consem**, c.q. **schema** value.

Chapter 6

Conclusion

6.1 Causal connectives: meaning and effects

In the first chapter, the following question was formulated as the leading question in this thesis:

how does lexical meaning of causal connectives affect discourse coherence and structure?

The central question was split up into more specific questions:

1. what interpretations of causal or contrastive relations should be distinguished?
2. how is lexical meaning of causal connectives represented?
3. how is lexical knowledge exploited when a causal connective is used to indicate causal coherence?
4. how do causal relations affect discourse structure?

In order to prepare for a formal analysis of the meaning of causal connectives, the first question was answered in chapter 2. A description was given of epistemic, speech act, causal, and contrastive interpretations of coherence relations expressed by connectives such as Dutch *hoewel* and *maar*, English *although* and *but*, Dutch *want* and *omdat* and English *because*. Their causal interpretation can be epistemic, speech act, or semantic.

Epistemic interpretation of these causal connectives represents a speaker's conclusion. Epistemic interpretation can be marked or indicated in context. Unmarked relations can be recognized as epistemic when abduction is needed for the acceptance of the relation as causal. In a systematic paraphrase of epistemic interpretation, it is possible to introduce one clause with the phrase *from the fact...*, and the other with *I conclude...*.

In speech act interpretation, the uttering of a clause is justified (or a justification is violated) by the other clause. Speech act interpretations

are linguistically marked. In a systematic paraphrase of speech act interpretation, the speech act clause is embedded by a speech act verb; the other clause refers to the speech act clause, taking it autonymously.

Semantic interpretation expresses locutionary meaning only. Epistemic and speech act interpretation are similar in their expression of illocutionary meaning instead of locutionary meaning. These two interpretations may be classified as pragmatic.

Relations of contrast were described in three different interpretations: denial of expectation, semantic opposition and concession. In a denial of expectation, an expectation is derived from the sentence and then violated, because the main clause in an *although* sentence or the *but* clause negates the second part of the expectation. The expectation is an implication: a denial of expectation is not only contrastive, but also causal.

A semantic opposition is characterized by parallel intonation and structure. The parallel form makes the predicates look for a contrast in their lexical meanings. This contrast is applied to the topics of the parallel clauses.

The interpretation of concession needs the inference of a tertium comparationis on the basis of contextual information. The utterance consists of an argument against, and an argument in favor of the tertium comparationis. A concession may occur in the parallel form of a semantic opposition, as well as the non-parallel form of a denial of expectation. The interpretation of concession is by definition epistemic: the tertium comparationis may be regarded as a speaker's conclusion, for which a positive and a negative argument are given in the utterance. Since there is no causality between the connected clauses, concession is not causal, but additive.

The causality of a coherence relation depends on the acceptance of a sufficient condition for a result. If this condition contains a necessary part (if it is an INUS condition), the relation is semantically causal. The necessary part is causally prior to the result. If the condition does not contain a necessary part, the relation between condition and result can be interpreted as a relation between a fact and a speaker's conclusion. This yields an epistemic causal relation. By definition, a fact is causally prior to a conclusion (the result). The conclusion can be drawn from the fact, because it is supported by a causal relation, in which the causal relation is reversed: the former result is an INUS condition for the former sufficient condition. In other words: if causal priority appears to be reversed in the utterance, the causal relation is interpreted epistemically.

The description of the meaning of causal connectives in terms of the different interpretations of the coherence relations the connectives express, was explained by a linguistic analysis in Chapter 3, where the second question was answered. The claim was defended that causal and causal contrastive connectives have a presupposition in the form of an implication that expresses causality.

Not only causality in content interpretation, but also in epistemic and speech act interpretation, can be explained by means of this presupposition. The assumption of a **B** operator for epistemic interpretation and a **S** operator for speech act interpretation is interpreted as the result of conversational implicatures, executed in order to obey Grice's (1975) maxims of conversation.

Although has a presupposition that represents the expectation. From the *although* clause, the antecedent of a defeasible implication is derived; the negation of the main clause is derived to form the consequence of this implication. There are cases in which *although* does not express denial of expectation, but concession. How concessions are derived can be explained by analyzing the interpretation in detail. In the concession interpretation, the presupposition has failed: it is defeated by its context, or it fails because it can not be interpreted with respect to lexical or real world knowledge. Instead of an interpretation based on a presupposition, an argumentative interpretation of the contrastive relation is derived. This argumentative use is a repair, needed because a maxim of conversation is flouted by presupposition failure. This repair has become conventionalized in the course of time. Just like conventionalized metaphors, flouting a maxim is hardly noticed in the actual use of concession. Context has become more important in the derivation of concessions than presupposition failure.

The analysis leads to a different translation of *because* in predicate logic: like *although*, *because* asserts a conjunction and presupposes an implication.

Corroboration for the implicational presupposition was found in the account of a corpus analysis, in which denial of expectation appeared to behave like a causal relation rather than a concessive relation. Independent evidence was found in an analysis of Gapping with epistemically interpreted causal connectives.

The analysis that causal connectives bear presuppositions shows how causal connectives indicate causal relations. It also predicts that there is a difference between inferring coherence using connectives and inferring coherence without connectives. Whether this prediction is borne out, was investigated in chapter 4, where an answer could be given to the third question. The framework of DICE was chosen to make the differences between these derivations clear. Causal coherence without linguistic marking is often underspecified and supported by knowledge that seems to be uncertain. The use of a causal connective makes the inference of a specific causal relation obligatory. The enforced causal relation is allowed to be interpreted in different ways, as described in chapter 2. This difference between defeasible and obligatory inference is not explained by difference in knowledge: given the same causal relation, causal connectives make the inference of the causal relation more certain. Without connectives, the causality has to be derived from the proposition and world knowledge, associated with the relevant lexical items in concatenated clauses. Using a causal

connective like *because* or *since*, the relevant lexical items are forced to derive a specific causal relation, which makes another selection of meaning aspects of these lexical items possible. DICE may profit from the incorporation of indefeasible laws for causal connectives, for 'inferential effort' will decrease in understanding the relation between sentences.

Causal coherence appears to have specific properties: causal connectives bear presuppositions and causal relations need to be established with respect to knowledge of the world or lexical knowledge. Coherence relations also build discourse structure. Do causal relations have different effects on discourse structure than other relations? This question was investigated in chapter 5. The answer was given in the framework of LDM. Unmarked propositional anaphors refer to constituents representing their abstracted meaning, and marked propositional anaphors refer to constituents representing clauses. In the former case, antecedents need to occur on the right frontier. In the latter case, antecedents should occur on the right frontier as well, unless they are connected with the right frontier through a causal coherence relation.

An anaphor is marked or unmarked, but an unmarked anaphor may be specified by predication of the anaphor or properties of its context. Anaphors like *that* are marked, and anaphors like *it* are unmarked. Unmarked VP anaphors may be specified, when part of the antecedent is excluded by a rebuttal. Unmarked anaphors like Dutch *er* may be specified by using disagreement in attitude between part of the antecedent, and the predication of the anaphor.

Analyses of discourses with different types of propositional anaphors and different contexts showed that the existence of a causal relation between the first and second clause makes it possible to find an antecedent for a propositional anaphor that is specific, and yet does not occur on the right frontier. It was argued that it is not subordination, but the causality of the relation that is responsible for this effect. In the specific construction of a VP anaphor with a rebuttal, the possibility of reference to a clause that does not occur on the right frontier is not an immediate effect of the Parallel relation.

Construction rules of LDM were changed, and extended. Conditions on construction rules may refer directly to DICE predicates. This way, inferences of causal relations made by DICE are the input for creating discourse structure. Rhetorical Coordinations and Rhetorical Subordinations are merged into one rule of Causal Relations. The characteristic property of these two rules is causality. A new construction rule, for Denial of Expectation, has been formulated. The analysis of VP anaphors with rebuttals is revisited. There is no need to introduce a non-incremental 'looking ahead' strategy, since a 'looking back'-strategy gives the right result.

6.2 Looking ahead

In this book, a lot has been explained about causal relations. One aspect of causality has been left out of the analysis, even when it was obvious that the explanations should go in that direction. Argumentation appeared to have significant effects on the discourses that were analyzed. In chapter 2 and 3, argumentation was intrinsically connected with concession, and also epistemic interpretation was considered to be argumentative rather than semantic. In chapter 5, argumentation disturbed some of the examples that should account for the availability of certain antecedents. In Argument-claim relations, claims are often too prominent in comparison with their argument: this makes the argument less accessible. Linguistic indication of argumentation and prominence of claims, relative to arguments, were not investigated in this thesis, but both phenomena form interesting research topics. Which connectives indicate argumentation, and do they indicate argumentative orientation? How does the prominence of the claim influence the accessibility of argument or claim?

Related questions from the field of argumentation to the processes investigated in this thesis, will become even more interesting when it is possible to show that argumentation needs coherence and discourse structure. That is, epistemic interpretation of coherence relations is used to indicate argumentation, and discourse structure is used to define more or less prominent constituents by means of argumentative orientation. Speakers thus use argumentation to achieve their communicative goals.

Argumentative orientation can be looked at as the desire to achieve a communicative goal. In general, the analysis of communicative goals is made in terms of intention, and intentional structures. It is interesting to analyze the differences and similarities between argumentation and intention, and their effects on coherence.

The notion of subordination in discourse is discussed mainly in chapter 5, but the Gapping examples in chapter 3 showed other interesting facts connected with subordination: coordinated structures like Gapping do not express causality. Only epistemic causality may be expressed in Gapping. At the same time, subordinative connectives appear to be causal or temporal. If coordinating connectives are causal, their interpretation is epistemic. In other words, Gapping and the discourse function of connectives are strongly related. Not shown in this thesis are data that provide evidence for the fact that Gapping constructions do not occur with causal or causal contrastive adverbs like *namelijk* ('namely') or *toch* ('yet'). Temporal adverbs like *tegenwoordig* ('nowadays') do not allow for Gapping, but temporal adverbs like *toen* ('then') do allow for Gapping. Research into the discourse function of subordinative connectives and causal and temporal adverbs might determine characteristic properties of Gapping. Moreover, a definition of discourse subordination in terms of causal or temporal terms might be

drawn from these facts.

Another question is the generalizability of the analysis in chapter 3: do connectives like Dutch *zodat* ('so that') or *waardoor* ('through by') express the same causality as *dus* ('so') or *daardoor* ('therefore')? And if not, are the differences related to differences between their presuppositions?

In chapter 5, it appeared that causality affected antecedents on propositional anaphors. Effects of causality in discourse structure might be investigated in another way, by looking at other phenomena. Do causal relations show comparable effects on the availability of constituents in discourse structure for other phenomena than propositional anaphors? A difference was found between semantic and epistemic interpretation with *because* sentences under the scope of a modal operator. Are there other differences in interpretation as a result of scope differences in causal relations? Or are there differences between causal and additive relations with respect to scope ambiguity?

The question of marked and unmarked anaphors has not been analyzed in detail. In combination with a theory of abstracted meaning in discourse structure, it might be possible to classify types of anaphors. It will be possible to describe the differences and similarities with nominal anaphors too. What are the properties that determine the markedness of an anaphor? In which contexts has an anaphor a nominal antecedent, and in which cases a propositional antecedent?

6.3 Looking back

In the first chapter, the central question was motivated by pointing out important issues in the field of discourse analysis. The study of causality is not only an important issue for philosophers, but also for discourse analysts, as recognizing causality is crucial for the understanding of discourse. By defining causality in terms of an INUS condition, it can be made explicit how coherence relations are interpreted as causal. Two problems can be solved.

The first problem is that recognition of causality is difficult in (our knowledge of) the real world: many causes are incomplete, and often a causal relation is not expressing undoubtedly certain knowledge. This is solved by assuming the INUS condition: an insufficient but necessary part of a condition that is, within the context of the utterance, sufficient for the result.

The second problem is that in natural language epistemic interpretation does not seem to refer to valid causal relations. This problem is solved by assuming that abduction may reverse condition and result, which gives a causal relation that contains an INUS condition. Epistemic interpretation is characterized by the relation between a fact and a speaker's conclusion, and this relation is supported by abduction.

Causal relations are thus defined in their semantic and epistemic

interpretation. But not all relations between fact and speaker's conclusion are supported by abduction. Sometimes, the fact contains a necessary part itself. The epistemic interpretation is, in that case, created by context. The context indicates that a speaker's conclusion should be interpreted, rather than a relation between facts. So, the interpretation of a speaker's conclusion is essential for epistemic interpretation. This observation is important for the study of coherence relations: there is a connection between epistemic interpretation and the introduction of the speaker in the interpretation. This might be an indication of a relation between the assignment of the value 'pragmatic' (for the Source of Coherence) and the recognition of perspective. Another indication is given too: the speaker's conclusion is an indication of argumentative use of the causal relation. This may be an interesting observation for the study of argumentation.

In the field of formal semantics, the meaning of causal and contrastive connectives is not represented in a satisfying way. The solution of presupposing an implication has not been proposed in a formal and comprehensive way. The development of discourse oriented presupposition theories makes such an extension possible. Formal semantics may extend its empirical scope in the meaning of natural language by incorporating presuppositions of causal connectives.

A consequence of the semantic 'visibility' of causal connectives, achieved in chapter 3, is that they become visible in other formal systems too. In DICE, it has become possible to make an obligatory causal inference in case of the occurrence of a causal connective. This obligation gives insight into an alternative process of deriving causal relations from the lexicon. In the normal case, the common meanings of lexical items are supposed to be related on their own, in order to derive a causal relation. In the case of obligatory causal inference, causally related lexical items are selected first, and less common meanings may be taken to form the causal relation. The latter process gives more seemingly certain knowledge, and takes less inferential effort. And this is precisely the intuition one has about the difference between using connectives and omitting them. DICE is not only improved on its reflection of linguistic knowledge, but it might also be improved on its properties as a system: less time is needed to compute an inference.

Theories of discourse structure have tried to define accessibility by applying a notion of discourse subordination. The right frontier restriction could be dodged by assuming that a subordinate clause could be skipped from a complex antecedent. In chapter 5, it was argued that instead of the notion of subordination, the notion of causality explained the availability of antecedents. Argumentative orientation can define constituents in a structure as more or less accessible. Although this analysis was applied in LDM only, it is relevant for every discourse structure that makes use of coherence or argumentation. In fact, the proposition is made to refine the notion of discourse subordination, by analysing it as a combination of two notions: causality (and right

frontier), making antecedents available, and argumentation, assigning a degree of accessibility to available antecedents.

In studying antecedents of propositional anaphors, a field was entered that has not been explored extensively. This is the study of properties of the anaphors themselves, choosing between antecedents on the grounds of their own properties, or the meaning of the sentence in which they occur. Propositional anaphors are not only marked or unmarked, but unmarked anaphors may also be specified afterwards. It is difficult to obtain precise data for these propositional anaphors, but further studies in this field may give rise to much insight.

Lakoff (1997) points out that a formal study of natural language in itself does not make very much sense: as long as the formal symbols do not refer to cognitively realistic entities, formal approaches do not achieve anything more than making (too many) generalizations over phenomena. Explanations for linguistic phenomena can not be given by symbols alone, according to this cognitively realistic approach.

In this thesis, symbols have been used to explain linguistic phenomena. For instance, the **B** operator was used to indicate epistemic interpretation and generalizes over epistemic interpretation with or without abduction. However, **B** is not considered to exist physically in the brain. Still, as a part of a formal system that analyzes natural language, it explains how people may represent language and use language. In fact, one of Lakoff's older approaches has been followed in this thesis. Formal semantic analyses should be more concerned with the meaning of natural language: this was the approach of natural logic (Lakoff, 1972). Presuppositions of denials of expectation, and the *because*-clause (establishing the truth of the subordinate clause), are examples of a better fit of formal semantics to natural language. Since then, the possibilities to do natural logic have been increased considerably. Formal theories of discourse representation, as well as theories of presupposition in discourse, made it possible to specify the intuition that causal connectives have presuppositions. In different chapters, the formal approach proved to be successful in finding explanations for complicated linguistic phenomena.

In chapter 3, the meaning of causal connectives was represented by using presuppositions. The restrictions and the tests that follow from these restrictions do not allow the meaning of additive connectives to be represented by presuppositions. The analysis of a concession as bearing a presupposition is impossible, for the presupposition tests failed. This formally defined problem could be solved in an interesting way: concession, in origin, is due to a repair of a flouted maxim, due to presupposition failure. This also explains why concessions are always epistemic (and argumentative): there has never been a concession that could be interpreted semantically.

In chapter 4, the formal analysis of presuppositions for causal connectives could be extended in another formal framework: difference was made between defeasible and obligatory inference of causal rela-

tions. This extension posed a formal problem again: the difference in inference should have consequences for the interpretation of the inference. A difference in lexical derivation was found: defeasible inference was in need for 'spontaneous' causality arising from common meanings of lexical items in each other's context; obligatory inference just puts two lexical items together, forcing them to select appropriate meanings. This insight into lexical processes could not be made visible without formal representation of linguistic phenomena.

In chapter 5, the right frontier restriction made it possible to define precisely how causal relations behave differently, compared to additive relations in discourse structure. Thus, the formal model of LDM is used to gain linguistic explanation.

Applying formal approaches in order to analyze discourse thus offers specific explanations for delicate phenomena. This thesis proves the approach of Lakoff (1972) to be successful. It suggests furthermore that the formal semantic analysis of lexical markers of coherence deserves a place at the core of the study of discourse.

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Samenvatting

In een necrologie van Greta Garbo stond op 17 april 1990 het volgende stukje tekst in *de Volkskrant*:

(1) Zij was al een legende tijdens haar leven en haar mythe groeide door haar volstrekt geïsoleerde bestaan in een flat te New York. In 1951 werd zij Amerikaans staatsburger, drie jaar later kreeg zij een ere-Oscar.

Hoewel Greta Garbo de maatstaf werd genoemd van schoonheid, is zij nooit getrouwd geweest.

De laatste zin van de tekst in (1) deed enkele lezers en lezeressen in woede ontsteken: was de journalist werkelijk van mening dat mooie vrouwen trouwen? Ingezonden brieven getuigden van hun verontwaardiging. Nu is het merkwaardig dat de journalist nergens in de necrologie de bewering heeft geuit dat mooie vrouwen trouwen, terwijl de meeste lezers zullen erkennen dat die mening wel voor het voetlicht wordt gebracht. Uit de zin *hoewel Greta Garbo de maatstaf werd genoemd van schoonheid, is zij nooit getrouwd geweest*, kunnen we het vooroordeel van de journalist dat mooie vrouwen trouwen blijkbaar afleiden. Deze afleiding wordt mogelijk gemaakt door de betekenis van het woordje *hoewel*. Woorden als *hoewel* en *maar*, maar ook *omdat* en *want* hebben een bijzondere betekenis.

In dit proefschrift wordt die betekenis, en zijn effecten op de samenhang en structuur van een tekst, geanalyseerd. In hoofdstuk 2 gebeurt dat door een beschrijving te geven van de soorten betekenisrelaties tussen zinnen die met behulp van deze connectieven verbonden worden. In hoofdstuk 3 worden presupposities voor de connectieven geformuleerd die vooroordelen als die van de journalist afleiden, en die ook de betekenisrelaties uit hoofdstuk 2 kunnen representeren. In hoofdstuk 4 wordt vervolgens de vraag behandeld of er verschil is tussen het aannemen van een betekenisrelatie met, of zonder de aanwezigheid van een connectief. In hoofdstuk 5 wordt beschreven hoe tekststructuur wordt beïnvloed door causale betekenisrelaties, door te analyseren wat de antecedenten zijn van diverse propositionele anaforen in diverse soorten contexten.

In hoofdstuk 2 worden verschillende betekenisrelaties tussen zinnen beschreven die uitgedrukt kunnen worden met de hierboven ge-

noemde connectieven. Deze zogeheten coherentierelaties drukken causaliteit uit, of een contrastrelatie, of een relatie die zowel causaliteit als contrast uitdrukt. Bovendien kunnen deze drie soorten relaties epistemisch, als speech act en semantisch worden uitgedrukt.

Epistemische interpretatie van causale connectieven representeren de conclusie van een spreker. Dit type interpretatie kan talig gemarkeerd worden, maar dat hoeft niet. Een epistemische relatie kan worden herkend aan de mogelijkheid om een parafrase van een zin te maken die systematisch aan een deelzin de frase *uit het feit dat ...* toekent, en aan de andere deelzin de frase: *concludeer ik dat ...*.

Bij de speech act interpretatie van een coherentierelatie wordt het uiten van een deelzin gerechtvaardigd (of juist ontkracht) in de andere deelzin. Speech act interpretaties zijn altijd linguïstisch gemarkeerd. In een systematische parafrase van een uiting met een speech act interpretatie wordt een deelzin ingebed in een speech act werkwoord, en de andere deelzin verwijst naar de eerstgenoemde deelzin, die op die manier in zelfnoemfunctie wordt gebruikt.

In een semantische interpretatie van een coherentierelatie worden uitsluitend de betekenisinhouden van de zinnen zelf met elkaar in verband gebracht. Dit onderscheidt semantische interpretatie van epistemische en speech act interpretatie. De laatste twee interpretaties brengen de betekenisinhouden met elkaar in verband op een ander niveau: dat van de speech acts, of dat van de houding van de spreker ten opzichte van betekenisinhoud. Ze worden daarom ook wel samengenomen als 'pragmatische interpretatie'.

Er zijn drie soorten betekenisrelaties die ieder contrast uitdrukken: ontkenning van verwachting, semantische oppositie en concessie. In een ontkenning van verwachting wordt een verwachting afgeleid van de zin, en vervolgens weersproken. De verwachting wordt systematisch afgeleid uit de *hoewel-zin*. Twee afgeleide proposities worden gevormd. Uit de bijzin wordt een propositie afgeleid die een generalisatie of implicatie is van de bijzin. Uit de hoofdzin wordt op eenzelfde wijze een propositie afgeleid, zij het dat de propositie tevens een ontkenning van de hoofdzin inhoudt (er wordt bij de afleiding een negatie toegevoegd). Naast een generalisatie of implicatie, kan de afgeleide propositie ook identiek zijn aan de corresponderende zin, of een contextueel bepaalde inferentie inhouden. De twee afgeleide proposities vormen een implicatie: de propositie die is afgeleid van de bijzin vormt het antecedent, de propositie die is afgeleid van de hoofdzin het consequent. Gegeven deze afleiding van de verwachting, wordt de ontkenning van de verwachting wordt gerealiseerd door de hoofdzin (bij een ontkenning van verwachting met *maar*: de deelzin die met *maar* begint). Omdat de gevormde verwachting een implicatie is, is een ontkenning van verwachting zowel contrastief als causaal.

Een semantische oppositie wordt gekarakteriseerd door parallelle intonatie en structuur. De parallelle vorm is een instructie voor de predicaten in de deelzinnen om een contrast te vinden tussen hun beider

betekenisinhoud. Dit contrast wordt vervolgens toegekend aan de zinsdelen die door de parallelle structuur als topic zijn gekenmerkt.

Voor de interpretatie van een concessie is de afleiding van een zogeheten tertium comparationis nodig, op basis van contextuele informatie. De twee deelzinnen die concessief verbonden zijn, vormen vervolgens een argument voor en een argument tegen de aanname van de tertium comparationis. Een concessie mag zowel in de parallelle vorm van de semantische oppositie, als in de non-parallelle vorm van de ontkenning van verwachting voorkomen. De interpretatie van een concessie is per definitie epistemisch: de tertium comparationis kan worden gezien als een conclusie van de spreker, waarvoor zowel een positief als een negatief argument wordt gegeven in de deelzinnen. De ontkenning van verwachting was zowel causaal als contrastief. De concessie is echter niet causaal, omdat er geen sprake is van een implicatie tussen twee afgeleide proposities: de relatie tussen de deelzinnen en de tertium comparationis (een contextueel afgeleide propositie) kan soms causaal worden geïnterpreteerd, maar dat is niet wat de concessieve betekenisrelatie uitdrukt.

Een causale relatie tussen twee zinnen wordt gedefinieerd door te beoordelen wat de relatie is tussen de van die zinnen afgeleide proposities. Als één van beide afgeleide proposities een zogeheten INUS-conditie vormt voor een resultaat, uitgedrukt in de andere afgeleide propositie, dan is de relatie tussen de zinnen causaal. Een INUS-conditie houdt in dat de conditie voldoende is voor het resultaat, en dat van een onderdeel van die conditie vastgesteld kan worden dat het causale prioriteit draagt ten opzichte van het resultaat. De INUS-conditie mag onvolledig zijn als alle mogelijke oorzaken voor het resultaat worden overwogen: het gaat om de causale relatie in het specifieke geval dat wordt uitgedrukt in de de zinnen waartussen de relatie bestaat. Gegeven de definitie van de INUS-conditie is het mogelijk niet-causale relaties van causale te onderscheiden, en semantische causale relaties van epistemische causale relaties.

In hoofdstuk 3 wordt aangenomen dat connectieven die een causale betekenisrelatie uitdrukken een presuppositie dragen in de vorm van een implicatie. Met deze aanname kunnen ook de epistemische en de speech act interpretatie worden verklaard. De afleiding van een **B** operator voor het consequent van de implicatie levert een epistemische interpretatie op; de afleiding van een **S** operator voor het consequent van de implicatie levert een speech act interpretatie op. **B** en **S** worden afgeleid door toepassing van conversationele implicaturen.

Hoewel heeft een presuppositie die de verwachting representeert. Van de *hoewel*-zin wordt het antecedent van de verwachting afgeleid; de consequent van de verwachting wordt afgeleid van de negatie van de hoofdzin. Er zijn gevallen waarin *hoewel* gebruikt wordt in een concessieve interpretatie. In die gevallen is er geen sprake van een presuppositie. Wat als presuppositie zou moeten gelden, wordt in die gevallen afgewezen: het kan niet worden geaccepteerd in de context, of het

kan niet als een causaal verband worden begrepen. In plaats van een interpretatie als ontkenning van verwachting, wordt de relatie nu argumentatief geïnterpreteerd als een concessie. Dat is mogelijk doordat de afwijzing van de presuppositie een grove schending van de maximes van conversatie oplevert. Als alternatief voor onacceptabiliteit van de zin, kan een taalgebruiker een nieuwe interpretatie wagen, maar nu als een argumentatief gebruikte uiting. Deze argumentatieve interpretatie leidt tot de concessie. Het gebruik van concessies wordt in het alledaagse taalgebruik niet ervaren als een grove schending van maximes van conversatie, omdat de interpretatie van concessie geconventionaliseerd is in het Nederlands, net zoals de interpretatie van ingeburgerde metaforen: veel idioom wordt niet meer als metafoor herkend, omdat de interpretatie ervan direct gekoppeld is aan de uiting. Context speelt daarom een belangrijker rol bij het desambigueren van relaties uitgedrukt door *hoewel*, dan het op grove wijze schenden van een maxime.

De analyse van *hoewel* kan eenvoudig worden toegepast op *omdat*: net als *hoewel*, representeert *omdat* een logische conjunctie op het niveau van de betekenisinhoud van de zinnen, en implicatie op het niveau van de presuppositie van *omdat*.

Een versterking van de analyse van causale connectieven in termen van presuppositie is gevonden in een rapportage van een corpusanalyse, waarin een ontkenning van verwachting zich eerder leek te gedragen als een causale relatie zoals *omdat* die uitdrukt, dan een concessie. Een analyse van samentrekking van het werkwoord in zinnen die verbonden zijn met een causaal connectief, levert onafhankelijke evidentie voor de analyse van causale connectieven op.

In hoofdstuk 4 wordt een consequentie uitgewerkt van de analyse dat causale connectieven presupposities dragen. Causale connectieven expliciteren causaliteit door middel van hun presupposities. Causaliteit hoeft echter niet expliciet gemarkeerd te zijn. Ongemarkeerde relaties kunnen echter ook causaliteit uitdrukken. De verschillen in afleiding van de causaliteit zijn onderzocht binnen het computationele model DICE, dat coherentierelaties kan berekenen uit de betekenisinhouden van met elkaar verbonden zinnen. Ongemarkeerde causale relaties zijn vaak ondergespecificeerd en ondersteund door kennis die onzeker lijkt. Causale relaties, uitgedrukt door een connectief, dwingen een specifieke causale relatie af (die overigens wel op verschillende wijzen geïnterpreteerd kan worden, zoals hoofdstuk 2 beschreef). Dit verschil tussen annuleerbare en verplichte inferenties wordt niet verklaard vanuit een verschil in kennis: dezelfde causale relatie tussen dezelfde proposities wordt als minder zeker ervaren als die niet is gemarkeerd door een causale relatie. Zonder connectieven moet de causale relatie worden afgeleid uit de betekenisinhouden en kennis van de wereld, verbonden met de corresponderende lexicale items in het lexicon. Alleen voor de hand liggende betekenisaspecten van de lexicale items kunnen worden gebruikt. Met het gebruik van een connectief als *omdat* of *want* zijn de relevante lexicale items veroordeeld tot een specifiek cau-

saal verband, waarin minder in het oog springende betekenisaspecten van die lexicale items met elkaar in verband kunnen worden gebracht om de causale relatie te ondersteunen. Zonder causaal connectief zijn het alleen de in het oog springende betekenisaspecten van de lexicale items die een causale relatie kunnen oproepen.DICE kan profiteren van het incorporeren van niet-annuleerbare inferenties voor causale connectieven, omdat er niet-annuleerbare inferenties minder inferentiële arbeid vereisen.

Causale coherentie heeft specifieke eigenschappen: causale connectieven dragen presupposities en causale relaties moeten gevormd worden in overeenstemming met kennis van de wereld of lexicale kennis. Coherentierelaties bouwen ook een structuur van de discourse. De vraag of causale relaties daarin een andere rol spelen dan additieve relaties, is beantwoord in hoofdstuk 5. Een computationeel model, LDM, dat discourse structuren bouwt vanuit de coherentierelaties die tussen zinnen bestaan, is gekozen als het kader waarbinnen de vraag beantwoord wordt. Het model bouwt structuren door steeds een volgende zin toe te voegen aan al bestaande structuur, waarbij de aanhechtingsmogelijkheden beperkt worden door de rechtergrens van de structuur (gevormd door die tak van de structuur die de hoogste knoop verbindt met de terminale meest rechtsgelegen knoop). Volgens Webber (1991) worden niet alleen de aanhechtingsmogelijkheden, maar ook de verwijzingsmogelijkheden voor anaforen door deze grens beperkt.

Zogeheten ongemarkeerde propositionele anaforen verwijzen naar constituenten die geabstraheerde betekenis representeren, en gemarkeerde propositionele anaforen verwijzen naar constituenten die enkelvoudige zinnen representeren. Anaforen zoals *het*, *er* en de Engelse VP-anafoor zijn ongemarkeerd, anaforen zoals *dat* zijn gemarkeerd. Een ongemarkeerde anafoor kan door het predicaat van de zin waarin hij voorkomt, nader gespecificeerd worden. Deze eigenschap is gebruikt om tests te ontwikkelen die eigenschappen van de voorgaande context van die anafoor naar boven kunnen halen. In deze tests bepalen acceptabiliteitsoordelen welke onderdelen van de voorafgaande context kunnen behoren tot het antecedent van de anafoor.

De tests leiden tot de conclusie dat de rechtergrens van de structuur van de voorafgaande context niet kan worden doorbroken als de context is gevormd door additieve relaties, maar wel als die is gevormd door causale relaties. Als de anafoor zich bevindt in een parallelle structuur, is deze rechtergrensconditie eveneens niet van toepassing.

De resultaten van de tests zijn uitgewerkt in LDM. Daarvoor zijn de constructieregels veranderd en uitgebreid. De voorwaarden op de condities zijn veranderd, zodanig dat ze verwijzen naar de coherentiepredicaten uit DICE, zoals die in het vorige hoofdstuk zijn geformuleerd. Bovendien zijn de regels die retorische subordinatie en coördinatie beschreven, vervangen door een regel die causale relaties beschrijft. Daarnaast is een regel voor ontkenning van verwachting geformuleerd. Met gebruikmaking van deze wijzigingen is een eerdere analyse van de En-

gelse VP-anaforen opnieuw verricht: de nieuwe analyse doet de taalkundige feiten beter recht.

Vrij complexe intuïties over de precieze betekenis van causale en contrastieve connectieven, en over de inferenties die ze in het gebruik in teksten teweegbrengen, kunnen aldus in een formele benadering van tekstbetekenis ingepast worden.

Curriculum Vitae

Luuk Lagerwerf was born on December 27th, 1962, in Renkum, the Netherlands. In 1981, he obtained the VWO certificate of the Eindhovens Protestants Lyceum. From 1981 until 1988, he studied Dutch Language and Literature at the University of Utrecht, and he graduated in Dutch Linguistics. Having refused military service for reasons of conscience, he worked in alternative service as a researcher of historical buildings from 1988 until 1990. Then, he became a lecturer in Dutch Linguistics at the University of Utrecht from 1990 until 1992. He joined the Discourse Studies Group at the University of Tilburg in 1992, as an 'assistent in training', with this thesis as the final result. In 1993, he married Marja van Soest, and in 1995 their son Jefta was born. In 1996, Luuk was appointed to the Applied Linguistics department at the University of Twente.