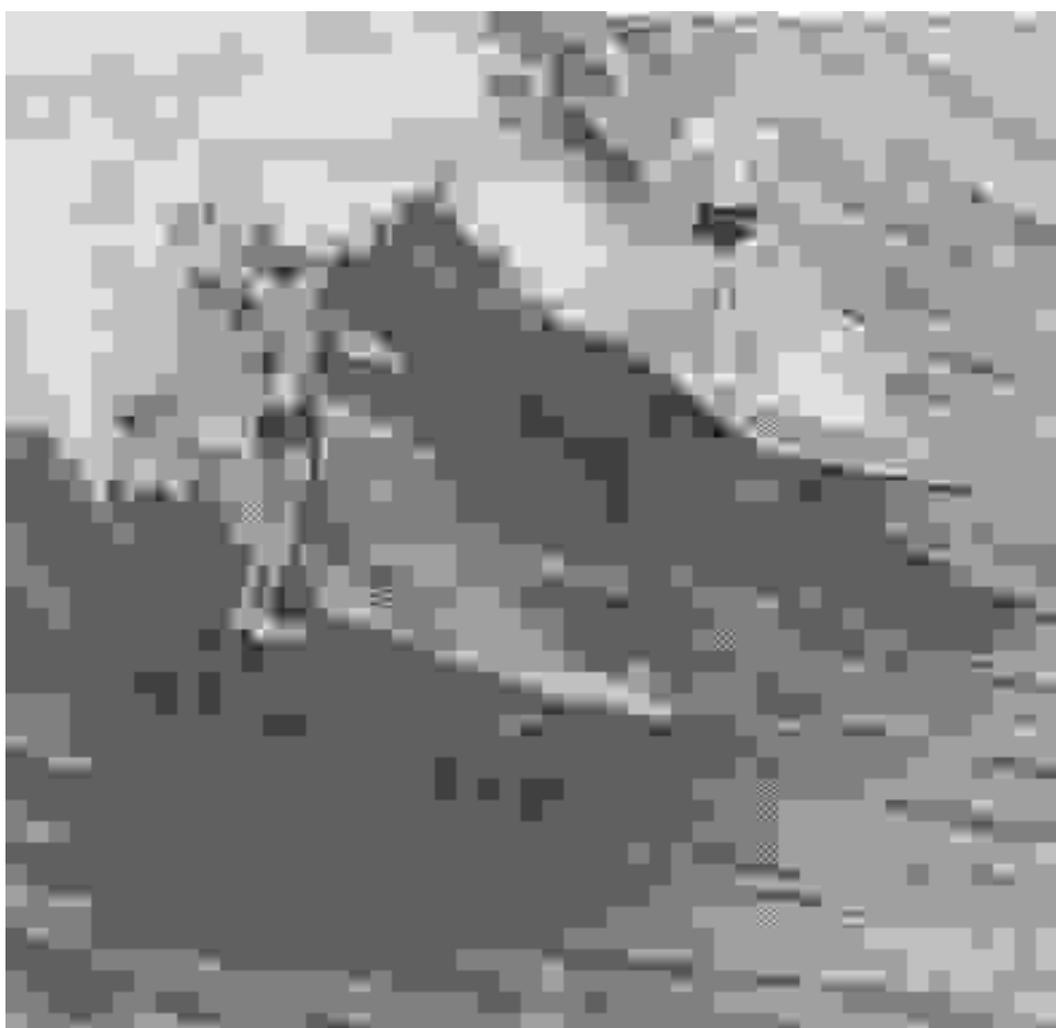


Intonation and Information Structure

Klaus von Heusinger



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Bolinger (1964, 282f) compares the complex of intonational features with the up and down motions of waves at the surface of the ocean:

The surface of the ocean responds to the forces that act upon it in movements resembling the ups and downs of the human voice. If our vision could take it all in at once, we would discern several types of motion, involving a greater and greater expanse of sea and volume of water: ripples, waves, swells, and tides. It would be more accurate to say ripples *on* waves *on* swells *on* tides, because each larger movement carries the smaller ones on its back (...) In speech (...) the ripples are the accidental changes in pitch, the irrelevant quavers. The waves are the peaks and valleys that we call *accent*. The swells are the separations of our discourse into its larger segments. The tides are the tides of emotion.

Preface

This work is the slightly revised version of my Habilitationsschrift, which was accepted by the Faculty of Philosophy at the University of Konstanz in June 1999. The research was funded by a grant of the Dr. Meyer-Struckmann-Stiftung (Habilitationstipendium der Studienstiftung des Deutschen Volkes). I started my research during 1997 as an affiliate at the Linguistics Research Center of the UC Santa Cruz and continued it as a researcher at the University of Konstanz. This work would not have been possible without the continuous support of my colleagues at Santa Cruz and Konstanz. I am particularly grateful to Aditi Lahiri, who always gave me all the personal, intellectual and financial support such a work requires.

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Due to limitation of time and other external conditions, this work is not as complete as it should. I therefore invite comments and criticism.

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Klaus von Heusinger

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0. Introduction

The concepts *intonation* and *information structure* refer to two components of grammar that are commonly assumed to be autonomous and independent of the canonical parts phonology, morphology, syntax and semantics. Both structures are closely related to each other: Intonational patterns express informational structuring, and a great part of the information structure is linguistically conveyed by intonation. Intonational patterns are not understood as a single structure, but as a complex of different intonational systems, such as the intonational contour, prominence, and phrasing, each of which expresses particular functions. For example, the contour indicates the speech act of the utterance, phrasing marks informational units, and the prominence pattern reflects in some way the *focus* of the utterance, which is often referred to as the highlighted unit. Thus, several functions of intonational features are related to information structure, which motivates the division of the sentence into units, organizes the internal structure of these units, and accounts for the relation of the units to each other and to other parts of the discourse. However, the theories on informational structure are as numerous as they are vague in their basic assumptions and their formulations.

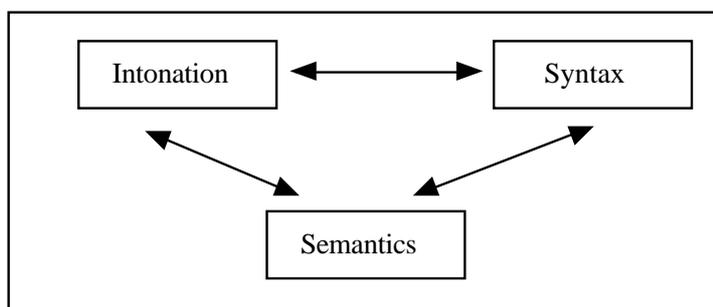
In this study, I challenge the view that intonation and information structure are autonomous grammatical levels. I argue that information structure is a proper part of semantics in the same way as intonation is beginning to be integrated into phonology. Information structure can be described by the means of the recently developed discourse semantics, i.e. Discourse Representation Theory. Like intonation, information structure is not conceived as one single component, but as a complex of different relations between discourse representation structures. For example, it will be argued that the representation of the non-focused part of an utterance, i.e., the *background*, serves different functions: it is mapped onto the already established discourse representation, before the utterance is evaluated; it further forms the restriction for operators and quantifiers. The view of information structure as a conglomerate of discourse relations operating on a representational level allows a more precise analysis of intonational features in terms of semantic functions. These functions are essential not only for the embedding of utterances into the discourse, but also for the representation of smaller phrases, and for the interpretation of semantic operators. It will be shown that, ultimately, there is no theoretical reason for an independent level of information structure, even though one might use this term informally to describe certain semantic properties and operations.

This picture leads to a generalized compositionality: The meaning of phrases, sentences, and discourses are composed from the meaning of their parts and their construction indicated by morphology, syntax and intonation. This view is not particularly new as illustrated by the following quotation by Drach (1940, 7f; highlighted in the original) from a linguistic textbook for schoolteachers:

Wenn eine Sprachäußerung dem Hirn und dem Mund eines Menschen entspringt, werden in Ateinheit erzeugt: der S i n n , die S prach g e s t a l t (Wortwahl, Satzbau) und die S ch a l l f o r m (Betonung, Intonation, Klangfarbe usw.). Die drei Teilbestände der sprachlichen Äußerung tragen und bedingen sich gegenseitig.

Drach expresses his intuition that in the act in which the utterance is produced by the human mind and mouth, the following aspects are generated together: the meaning, the form, and the sound (stress, intonation and voice quality). These three parts of the utterance are mutually dependent, as illustrated in figure (1):

(1) Simple architecture of grammar



In the following, I will concentrate on the relation between intonation and semantics, since this is the grammatical interface that is least intensively investigated. There is much research on the syntax-semantics and the syntax-phonology interaction. However, the exact relation between intonational patterns and informational structure (as part of semantics) is still to be investigated. Before this relation can be accounted for, a clear understanding of the representation of intonation and information structure has to be gained.

In the remainder of the introduction, I first summarize some historic and systematic background of the concept of information structure. Second, I sketch the object of this investigation against that setting. Third, I give a very short overview of the different research traditions on intonation and information structure, and I end with an outline of the chapters in this book.

0.1 The concept of information structure

Intonation and information structure are often linked in one way or the other. The way a particular intonation contour is used is explained with reference to the function or the meaning of a sentence – or more precisely – to its informational organization, which is also known under the term *information packaging*. On the other side, semantic structure that goes beyond the capacity of a linear compositionality is linked to particular intonational patterns, like the hat-contour in German.

Going back to our linguistic textbook, Drach (1940, 8f) notes that the intonational features such as contour, prominence, and phrasing have two functions. First, they are as important for the expression of semantic relations in the sentence as morphology, particles, and word order are. Furthermore, intonation can express meaning proper: "The way a sentence sounds reveals its meaning."

Die Merkmale der Schallform spielen im Satz immer die Rolle wichtiger Beziehungs träger, nicht weniger sinnbedeutend als die anderen Beziehungsträger Flexion, Partikeln, Wortstellung. In manchen Fällen erhebt sich die Schallform zum Rang des Bedeutungs trägers : die Weise, wie der Satz klingt, offenbart seine Bedeutung.

In contrast to this picture, the widely accepted view of intonation and information structure is that they form two grammatical levels that cannot be comprised by phonology, syntax, and semantics. Both levels are closely interrelated as intonation expresses to a great extent information structure and vice versa. For example, intonational phrasing organizes the words in an utterance in a way that can be inconsistent with syntactic constituents, as illustrated by (2), where brackets indicate phrasing, and small capitals prominence:

- (2) A: I know that Alice likes velvet. But what does MARY prefer?
 B: (MARY prefers) (CORDUROY)

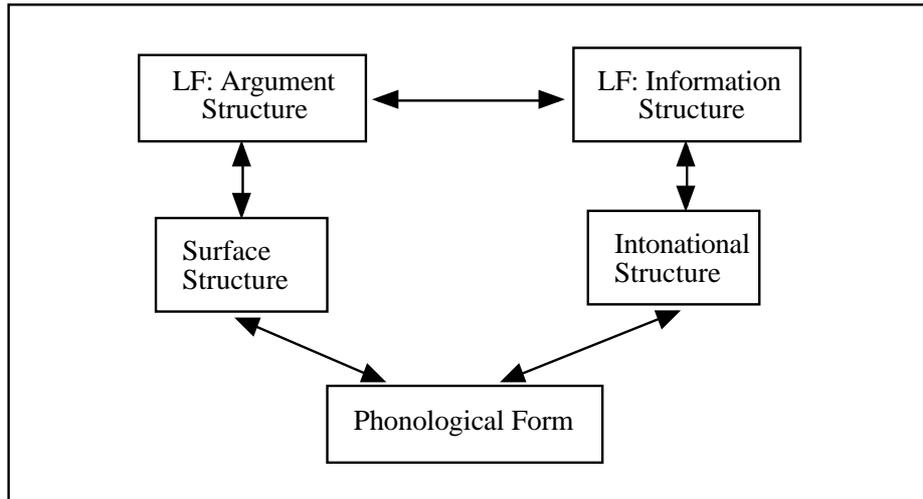
In the answer, not only is the new information *corduroy* prominent, but the subject *Mary* of the sentence is also stressed. Furthermore, the intonation indicates a phrase boundary between the predicate *prefers* and the object *corduroy*. Such a phrasing does not correspond to the traditional syntactic analysis of the sentence into a subject NP and a predicate VP. Examples like this lead to proposals in which intonational structure is independent of surface syntactic structure, and related only indirectly to the lexical meaning, i.e. to the logical form or function/argument structure, via information structure.

Even though the data seem to strongly endorse such a view, the assumption of the two structure-function pairs syntax-semantics, and intonation-information structure complicates the grammatical architecture. This complication becomes even worse if we consider focus particles, like *only* in (3), which have effects on both domains.

- (3) John only introduced BILL to Sue.

These and other observations seem to suggest the theoretical architecture shown in (4) for these components of grammar:¹

- (4) The architecture of a standard grammar with intonational structure



According to this perspective, the lexical meaning of words and their syntactic composition encode the ordinary meaning of a sentence, while intonation provides different functions, which are represented at a separate level. In other words, intonation comes on top of syntax and information comes on top of semantics.

This additional informational component has received different names such as *psychological or logical structure* (von der Gabelentz 1869), *thematic structure* (Mathesius 1929), *information structure* (Halliday 1963b), or *information packaging* (Chafe 1976). The primary function of this structure is informally described as inducing a partition of the sentence into two informational units, which are independent of the grammatical, i.e. syntactic-semantic, organization. Nevertheless, the units are defined with respect to the grammatical sentence: They can be reunited to the whole in an extra-grammatical subject-predicate manner.

The theoretical basis for this additional subject-predicate structure varies according to the background theory of the researcher. E.g., von der Gabelentz (1869) introduces the pair *psychological subject-psychological predicate* according to his view that psychology is the ultimate base for language structure. The Prague School used the

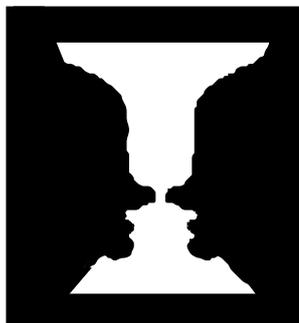
¹ Figure (4) is from Steedman (1991, 262), who use it to characterize this very common picture. However, Steedman criticize this: "However, compelling the logic of this argument may appear, the involvement of two apparently autonomous levels of structure, related to two autonomous levels of meaning representation, complicates the theory considerably. The picture becomes even bleaker when it is realized that the two levels of structure must communicate, because of the presence of certain focussing construction and operators—such as the English topicalization construction—or the focussing particle *only*, exemplified."

terms *theme-rheme* and later *topic-comment*, which are both borrowed from traditional rhetoric and philology. Chomsky (1971) uses *focus-presupposition*, indicating the semantic nature of the distinction. É. Kiss (1995, 7) uses the distinction *notional subject-notional predicate*, trying to abstract from the grammatical connotations. The list goes on. Researchers at the end of the last century and the beginning of this century believed that the function of language is to convey (psychological) concepts ("Vorstellungsinhalte"). The function of a sentence is to attribute one concept to another one. Jespersen (1925, 147) summarizes this psychological view from von der Gabelentz, who had already employed the metaphor of the telegraph, anticipating the turn to information theory as the epistemological base for linguistic theory:

(...) the hearer first apprehends a word A and asks full of expectation: What about this A? Then he receives the next word or idea B, adds together these two and asks: Now, what about this (A+B)? The answer is the next idea C, and so forth. Each successive word is the predicate of the subject contained in what he has already heard. It is as with the two rolls of paper in a telegraphic apparatus, on the one side there is the roll filled with writing, which is continually expanding, on the other side the blank roll, which is continually gliding over and swelling the other. The speaker knows beforehand both what is contained in one roll and what is to fill the empty paper. What now makes him mention A first, and then B, etc.? Evidently he will place first what makes him think: his 'psychological subject', and next what he thinks about it; his 'psychological predicate'.

More recent theories have replaced the psychological concepts with notions of information or communication theory, and with theories of data processing. However, in all the theories, the basic idea is that a sentence transmits its content by expressing something new against something old, i.e. the *background* or *common ground*. This picture of unequal parts in a composition was most prominently developed in *Gestalt psychology* at the end of the last century. According to this school of psychology, the perception of a stimulus, particularly in the case of vision, generally consists in attributing a structure in which one part of the stimulus, called the *figure*, seems to stand out against the rest of the stimulus, called the *ground*. The same stimulus can be structured differently into figure and ground, giving rise to a number of familiar optical illusions, as in (5) (from Edgar Rubin as reproduced in Katz 1961, 53), where one can see either a chalice or two faces, but not both at the same time.

(5)



This very idea of the dichotomy in figure-ground was transmitted unnoticed from the psychological tradition of linguistics to the anti-psychological one, which has based linguistic functions on informational concepts.² Thus the modern view of information structure has inherited the following three characteristics from the psychological tradition:

- (i) It constitutes an autonomous grammatical level, often associated with discourse or text.
- (ii) It is realized as a dichotomy of the sentence, which goes back to the gestalt-notion of figure-ground.
- (iii) The basic operation over the informational units is defined in terms of an extra-grammatical subject-predicate structure. The composition of the two units yields a sentence meaning, which means that they are defined with respect to the propositional content of a sentence.

I argue that none of these characteristics conforms to modern standards of linguistic theory. The definition of information structure must be based on well established grounds.

0.2 The structure of the argument

The linguistic analysis of intonation has made great progress over the last decades. There is a successful development from the first description of intonation as a holistic contour towards the recent analysis as a sequence of abstract tones. One could summarize the development of the research into intonation with the following five steps: (i) it was accepted that intonation is a linguistic phenomenon worthy of investigation. This includes distinguishing intonation from non-linguistic auditory effects, as in Crystal (1969), Ladd (1980) and others. (ii) Intonation was described according to its main acoustic effect, the F_0 -contour. Thus, the intonation contour received an abstract gestalt contour which is aligned to the sentence. (iii) The gestalt-form of intonation was divided into characteristic movements such as fall, rise or combinations of those. (iv) The analysis of tones was borrowed from autosegmental phonology and applied to the contour. The intonation contour is described as a sequence of abstract

² For example, Crystal (1969, 97): "An act of communication is seen as a 'bundle' of interacting behavioural events or non-events from different communicational subsystem (or 'modalities') simultaneously transmitted and received as a single (usually auditory-visual) impression. (This communicative activity has been variously called a 'signal syndrome', a 'total configuration', and a 'communication network'.) At any particular time and place, an individual communicates by making use of behavioural events which he feels to be relevant to his message from these subsystems, but his ability to do this will be restricted by patterns available in the total cultural complex in which he finds himself."

tones expressing different functions. (v) The description of intonation by abstract tones is beginning to be integrated into phonology proper.

I argue that a similar progress of the research into information structure will ultimately lead to the integration of information structure into semantics. The following steps are necessary for this goal: (i) domain delineation for informational phenomena, (ii) defining criteria for deciding which data belong to information structure and which not, (iii) reflecting the tools of sentence semantics, (iv) evaluation of formal approaches to information structure, (v) considering formal accounts to discourse representation, (vi) applying discourse representation to information structure. The first two steps have already been taken by the European tradition in describing information structure (Paul 1880, Amman 1928, Mathesius 1929, Firbas 1964, Sgall & Hajičová & Benešová 1973, etc.), and the American tradition beginning with Halliday (1967a). Steps (iii)-(iv) are a revision of the capacity of semantic description of focus, such as von Stechow (1982), Jacobs (1983), Rooth (1985), Krifka (1990) among others. However, steps (iv) and (v) enable us to venture into new territory.

(i) Domain delineation for informational phenomena

As discussed above, information structure has been assumed to be an autonomous part of grammar for more than 100 years. However, it is still controversial what the data are that belong to information structure. Since the relevant phenomena are mostly informally described, there is only a small uncontroversial set of data. Most of the data are vague in their description with respect to properties of information structure.

(ii) Defining criteria for data belonging to information structure

Information structure is mainly indicated by intonation. It consists of a dichotomy of the sentence into two units, which stand in a subject-predicate relation. Even though information structure is sometimes understood as textual or discourse structure, its organizational level is still defined with respect to a proposition. But information structure is often described as not varying in truth conditions, but in the appropriateness in a given context.

(iii) Reflecting the tools of sentence semantics

Sentence semantics has developed a very robust test that decides whether a given contrast is of a truly semantic nature: truth conditions. If two sentences or two readings of one syntactic structure have different truth conditions, then they also have a different semantic structure. Differences in semantic structure are generally induced by semantic operators and their scope. This test cannot be directly applied to information structure, since the latter is often explicitly defined *not* to show truthconditional effects.

(iv) Evaluation of formal approaches to information structure

Focus-sensitive particles interact with information structure exhibiting truth-conditional or presuppositional effects. This interaction is called association with focus and stands in the center of interest of semantic theories of information structure. These theories also assume that focus indicates a partition of the sentence into two informational units. The focus particle is translated into an operator that takes these informational units as its arguments. Like for other functional words, the semantics of the operator is defined as its contribution to the propositional content of the whole sentence. Again, informational effects are restricted to the propositional level, and effects on non-propositional levels are not explained. Furthermore, a detailed analysis will show that these theories are too restricted even in the propositional domain. A different account seems to be necessary.

(v) Considering formal accounts to discourse representation

In the beginning of the 80s, a family of new semantic theories of discourse structure was established. The central concern of discourse semantics had been cross-sentential anaphora. Since the Greeks, the nature of anaphoric relations had been very controversial (see Egli 1979 for an overview). The main insight of the new theories was that anaphoric relations do not relate linguistic expressions to their denotations, but they relate so-called discourse referents to each other. Discourse referents "live" on an intermediate representational level that mediates between the linguistic expression and its denotation. Thus discourse representation theories (cf. Kamp 1981, Heim 1982) give a model of how we organize our discourse. The representation of the discourse is incrementally built up: Each sentence contributes its representation to the representation of the previous discourse. Different conditions govern this process, e.g., discourse referents must be linked, subdomains are created that correspond to the scope of operators, additional representations are inserted by accommodation if the previous discourse does not license certain conditions, etc. The development of discourse representation theory led to new ways of explaining other discourse phenomena, as well. For example, the notoriously difficult concept of presupposition gets a new structural description at this level.

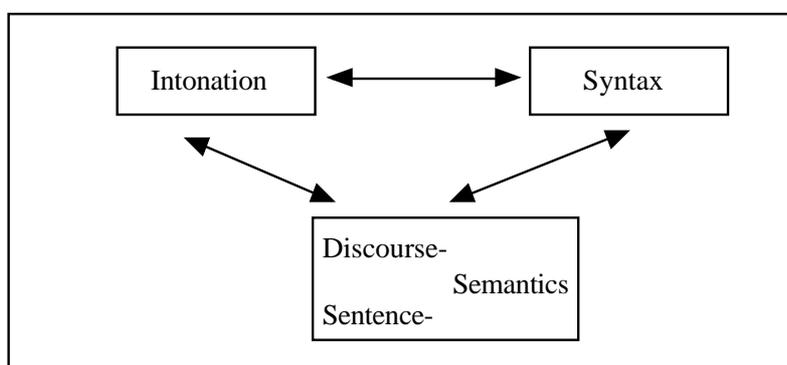
(vi) Applying discourse representation to information structure

I will apply these new tools for describing discourse to information structure, which I take to be a cover term for a wide variety of different discourse relations corresponding to the complex structure of the discourse representation. Therefore, I first distinguish the different functions subsumed under this general heading, before analyzing the functions in detail. I will start the investigation into information structure by revising semantic theories of association with focus. Combining the insights of discourse representation theory with the detailed analysis of truth-conditional effects of information structure, I will give a new account of these phenomena in semantic terms.

This account is then applied to other domains of information structure as well, without relying on any of the three traditional characteristics for information structure, namely the assumption of an autonomous level for information structure, the assumption of the dichotomy of the sentence, and the underlying subject-predicate structure of the informational structuring.

To make this program a success, we would need to integrate the discourse phenomena covered by the term information structure into semantics proper. This will eventually lead to a better understanding of the discourse-semantic function of intonational features and their representation in an intonational lexicon. And finally, we will have a much better understanding of the composition of lexical meanings by means of syntax and intonation, and the general architecture of grammar, illustrated in (6), which is a slightly modified version of (1) above. Here semantics is understood as comprising phenomena of sentence *and* discourse meaning, thus including phenomena of information structure:

(6) Simple architecture of grammar (modified)



0.3 Research on intonation and information structure

There are several distinct research traditions for intonation and information structure and their interaction with other areas of grammar. In particular, the following interfaces are intensively studied: intonation and phonology, focus and phonological phrasing, intonation (focus) and syntax, information structure and discourse analysis, association with focus and formal semantics. It is not possible to give an exhaustive or even an comprehensive overview of these research traditions. However, I give some references to more comprehensive studies. This also helps to locate the present study in the recent research environment.

Intonation in phonology

Most recent approaches to intonation goes back to the analysis of Bruce (1972), Liberman (1975) and Pierrehumbert (1980), who for the first time used abstract tones

for representing the intonation contour. A good overview of intonational phonology can be found in Ladd (1996). The application of these description to German was undertaken in Uhmann (1991) and Féry (1993). The relation between intonational phrases and prosodic phrases, on the one hand, and to syntactic constituents on the other hand was investigated by Hayes & Lahiri (1991), Truckenbrodt (1995), Grice (1995), Fitzpatrick-Cole (1996) and Lahiri & Fitzpatrick-Cole (in press).

Focus and syntax

The interaction of focus and syntax, i.e. word order or sentence type is subject of various studies. Sasse (1995) has collected more than 1000 articles of focus and syntactic structure. A classical collection is "Topic, Focus and Configurationality" of Abraham & de Meij (1986), where questions of information structure and configurationality are discussed. More recent studies on configurationality and focus are collected in É. Kiss (1995). Most, if not all of these approaches focus on syntactic structure and do not take semantic representation into account.

Information structure and discourse analysis

Discourse pragmatic theories use intonational features for the construction of their discourse models (Pierrehumbert & Hirschberg 1990). Vallduví (1990) uses Chafe's (1976) concept of *information packaging* in his discourse pragmatic representation (see also Vallduví & Engdahl 1996 and Erteschik-Shir 1997). However, none of these theories is explicit about the nature of the semantic concepts they informally use.

Focus and formal semantics

Since the beginnings of the 90's, formal approaches to the semantic effects of focus and association with focus has been widely discussed. Besides two extra editions of journals on this topic (Journal of Semantics 1991, Linguistische Berichte 1992), there are several studies which go back to two theories: structured propositions (König 1981; von Stechow 1982; Jacobs 1984; Krifka 1992), and alternative semantics (Rooth 1985; 1996). These theories have developed in different directions. Von Fintel (1994) and Roberts (1996) integrate more pragmatic elements into the theory, while Pulman (1997) uses underspecification for the representation of focus. In a different approach, Steedman (1991, 1994) uses flexible constituents in categorial grammar in order to describe the the information structure of a sentence. The volume of Bosch & van der Sandt (1999) presents a collection of current research directions. However, none of these studies accounts for the intonational facts in detail.

To sum up, there is no study that investigates intonational patterns along with semantic aspects of information structure (or vice versa) and which tries to correlate these different levels to each other.

0.4 The outline of the book

In the first chapter *Intonational effects – an overview*, I discuss some characterizations of intonational features, and present data that illustrate how intonational patterns give important – and sometimes necessary – clues for the interpretation of utterances at various levels. This more impressionistic picture should illustrate the wide range of intonational phenomena in linguistic theory and it should also present some informal grouping of these phenomena. It provides the data which forms the base of the discussion in the following chapters.

The second chapter *Intonational phonology* sketches the development of phonological theories of intonation, from early iconic approaches to the more recent theories, in which the intonation contour is formed by a sequence of abstract tones. The three subsystems of intonational patterns, the intonational contour, the intonational phrasing and the prominence relation of a text are described and related to each other. A short overview of the discussion on pitch accent, stress, and focus is given, in which the notion of *focus projection* is also introduced. Finally, different aspects of the function of the intonational features are presented and discussed.

The third chapter *Information structure and the partition of the sentence* presents various theories of information structure in their historical and systematic context, and their basic assumption of the semantic structure of a discourse. In the course of the discussion I argue that the dichotomy of the utterance into two informational units does not correspond to recent linguistic methodology. Furthermore, the idea of an extra-grammatical subject predicate structure is shown to be superfluous.

The fourth chapter *Semantic theories of focus* discusses formal approaches to focus and association with focus. In particular, I present the LF-movement theory and Alternative Semantics. In the course of the chapter, different levels of semantic analysis are introduced which are effected by information structure. It is argued that the representational level is the most appropriate one for describing informational effects.

The fifth chapter *Association with focus in definite NPs* presents a detailed analysis of the interaction of semantic operators with focus-sensitive particles and their translation into a semantic representation. It will be shown that the two most accepted theories, LF-movement theories and Alternative Semantics, cannot deal with the problem of association with focus in definite NPs. A different approach is called for.

In the sixth chapter *Focus and discourse semantics*, I sketch a new approach to information structure. I use the basic formalism of Discourse Representation Theory. Information structure is understood as the collection of various relations between different expressions, sentences or larger units with each other. A comprehensive description of the particular relations accounts for the different aspects of information structure.

The seventh and final chapter *New vistas of the intonational lexicon* relates the elaborated discourse semantic representation to the phonological representation of intonation. The concept of the *intonational lexicon* is discussed and further research directions are defined.

Chapter 1

Intonational effects – an overview

The way a sentence or an expression is uttered expresses much more than just the information that is lexically encoded in the words. Auditory means may add other functions to the "literal" meaning. In particular, intonational patterns may influence the interpretation of a sentence and can interact with different levels of meaning. In this introductory chapter, I first discuss some characteristics of intonational features. Then, I present data that illustrate how intonational patterns give important – and sometimes necessary – clues for the interpretation of utterances at various levels. This more impressionistic picture should illustrate the wide range of intonational phenomena in linguistic theory and it should also present some informal grouping of these phenomena.

Linguistic theories of intonation generally concentrate on one group of intonational effects or another. They are tailored for that particular use, but are also applied to other cases. Depending on the particular features of the prototypical data, the theory might be unable to describe the whole range of intonational phenomena. This can be illustrated with two theories that are located at opposite poles on a scale of linguistic approaches: Bolinger's iconic theory of intonation and Rooth's formal approach to the semantics of focus.

Bolinger (1998, 45) describes intonation very close to other paralinguistic features:

As with intonation in general, that of American English is highly iconic and must be studied in relation to the entire gestural setting, especially facial expression and expressive body language. A higher pitch is typically associated with higher positions of the eyebrows, shoulders and often hands and arms (...).

On the opposite end of the scale we find semantic theories of association with focus (see section 4.3.2 and chapter 5) which take their basic intuition of the function of focus from its contrastive use. For example, Rooth (1985) describes the function of different usages of focus in his theory by assuming that the focused expression evokes alternatives to its ordinary meaning. Rooth (1992, 113) comes to the following conclusion:

I have argued that intonational focus in English has a uniform semantic import, which can be related to the intuitive notion of contrast within a set of alternative elements. The key to a uniform interpretation for focus is an interpretation principle which introduces a

variable, thought of as a contrasting element or set of contrasting elements. This variable can be anaphoric to a variety of pragmatic and semantic objects, resulting in a variety of focus sensitive effects, including both discourse effects and sentence-internal association with focus effects.

I am not arguing here that one theory is better than the other. The argument is rather that one has to understand the genuine domain of a theory before one can evaluate the theory and its application to other domains. The same holds for theories of intonation. In section 1.1, I present some characteristics of intonational features, and the remainder of the chapter is then dedicated to an incomplete listing and informal classification of intonational effects.

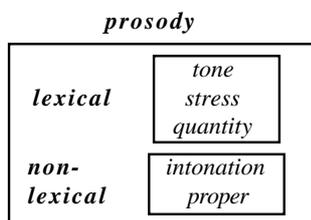
1.1 The characterization of intonation

Intonation patterns consist of intonation features or subsystems of various kinds and names.¹ Here the terms *intonational contour*, *prominence*, *intonational phrasing*, and *pitch range* are used to refer to these features. Other terms for contour and prominence are *tune* and *stress*, respectively. *Stress* refers to the relative prominence of syllables in an utterance. The *contour* indicates the movement of pitch, which correlates with the fundamental frequency F_0 . For example, the characteristic intonation pattern of an assertion has a distinct contour from that of a question. *Phrasing* divides the sequence of words into intonational units, the intonational (or prosodic) phrases. Phrase boundaries are marked by pauses, boundary tones and duration patterns. *Pitch range* controls the limits in which the contours are realized. One may increase one's pitch range for many reasons – for example, to project one's voice or to highlight the information in a particular phrase. Thus the pitch range constitutes the personal or situational induced "landscape" on which the (linguistically relevant) pitch movement is realized:

The pitch movement of an utterance is basically describable in terms of direction of pitch (...) and range of pitch. This latter parameter covers the width of a pitch glide, which is a

¹ The term *prosody* has been used interchangeably with *intonation* in the literature. Often prosody is understood as the term with the wider range, as for example described in Hirst & Di Cristo (1998, 4ff). They restrict the use of *intonation proper* for "supralexical, postlexical, or simply non-lexical characteristics" as indicated in (i). Compare also Crystal (1969, ch. 1).

- (i) Relation between prosody and intonation



Selkirk (1995, 550): "The term sentence prosody encompasses three distinct aspects of the phonological representation of the sentence: intonation, phrasal rhythmic patterning and prosodic phrasing."

variable, and the distance between pitch levels of adjacent static syllables. In defining *pitch-range* contrasts in both these cases, it seems best to isolate the range distinction by hypothesising a pitch constant for any speaker. This constant is taken to be the first prominent syllable (the 'onset') of any stretch of utterance definable as tone-unit. For any speaker, the first prominent syllable of a tone-unit is articulated at or around a stable pitch-level for the majority of his tone-units. (Crystal 1969, 143)

The terms *contour*, *prominence*, *phrasing* are abstract notions or concepts of the linguistic theory, namely of phonology. The articulatory, acoustic, and auditory correlates can be captured as in (1) (from Couper-Kuhlen 1986, 7):²

(1) Articulatory, acoustic, and auditory correlates

Articulatory	Acoustic	Auditory
Vibration of vocal folds	Fundamental frequency (f ₀)	Pitch
Physical effort	Amplitude (intensity)	Loudness
Timing of articulatory movements	Time	Duration

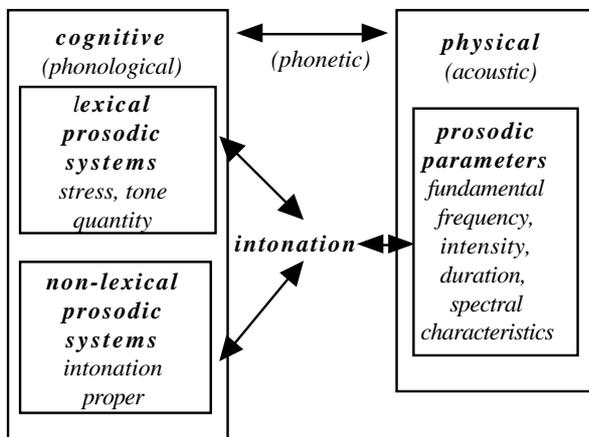
The terms *intonation*, *intonation patterns*, or *intonational features* are used in this study as referring to abstract phonological notions. The ingredients of intonation,

² The relation between the phonological notions of *contour*, *prominence/stress*, and *phrasing* to *pitch*, *loudness* and *duration* are more complex. For example, it is controversial whether loudness or pitch movement is the more important correlate for prominence (see section 2.4.1 for discussion).

A slightly different picture is drawn by Hirst & Di Cristo (1998, 7), who understand intonation in two ways interacting with their broader term *prosody*: "On the abstract, phonological level, prosody consists of a number of lexical systems (tone, stress and quantity) and one non-lexical system: *intonation*. We also propose to use the term *intonation* with a second meaning, to refer to a specifically *phonetic* characteristic²⁷

of utterances, a construction by which the prosodic primitives on the lexical level and the non-lexical level, however we choose to represent these formally, are related to acoustic prosodic parameters. This phonetic interpretation of intonation as the interface between prosodic systems and prosodic parameters is illustrated in the following figure:"

(i) Intonation as relation between phonological and acoustic features:



prominence, *contour*, *phrasing*, and *pitch range*, occur also at other phonological levels such as the lexical level or paralinguistic levels. Ladd (1996, 6ff) discusses three criteria that characterize or define a proper intonational feature: (i) it is suprasegmental, (ii) it conveys meaning effects at the sentence level and (iii) it is linguistically structured and therefore distinguished from paralinguistic means.

1.1.1 Suprasegmentals

Spoken language is organized in segments – vowels and consonants, which combine to produce syllables, words, and sentences. This aspect is called the 'verbal' aspect of speech. We articulate these segments according to their segmental features; simultaneously our pronunciation varies in other respects, as well. We modify our voice by a wide range of tones and other auditory means, which are called suprasegmental since they do not affect one segment but are associated with more segments or spread over a sequence of segments. It is part of the nature of intonational features that they are of the same substance as segmental features. However, intonational features refer to larger sections of the speech continuum:

[S]uprasegmental features are established by a comparison of items in sequence, whereas segmental features are identifiable by inspection of the segment itself. (Lehiste 1976b: 225-6)

Besides the suprasegmental features contour, prominence, phrasing, and pitch range, languages make use of several other suprasegmental vocal effects, using the range of articulatory possibilities available in the vocal tract. The laryngeal, pharyngeal, oral, and nasal cavities can all be used to produce 'tones of voice' which can give additional information about the contextual setting in which an utterance is produced. The paralinguistic modifications by *voice qualifiers* like a whisper, creak, falsetto etc. or by *voice qualifications* like a giggle, laugh, sob etc. express the attitude or the emotional state of the speaker.

Thus, suprasegmental features include the intonation contour, prominence relations, phrasing, and pitch range as well as voice qualifiers and qualifications and other auditory means that can be produced by our vocal tract. However, not all of these features belong to intonation proper. We therefore have to separate the intonational features from other auditory features by additional characteristics (see also section 2.1.1).

1.1.2 Linguistic vs. paralinguistic information

We define intonation as part of the linguistic system i.e. as part of the grammar of a natural language. This distinguishes intonation from so-called paralinguistic features which are not part of the linguistic system proper, such as *voice qualifiers* (whisper, breathy, husky, creak, falsetto, resonant), and *voice qualifications* (laugh, giggle, tremulousness, sob, cry). The main distinction between linguistic and paralinguistic features such as gestural and facial expressions, body language and in particular by the way an utterance is spoken is the systemic and categorial character of linguistic features vs. the iconic and scalar character of the paralinguistic features. Paralinguistic messages express basic aspects of interpersonal interaction, such as aggression, appeasement, solidarity, condescension, and with the speaker's current emotional state, such as fear, surprise, anger, joy, boredom. For example, the pitch level may rise according to the level of excitement: the higher the pitch the more excitement. Or the intensity (loudness) of an utterance may express the grade of anger the speaker has. Furthermore paralinguistic means may cooperate in a bundle of features: a "higher pitch is typically associated with higher positions of the eyebrows, shoulders and often hands and arms (...)." (Bolinger 1998, 45). Paralinguistic features often refer to a continuum without clear categorial boundaries, which is particularly noticeable with *laugh-giggle* and *sob-cry*.

Linguistic features, on the other hand, are categorial, i.e. something is either a /p/ or a /d/, an utterance has either a question intonation or an assertion intonation, the focus-sensitive particle associates with this or that expression, etc. It is often very difficult to distinguish between auditory effects that are paralinguistically used and those that are used for intonation as a linguistic feature. However, a theory of intonation should be able to describe both kinds of features in a different way (see also section 2.1.2 for further discussion).

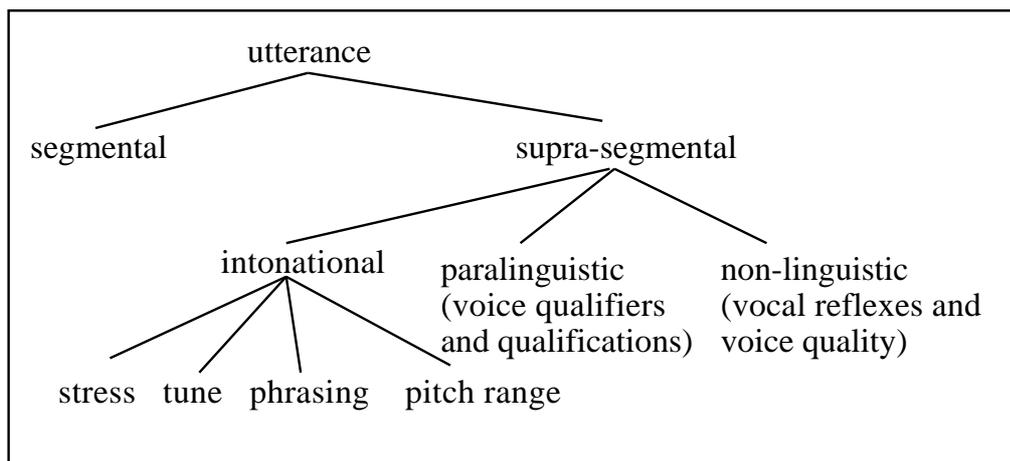
1.1.3 Sentence-level or postlexical

Intonational features convey meanings that apply to phrases or utterances as a whole, such as sentence type or speech act, or focus and information structure. But the same features can have lexical meanings. The lexical meaning of stress is illustrated by the contrast of the verb *perμίt* and the noun *pérmit*, which can only be distinguished by the place of stress. Similarly in German, we distinguish between *'übersetzen* ("carry or ferry across") vs. *übersétzen* ("translate"). In so-called tone-languages like Chinese, the level or contour of pitch indicates the lexical meaning of a word: Chinese *hua* with a high level pitch on the *a* means "flower", while *hua* with a sharply falling tone on the *a* means "speech, language". Thus, we have to distinguish between lexical features whose values are determined by the lexical entry and which are restricted to the word-

level, from intonational features that are not determined by the lexical entries of words, but by semantic-pragmatic functions that apply to sentences or complex phrases.³

This very short discussion of the characteristics of intonational features is summarized by the following chart (adapted from Crystal 1969, 131; 177). An utterance consists of segmental and suprasegmental features. The latter are divided into intonational, paralinguistic and non-linguistic features.

(2) Characterization of intonational features

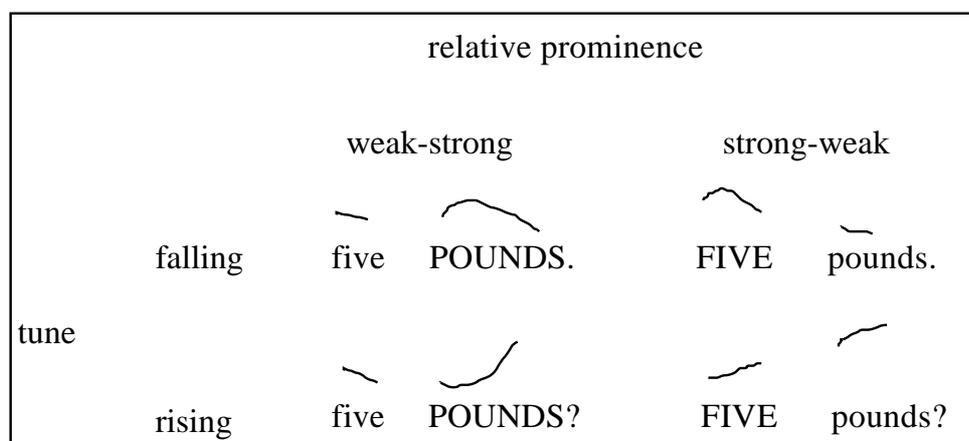


1.1.4 The interaction of intonational features

Intonational features are determined independently of lexical or paralinguistic information. However, in their realization they partly interact with lexically assigned stress, tune or pitch on the one hand and with other auditory means for paralinguistic functions on the other hand. A very similar picture holds for the intonational features themselves. They are partly independent of each other, but they are aligned to the same piece of text such that they may influence each other in their realization. This interaction can be illustrated with the two features relative prominence and pitch contour (cf. Ladd 1996, 8). Stress is expressed in the (categorical) contrast of *weak* vs. *strong* and the contour is instantiated as falling or rising.

³ This definition assumes a clear distinction between word or lexical meaning on the one hand and sentence or discourse meaning on the other. As we will see in the discussion of focus-sensitive particles, this distinction is far from clear cut. This is because the lexical meanings of focus-particles make reference to the intonation properties of the whole utterance. Furthermore, there is an increasing interest in the lexical encoding of discourse functions. For the time being, however, we use the distinction lexical vs. sentence function as a convenient one.

(3) Interaction of relative prominence and pitch contour



The two pitch patterns (or intonation contours) are clearly distinct. The falling contour indicates a declarative sentence, for example the answer to the question *How much does it cost?*. The rising pitch movement is normally used to convey doubt, uncertainty or some other kind of questioning modality. In general, this contour invites feedback from the other participants. The contrast in relative prominence or stress is orthogonal to the contour. The weak-strong pattern is the unmarked one if the whole phrase is in focus and corresponds to the answer to the question *How much does it cost?*. The second pattern focuses on the numeral *five* and might be the answer to the question *How many pounds does it cost?* or *Did you say five pounds?*. Both dimensions, contour and relative prominence, qualify as intonational features according to the three characteristics discussed above: they are suprasegmental, they do not express lexical meaning but meaning aspects at the level of a sentence or speech act, and they have categorically distinct features (falling vs. rising, weak vs. strong). Even though prominence and contour are independently generated they are linked: the pitch accent, i.e. the location of the greatest pitch movement is associated with the most prominent location of the text (see sections 2.2.3 and 2.4.1).

Phrasing and prominence are also independent as shown in examples (4a)-(4c), which are adapted from Halliday (1967b, 202):

- (4a) (MARY) (always goes to TOWN on Sundays)
- (4b) (MARY) (always goes to town on SUNDAYS)
- (4c) (MARY always goes to) (TOWN on Sundays)

Sentence (4a) contrasts with (4b) only in the location of the pitch accent (in small capitals) in the second phrase, while the phrasing is the same. On the other hand, (4a) contrasts with (4c) in phrasing, but not in the location of the pitch accent (see section 3.2.2).

1.1.5 The functions of intonation

One of the main characteristics of intonation as a grammatical phenomenon is that it expresses contrasts at different levels of meaning. Intonation can categorically indicate, among other things, speech acts, phrasing, discourse structure, implicatures, presuppositions, truth conditions, and scope relations. Given these somewhat arbitrary categories, certain phenomena may belong to more than one category and overlapping of one or the other categories is possible.

The material presented in the following sections forms the basis with which the range of different theories is illustrated. In particular, it will be shown that different theories take different categories as the prototypical ones. E.g., Bolinger understands intonation as an iconic reflex of our emphatic behavior (see 1.2 *Communicative Functions*), while formal theories of focus start with the truth-conditional effects (see 1.7 *Association with Focus*).

The presentation of the different effects follows the particular parts of intonation: pitch movement, phrasing and prominence. For all these features we find paralinguistic, linguistic/postlexical, and lexical effects. Even though we are mainly interested in the linguistic/postlexical effects of intonational features, we include in our discussion some of the other effects, too. The remainder of this chapter is organized as follows: We first present data illustrating the effect of different pitch contours. They can have communicative functions or they can indicate speech acts. Then the relation between pauses and phrasing is discussed. Finally, prominence is shown to have a wide range of functions: it can indicate different kinds of contrast, it can mark discourse structure and can interact with operators (association with focus). In the latter two domains, the domain to which the stressed item is linked is called *focus*.

- (5) Overview of the functions of intonational features
- | | |
|---------------|--|
| pitch contour | communicative functions
speech acts |
| phrasing | segmentation of the sequence of words |
| stress | contrast |
| | focus discourse structure
association with focus |

1.2 Communicative functions

Utterances are not only used to transmit propositional information about the world but also so-called *communicative functions*, such as information about the emotional or emphatic state of the speaker or about interpersonal interaction such as aggression, appeasement, solidarity, condescension. Paralinguistic functions are non-propositional and difficult to paraphrase precisely. Paralinguistic cues can be consistently interpreted even in the absence of the linguistic (propositional) message. Communicative functions are often transmitted by *extra-* or *paralinguistic* features such as gestural and facial expressions, body language and in particular by the way an utterance is spoken. Like other paralinguistic means, these modifications are realized in a parallel *channel* to the one in which the (propositional) information is expressed. Paralinguistic features are typically non-categorical and iconic. For example, the pitch level may rise according to the level of anger.

Suprasegmental features also have a significant function as markers of personal identity – an 'indexical' function. In particular, they help to identify people as belonging to different social groups and occupations, such as preachers, street vendors, army sergeants etc. (cf. Crystal 1987, 171). This indexical function depends on the non-linguistic context and world knowledge. Nevertheless, paralinguistic features can be systematized and conventionally controlled. They can play an important role in setting the communicative background for the interaction of the participants:

Setting the Tone for Talk

Researchers at Kent State University analyzed 25 taped "Larry King Live" interviews and found that the host's level of deference to his guests – and vice versa – is demonstrated by tone of voice. The dominant person in the conversation sets its tone by establishing "a frequency," the pitch generated by the speaker's vocal cords; the person deferring alters his or her tone to match that.

The frequency "gives an indication of status," sociologist Stanford Gregory of Kent State told *Self* magazine. "It has nothing to do with what is said ... Throughout the animal world, there's always a pecking order – and this signal is a way of producing an order."

The researchers found King deferring to: George Bush, Elizabeth Taylor, Ross Perot, Bill Clinton, Barbra Streisand, Sean Connery and Mario Cuomo. Among the guests who treated King as king: Henry Kissinger, Lee Iacocca, Spike Lee, Jeane Kirkpatrick, Garrison Keillor and George Mitchell. (San Francisco Chronicle, Oct. 8. 1997)

The existence of a system of such paralinguistic features becomes obvious in those cases in which not all participants act according to the same conventional rules. Gibbon (1998, 89) reports the following example for the pitch height:

The indexical function of pitch height to indicate degree of excitement is widespread, and certainly it occurs in German. However, the range of pitch modulation in German is in

general much less than in English and many other languages in otherwise comparable situations, which may lead to misjudgements of intention or attitude. British female voices, in general relatively high pitched, tend to sound aggressive and over-excited to the German hearer, and conversely, German males may sound "bored" or "unfriendly" to the British hearer.

Another instantiation of such paralinguistic auditory means is the emphatic or emotive accent, which indicates "more of everything" as in *Schöööön* ("fiiiiiine"). Emphatic accent is often merged with contrastive accent (below), and finally, the expression of the attitude of the speaker towards his communicative setting is very close to his attitude towards the proposition expressed, as discussed in the next section.

1.3 Speech acts

One of the most prominent functions of the intonation contour, i.e. the pitch movement, is to indicate the speech act of an utterance, i.e. the way (or the "force") in which a proposition – or more precisely: a propositional content – is presented. A propositional content can be presented as assertion, as question, as command etc. This function of intonation is believed to be a (near) universal feature of language:

It has often been noted, for example, that in a vast majority of languages some sort of raised pitch (final or non-final) can be used in contrast with lower pitch to indicate that an utterance is intended as a question rather than as a statement. In this sense the universal status of intonation is rather different from that observed for other phonological systems such as vowels or consonant systems (...). (Hirst & Di Cristo 1998, 1)

Ladd (1996, 113f) summarizes this view, which goes back to Bolinger in the following way: "Intonation, according to Bolinger, has direct links to the prelinguistic use of pitch to signal emotion. Broadly speaking, high or rising pitch signals interest, arousal, and incompleteness, while low or falling pitch signals absence of interest and hence finality and rest. This fundamental opposition between high and low (or up and down) is clearly seen in the use of pitch range of obviously emotional expression – raised voice for active emotions such as anger or surprise and lowered voice for boredom, sadness, and the like." According to Bolinger, the iconic function of intonation also shows up in more grammatical uses, as listed below:

- (6) The iconic function of intonation in grammatical uses (Bolinger)
 - (i) the tendency of pitch to drop at the end of an utterance, and to rise (or at least not to drop) at major breaks where the utterance remains incomplete;
 - (ii) the use of higher pitch in questions, since in questions the speaker expresses interest, and since the exchange is incomplete until the addressee answers;

- (iii) the use of local pitch peaks (e.g. pitch accents) on words of special importance or newsworthiness in an utterance.

However, as Ladd (1980; 1996) has convincingly shown, there is no universal function of pitch movements. For example, in certain American English varieties, a declarative sentence ends with a final rise expressing an assertion rather than a question. In other words, the final rise does not always indicate a question or some "incomplete" utterance.

Furthermore, the speech act indicated by the intonation contour does not always correspond to the sentence type or sentence mood marked by the syntax. Sentence (7) expresses a question due to its intonation (final rise) even though its syntax is of a declarative sentence type. Similarly, (8) expresses an assertion by the final fall, while the syntax is of an interrogative type.

- (7) The talk is about linguistics? (with final rise indicating question)
 (8) Did I make a fool of myself yesterday! (with final fall indicating assertion)

There are different ways of explaining this "clash" between syntactic sentence type and intonationally indicated speech act. In one view, it is assumed that the intonational contour overrides the syntactic information. In another view, a sentence like (7) is understood as an indirect speech act. If the direct speech act (here: a declarative) does not make sense, the hearer accommodates it to a different speech act (here: a question). Intonation can determine whether an utterance is to be understood according to its sentence type or whether it is allowed to use/understand it as a different, i.e. indirect, speech act. Sag & Liberman (1975) claim, for example, that in English the TILDE-contour has the function to force an interrogative sentence to become a question. They observed that an interrogative sentence with such a contour can never be used as an assertion, as in (9a), while with a different contour as in (9b) it can be used as suggestion rather than as question:

- (9) Hey Baldwin, the climate here is really bad for you!
 (9a) I've got a suggestion—


 *Why don't you move to California?

- (9b) I've got a suggestion—


 Why don't you move to California?

Sag & Liberman (1975, 496) conclude with the following hypothesis: "some intonation contours can 'freeze' an utterance pragmatically, i.e. require a literal interpretation, but no intonation contour can force an indirect interpretation." (see also Cutler 1977 for a response to this argument). We will come back to this claim in section 1.6.4 below, where we discuss intonational clues and referential properties of the associated expressions. The argument of Sag & Liberman leads to a strong and a weak claim: The strong claim says that intonation contours have an independent meaning, which must be presented in an "Intonational Lexicon" (Liberman 1975), see chapter 7. The weak claim says that intonation contours do not express meanings proper, but they indicate general attitudes toward the propositional content: "It is immediately apparent that many of the 'meanings' attributed to intonation contours would be better termed attitude or emotions – rage, fear, surprise, etc. – and Pike, for one readily admits this to be true." (Cutler 1977, 106). And in fact, Pike (1945, 22), who is one of the defenders of the view that intonation contours do have meaning, writes:

"the hearer is frequently more interested in the speaker's attitude than in his words – that is, whether a sentence is 'spoken with a smile' or with a sneer... If one says something insulting, but smiles in face and voice, the utterance may be a great compliment; but if one says something very complimentary, but with an intonation of contempt, the result is an insult. A highly forceful or exciting statement in a very matter-of-fact intonation may, by its lack of balance, produce one type of irony."

This view, however, moves the function of intonation back into the realm of paralinguistic means, as discussed in the last section. Given the arguments presented there, we prefer to distinguish between these paralinguistic functions like expressing personal or interpersonal attitudes and the indication of the speech act, i.e., the way the propositional content is presented: as an assertion, as a question, as a command etc.

The interaction between sentence type and intonational contour can also be understood as complementary: the sentence type gives the general class while the intonational contour marks the specific speech act. This view leads to the following table for German mood-speech act interaction (Gibbon 1998, 88):

(10) Relations between speech act and sentence function in German

Sentence Type (Mood)	Tone	Speech Act
Declarative	Fall Rise	Assertion Echo question Uncertain statement
Imperative	Fall Rise	Command Request, plea
Interrogative (auxiliary inversion)	Fall Rise	Peremptory question Neutral question
W-question <i>wer, wie, ...</i>	Fall Rise	Neutral question Interested or echo question

Finally, some stylized patterns should be mentioned, even though they do not fully qualify as speech acts, because they are associated with very short expressions and not with phrases that express a complete proposition. I do not intend to discuss their position between paralinguistic and linguistic means.⁴

(11) Stylized patterns (cf. Gibbon 1998)

(i) Call:

Manu	e-	la- !
------	----	-------

(ii) Leave-taking:

Auf	Wie- der-	sehen - !
-----	-----------	-----------

(iii) Request for louder repetition:

Lau-	ter- !
------	--------

(iv) Repetition after mishearing:

Ich habe	"Jo- hann" - ge - sagt -!
----------	---------------------------

⁴ Ladd, who has intensively studied such stylized patterns concludes (1978, 537): "Two observations should be made in conclusion. First, the fact that stylized intonation is derivative from plain intonation means that we should be cautious about studying chants to learn about intonation. Given their special function and phonological status, it would seem more reasonable to treat them as a category apart—or, at the very least, not to treat them as critical evidence about the heart of the system."

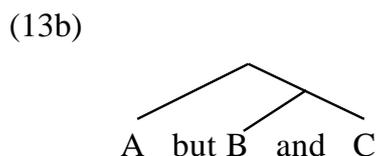
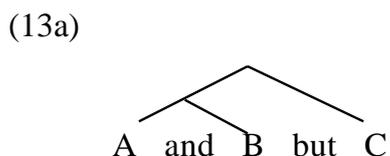
1.4 Phrasing

Beside the pitch movement and the speed of articulation, one of the most prominent means to organize speech is pausing. Pauses or breaks organize the structure of a discourse marking a place of potential change of speaker, uncertainty of a speaker how to continue a contribution, and other rhetoric means. Beside this discourse function it clearly has a very important function in structuring the utterance internally, as well. Pauses separate units of speech from each other. These prosodic units often correspond to syntactic constituents. The duration of a pause is sometimes taken as the intonational correlate of the strength of the syntactic boundary between two constituents. Here, we only present some data that illustrate the influence of pauses to syntactic structure and semantic interpretation.⁵

Ladd (1996, 242) quotes the following examples (12a)-(12b) and notes that "the most natural interpretation of these sentences treats the *but* boundary as stronger – that is, in (6.45a) [= (12a)] it opposes the conjunction of *A and B* to *C*, while in (6.45b) [= (12b)] it opposes *A* to the conjunction of *B and C*:" The discourse trees (13a)-(13b) illustrate these relations:

(12a) Warren is a stronger campaigner, and Ryan has more popular policies, but Allen has a lot more money.

(12b) Warren is a stronger campaigner, but Ryan has more popular policies, and Allen has a lot more money.



Crystal (1969, 264) gives a list of effects of intonational phrasing (or what he – following Halliday's terminology – calls *tonicity*). Phrasing can express the contrast between restrictive vs. non-restrictive relative clauses as in (14a)-(14b), the interpretation of a name as end-placed vocative vs. apposition as in (15a)-(15b), the reading of an NP as apposition or as coordinated element (list-reading) as in (16a)-(16b). He mentions further constructions such as the contrast between parenthetic vs. main clause, the idiomatic interpretation vs. literal interpretation, the different uses of adverbs, the use of an expression as an adjective or an adverb as in (17a)-(17b), among other contrasts:

⁵ Like speech acts, pauses may be graphically realized by punctuation.

- (14a) my brother who's ABROAD
- (14b) my BROTHER | who's ABROAD
- (15a) It's the BAKER Mr Jones
- (15b) It's the BAKER | Mr JONES
- (16a) John my SON | and his WIFE
- (16b) JOHN | my SON | and his WIFE
- (17a) I want more EXPERIENCED people
- (17b) I want MORE | EXPERIENCED | PEOPLE

There is an interesting relation between the intonational phrasing and the pitch accent in these examples. An additional pitch accent seems to require an additional domain and therefore induces an intonational break. However, the exact relationship between pitch accent and phrasing, on the one hand, and between phrasing and grammatical construction, on the other hand, are not clear at all (compare Crystal 1969, 265; Bierwisch (1966) and Féry (1993) for German).

1.5 Contrast

Besides the pitch movement and the phrasing, the intonational system also consists of prominence patterns. Prominence patterns are independent of both the pitch movement and the phrasing (see section 1.1.4 above). The location of prominence in an utterance is generally referred to as the pitch accent, the sentence accent or the nuclear tone of the intonational unit. The prominence patterns are associated with a contrastive or focal meaning. *Focus* means here some vague semantic concept of including new information.

It is possible to give any syllable contrastive or emphatic stress as in (18)-(20). This use is often called metalinguistic contrast or correction since it can be applied to any linguistic category. Since not all linguistic categories involve (propositional) meaning, this kind of marking does not always carry meaning, rather it indicates that something contrasts with something else. In the case of contrasting a full word (or expression), contrastive focus is sometimes also called narrow focus.

- (18) I did not say THink, but Sink.
- (19) I did not say EAST-German, but WEST-German.
- (20) I did not say that [JOHN was SELLING], but that [JIM was BUYING].

Often the contrastive stress is symmetric in such a way that the expression or phrase it contrasts with is also prominent, as in (21)-(22):

- (21) If an AMERICAN farmer meets a CANADIAN farmer...
- (22) Maxwell killed the JUDGE with a silver HAMMER, and I'd like to do the same thing to that COP, with a CUDGEL.

If there is no explicit contrastive pair of expressions, the hearer will construct one by the Gricean maxim of informativeness. The following example is quoted from Rooth (1992, 82). The setting here is that Mats, Steve and Paul took a calculus test. After the grading, George asks Mats how it went. One and the same sentence, uttered with different intonation patterns, provides different answers to the question.

- (23) Q: How did it go?
- (23a) Well, I passed
- (23b) Well, I PASSED_F
- (23c) Well, I_F passed

Uttered with a default intonation contour, i.e. with a simple fall on *passed* as in (23a), Mats' answer provides a neutral description of the situation, with no specific meaning effects related to focus.⁶ The sentence is an all new, presentational focus sentence. However, if the VP is marked as being the narrow informational focus of the sentence as in (23b), this introduces a set of relevant alternatives for the focused expression. Mats' use of the verb *pass* suggests that he did no better than passing. In answering with (23c), Mats' might suggest that Steve and Paul did not pass. The difference is one of conversational implicature rather than truth conditions. The reasoning behind this goes as follows. The Gricean maxim of quality and quantity tells us to use the strongest statement we have adequate evidence for. If Mats uses *pass* in (23b) instead of a stronger expression like *ace*, then there is a conversational implicature that Mats did not ace. After all, if he did ace, he should have said so. So the information conveyed by the utterance is that he just passed. Similarly for (23c). Mats does not claim that any of the other people passed, which conversationally implies that they did not. In other words, it was just Mats who passed. After all, if Mats knew that they did pass, he should have said so. Narrow focus serves a pragmatic function here in that it affects the conversational implicature of the sentence.

⁶ Mark Steedman (p.c.) brought to my attention that a closer examination of this example shows that it is not the place of accent but the kind of accent. While we find a simple fall (H*LL%) in (23a), the focus in (23b,c) is realized by an rise-fall-rise (L+H*LH%)

1.6 Discourse structure

The pitch accent highlights one part of the utterance in a particular way. This is generally believed to reflect some kind of pragmatic organization of the utterance content, which is often called *information structure* or *information packaging* (see chapter 3 for a detailed discussion). Information structure is independent of syntactic structure. The idea that there is more than the syntactic organization of a sentence goes as far back as the precise definition of syntactic relations. For example, Hermann Paul (1880, 283ff) distinguishes between the pair *grammatical predicate* and *grammatical subject* on the one hand and the pair *psychological predicate* and *psychological subject*, on the other.⁷ The grammatical pair consists of the grammatical subject (in the nominative case) and the grammatical predicate consisting of the verb or verbal complex. Other expressions in a sentence are considered to be either modifiers of these two constituents or independent constituents. In the latter case, the sentence consists of more than two equal parts. However, "the dichotomy is – as we have seen – the archetype of the sentence" (Paul 1880, 282: "Zweigliederigkeit ist, wie wir gesehen haben, die Urform des Satzes")

The psychological structuring is independent of and primary to the grammatical one and can take any constituent as psychological subject or predicate. The psychological predicate is the center of information of a sentence and its ultimate goal.⁸ This center of information corresponds to a constituent question. The sentence in (24) can have different intonation centers on different constituents corresponding to an explicit or implicit question, as in (25a)-(25d):

- | | | |
|-------|---|-----------------------------------|
| (24) | Karl fährt morgen nach Berlin. | "Karl goes to Berlin tomorrow." |
| (25a) | Wohin fährt Karl morgen?
Karl fährt morgen nach BERLIN. | "Where does Karl go tomorrow?" |
| (25b) | Wann fährt Karl nach Berlin?
Karl fährt MORGEN nach Berlin. | "When does Karl go to Berlin?" |
| (25c) | Wie reist Karl nach Berlin?
Karl FÄHRT morgen nach Berlin. | "How does Karl travel to Berlin?" |
| (25d) | Wer fährt morgen nach Berlin?
KARL fährt morgen nach Berlin. | "Who goes to Berlin tomorrow?" |

⁷ Paul has borrowed the terms *psychological predicate* and *psychological subject* from von der Gabelentz (1869, 378). Paul himself also uses the characterization *logical*, meaning the same as *psychological*. One is tempted to replace both terms by *underlying*.

⁸ "Am schärfsten von den übrigen Gliedern des Satzes sondert sich zunächst das psychologische Präd. ab als das wichtigste, dessen Mitteilung der Endzweck des Satzes ist, auf welches daher der stärkste Ton fällt." (Paul 1880, 283)

Paul says that each of the answers has a different psychological predicate, either a constituent as in (25a), (25b) or (25d), or a part of the lexical meaning of *fährt* in (25c). The complement, i.e. the non-focused part of the sentence, is the psychological subject. The psychological subject is that part which is already known to which a new predication is added.

The idea of an additional level of sentence structure is now known under the header of *information structure* or *information packaging*. What psychology meant for Paul, has meant information theory (of communication) for linguists since the 60's. The notion of an independent structural level has remained more or less the same.

Such a very general idea of information structure has at least two aspects: the first aspect refers to the informational embedding of the expressed information into the larger discourse. Here, there is a general distinction between what is new and what is already known. This structure is known under different terms, one of which is *focus-background structure*. The second aspect concerns the internal organization of the information; it involves a distinction between 'what the utterance is about' and 'what the speaker says about it'. The former unit is often called *topic* (or *theme*) and the latter *comment* (or *rheme*). I will refer to these two aspects of information structure as *discourse anchoring* and *aboutness*. Both aspects are closely related to each other, but they are expressed by different means. E.g. English marks a topic constituent by a fall-rise pitch accent and a focus constituent by a fall pitch accent. Other languages, like Hungarian, provide distinct structural positions for topic and focus.

1.6.1 Focus-background structure

A sentence can be structured into two informational units according to their informativeness. The intonationally highlighted part is associated with the most informative while the remainder of the sentence contains mainly background knowledge, i.e. information that is already available in the discourse. The typical test for the focus unit of a sentence is the constituent question illustrated above. The focal unit of a sentence can be one word as in (26), a phrase as in (27), or it can contain the whole sentence, as in (28).⁹ A focused unit must contain a pitch accent of the utterance. The exact alignment of pitch accent with focused units is determined by so-called *projection rules* (see 2.4.3). We indicate prominence (here pitch accent) by small capitals and the focused unit by indexed square brackets.

⁹ It is controversial whether one focus unit can span over more than one constituent, or whether we have independent focal units, one for each maximal projection. This is different from the topic-comment structure: there we can distinguish different topics and add to them one comment.

- (26) A: Who did Sue introduce to Bill?
B: Sue introduced [JOHN]_F to Bill.
- (27) A: Who did Sue introduce to Bill?
B: Sue introduced [the woman with the red SCARF]_F to Bill
- (28) A: What happened?
B: [Sue introduced John to BILL]_F.

Often the contrast between (26) and (28) is captured by the distinction between *narrow focus* and *wide focus*. Narrow informational focus is associated with a constituent wh-question as in (26). Wide informational focus is associated with a general question like *What happened?* as in (28). No background knowledge or given information is necessary. Wide informational focus is indicated by intonational prominence on the default position in the utterance, which is determined by different structural and semantic conditions. Narrow focus is close in its descriptive behavior to contrastive focus (see above), while wide or widest focus corresponds to a sentence out of the blue. However, example (27) illustrates that an absolute notion of narrow vs. wide focus does not make sense. If this distinction should be applied at all, then it must stand in relation to some structural domain. E.g., the focus in (27) is a narrow focus with respect to the main clause, but a wide focus with respect to object constituent. A narrow focus with respect to the object constituent would be *red* in *the woman with the [RED]_F scarf*. Thus it seems that the contrast between wide and narrow focus is a purely descriptive term that should not have theoretical implications.

1.6.2 Topic-comment structure

The other aspect of informational structure might be closer to what Paul had in mind: the *topic-comment* structure, where 'topic' means 'what the utterance is about' and comment 'what the speaker says about it'. The topical element is associated with an explicit or implicit question of the type *What about X?*. Thus, the topic is discourse established, while the comment gives new information with respect to the topic. The topic position is generally to the left of the sentence. In English both, topic as well as focus, are marked by a pitch accent, but of a different movement, which were called A and B accents by Bolinger (1958). The A accent (focus-accent) is a typical falling movement while the B (topic-accent) is realized as a fall-rise. Jackendoff (1972, 261) gives the following examples together with the appropriate questions. Note that the focus is related to a constituent question and the topic to a question of the type *What about X?*.

(29) A: Well, what about FRED? What did HE eat?

B: FRED ate the BEANS.



(B-A)

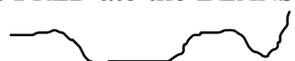
topic

focus

accents

(30) A: Well, what about the BEANS? Who ate THEM?

B: FRED ate the BEANS.



(A-B)

focus

topic

accents

Topic proper is often contrastive, and then it may bear a secondary pitch or phrasal accent (rising), which we indicate by italics. Thus, the example known from Carlson (1983, 200f), in which the defendant is asked what he hit the victim with and utters (31), indicating that he must have hit also other victims, can be analyzed as containing *him* as a contrastive topic and *bicycle chain* as focus.¹⁰

(31) I hit HIM with a BICYCLE CHAIN.

With this partition into two informational units the question arises whether we find sentences or utterances that include only one unit. From a purely informational point of view, a focus-less (or comment-less) utterance does not make sense since it does not provide information. More interesting is the contrast between topic-comment and topic-less sentences (or in another terminology: focus-background and all-focus-sentence). This contrast is related to the distinction betweenthetic vs. categorial judgements (Kuroda 1972, Sasse 1987, and others). In the remainder of this study I concentrate on the focus-background structure of a sentence and its function in a discourse semantics.

¹⁰ Büring (1997) gives a comprehensive analysis of contrastive topics in terms of Alternative Semantics of Rooth (1985). He describes contrastive topics of the following kind:

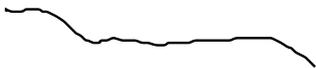
- (i) A: Do you think that Fritz would buy this suit?
B: Well, [*I*]_T certainly [*Wouldn't*]_F
- (ii) A: What did the pop stars wear?
B: The [*female*]_T pop stars wore [*caftans*]_F
- (iii) A: Did your wife kiss other men?
B: [*My*]_T wife [*didn't*]_F kiss other men.

1.6.3 Scope effects

Besides the integration of sentence information into the larger context, intonation can also give clues about the internal organization of a sentence. This is illustrated by the German "hat-contour" with a rising tone on the first operator and a falling on the second operator as in (32). The sentence with this marked contour receives the wide scope reading (32b) for the negation *nicht*, although the negation operator stands in the linear order after the universal quantifier *alle*. The wide scope reading (32a) for the universal quantifier is easily available for sentence (32) with an unmarked intonation. Similarly in (33a) the hat-pattern indicates wide scope for the negation, while the unmarked intonation in (33b) gives wide scope to *beide* ("both").

- (32) /ALLE Politiker sind NICHT\ bestechlich
 "all politicians are not corrupt"
- (32a) "No politician is corrupt"
 x [politician(x) \rightarrow \neg corrupt(x)]
- (32b) "It is not the case that all politicians are corrupt"
 $\neg x$ [politician(x) \rightarrow corrupt(x)]
- (33a) BEIDE / Theaterstücke sind NICHT \gespielt worden
 both theater plays are not plaid been
 "It was not the case that both theater plays have been performed."
- (33b) BEIDE \ Theaterstücke sind nicht gespielt worden.
 "Both theater plays have not been performed."

The hat pattern realization illustrated in (32)-(33) has been called *I-Topikalisierung* ("I-topicalization") (Jacobs 1982) and *I-Topic intonation* (Höhle 1991). Similar examples have been discussed for English (e.g. Jackendoff 1972, 352). Instead of the hat-contour, English employs the combination of A and B-accents, described above. The A (or focus accent) is realized as a fall, and the B (or topic-accent) as a fall-rise. The A-accent in (34) is the unmarked intonation and does not change the order of operators involved, while the B-accent conveys the same function as the German hat-contour: it changes the scope relation between the operators.

- (34) ALL the men didn't go
 (A-accent: fall)
 None of the men went
- (35) ALL the men didn't go
 (B-accent: fall-rise)
 Not all the men went

1.6.4 Deaccenting

The location of the pitch accent is determined by a variety of constraints. One constraint involves deaccenting. An expression cannot receive the nuclear pitch accent if it is already mentioned in the context. For example, in English the default accent position is sentence final, as in (36). However, in (37) the accent must move to the next available position, here the verb *make*, since the object *French Toast* has already been mentioned in the context. Similarly, in (38) the accent must be placed on the verb since the expression *German* is available in the local discourse (cf. Ladd 1996, 175):

- (36) A: What's the matter?
B: I've forgotten how to make French TOAST
- (37) A: Why don't you have some French Toast?
B: I've forgotten how to MAKE French Toast
- (38) A: I found an article for you in a German journal.
B: I don't READ German.

Languages can differ with respect to this constraint. For example, Italian does not follow the deaccenting patterns of English (and German) (example from Ladd 1996, 176): The speaker was Italian President Scalfaro, on the subject of the judicial investigations into massive bribery and corruption during the so-called 'Tangentopoli' scandal:

- (39) [le inchieste] servono a mettere a POSTO cose andate fuori POSTO
[the investigations] serve to put to place things gone out-of-place.

It is not necessary for the deaccented expression to have already been mentioned in the context. It is sufficient that the referent of the deaccented expression can be inferred from the context, which is sometimes called *bridging*. The following examples are quoted from Ladd (1980, 52):

- (40) A: Has John read Slaughterhouse-Five?
B: No, John doesn't READ books. [books deaccented]
- (41) A bill was sent to Congress today by President Carter which would require peanut butter sandwiches to be served at all government functions. At a press conference today, a group of Senators led by Republican Barry Goldwater of Arizona DENOUNCED the measure. Goldwater said...
[measure deaccented]
- (42) Harry wants a VW, but his wife would prefer an AMERICAN car.
[car deaccented]

Ladd (1980, 52) concludes: "Most of these writers talk about the deaccenting of 'repeated' or 'presupposed' material or 'given (old) information' or items which are 'already in the discourse' or are in some way 'predictable'." These notions of *givenness* or *presupposition* will be discussed in section 3.2. In (43), this bridging effect is even more subtle in presupposing that the referent of the metaphorically used *butcher* is already mentioned in the discourse: "The deaccenting of *butcher* signals that it is an epithet, which is intended to refer to the doctor whose presence in the context is somehow understood. If *butcher* is accented [as in (43')], it seems to refer to a literal butcher, and B's reply sounds like an incoherent psychopathic raving (..)." (Ladd 1978, 65).¹¹

- (43) A: How did your operation go?
B: Don't talk to me about it – I'd like to STRANGLE the butcher.
- (43') A: How did your operation go?
B: Don't talk to me about it – I'd like to strangle the BUTCHER.

1.7 Association with focus

Besides the discourse-pragmatic effects, focus also interacts with semantic operators yielding presuppositional or truth-conditional effects. In the following I present a list of instances of so-called *association with focus* (Jackendoff 1972, 247). The prototypical cases of association with focus are the interaction of focus-sensitive operators like *only*, *even* with a focus-background structure. These particles are translated into operators that need two arguments: the background and the focus. Again, focus informally means the expression with the pitch accent or one constituent that contains the pitch accent. For the time being, we assume that the focus is marked by the feature *F* (cf. Jackendoff 1972) at the level of logical form (see section 4.2.1). Theories that define the function of focus particles in terms of operators that relate the focus value to the background value are so-called *relational theories of focus* (cf. Jacobs 1983, von Stechow 1990, Krifka 1991). These theories were generalized to *free focus*, where no overt operator is present, but speech act operators like *ASS* are postulated that interact with the focus in the sentence (cf. Jacobs 1984). This yields the formal approach to informational focus discussed in section 1.6.1.

¹¹ This connects with the function of intonation as speech act operator in the sense of Sag & Liberman (1975), discussed section 1.3. They assumed that intonation can force a "literal" meaning of the syntactic sentence mood and block an indirect speech act. In (43), one could argue, the function of intonation is to indicate that the NP must be interpreted referentially and to block another interpretation. The other explanation of this data is that the unaccented *butcher* indicates that it is anaphoric to the implicitly mentioned agents of the operation. In this function, it need not establish reference, but can add another kind of information.

Other operators like nominal and adverbial quantifiers, modals, counterfactuals and superlatives also interact with focus. Other than focus-sensitive particles, they do not necessarily need a focus constituent for their interpretation. However, if there is a focus then the focus gives additional restrictions on the domain of quantification. Thus, we can group association with focus-effects into two major classes according to the semantic description of the way focus affects the interpretation:

(44) Two classes of association with focus

(i) Focus-sensitive particles:

They are interpreted as operators that quantify over objects of the same kind as the focused expression with respect to the background. Here we find truth-conditional effects, presuppositional effects and felicity conditions (i.e. conditions on the discourse-pragmatic acceptability).

(ii) Effects of domain restriction of quantification:

The operators involved do not quantify over objects of the same type as the focused expression, but over a different kind of object. The focus expression, however, interacts with the construction of the operator restriction. Material from the focus constituent must not be copied into the restriction, where the focus constituent is merely represented by a variable. Only material from the background can (or must) be copied into the restriction. This class consists among other things of nominal and adverbial quantifiers, the generic operator, modals, and counterfactuals.

1.7.1 Focus-sensitive particles and truth-conditional effects

The classical focus-sensitive particle is *only*, which needs for its interpretation a focused element in its scope. Depending on the position of the scope, the interpretation of the whole sentence can vary in its truth conditions. This is illustrated by sentences (45) and (46) and the situations A and B. If we evaluate the sentences with respect to the situations described we get different truth conditions, in fact, in these particular settings we get opposite truth conditions for the two sentences.

(45) John only introduced [Bill]_F to Sue.

(46) John only introduced Bill to [Sue]_F.

(47) Situations for the interpretation of the examples:

A: John introduced Bill and Tom to Sue, and there were no other introductions.

B: John introduced Bill to Sue and Bill to Jane, and there were no other introductions.

(48) Evaluation of the sentences according to the situations A and B

Example	Situation A	Situation B
(45)	false	true
(46)	true	false

This clear contrast in truth conditions made the focus particle *only* the most celebrated example of focus-sensitive particles. Formal theories of focus are primarily developed on *only*. The basic idea is that *only* is translated into an operator that quantifies over alternatives to the focused expression. The quantificational force of the operator for *only* asserts that there is only one fitting alternative to the focused element, namely that element itself. Thus, we can paraphrase the examples as (45a) and (46a) and the logical forms as in (45b) and (46b). (45b) expresses that for all x that are suitable alternatives to Bill, if John introduced x to Sue, x is Bill. The restriction of the quantifier corresponds to the background while the nuclear scope is the focus.

(45a) Truth condition: John introduced no one but Bill to Sue.

(45b) $x \sim \text{Bill}$ [Introduce(John, x , Sue) \rightarrow $x = \text{Bill}$]

(i) domain of quantification: suitable alternatives to Bill: $\{x \mid x \sim \text{Bill}\}$

(ii) restriction = background: x [Introduce(John, x , Sue)]

(iii) nuclear scope = focus: Bill

(46a) Truth condition: John introduced Bill to no one but Sue.

(46b) $y \sim \text{Sue}$ [Introduce(John, Bill, y) \rightarrow $y = \text{Sue}$]

(i) domain of quantification: suitable alternatives to Sue: $\{y \mid y \sim \text{Sue}\}$

(ii) restriction = background: y [Introduce(John, Bill, y)]

(iii) nuclear scope = focus: Sue

We can generalize this analysis to other focus particles as well: We will say that a focus particle translates into an operator for which the following conditions must hold:

(49) Conditions on operators for focus particles of the form $Ox (B, F)$

(i) They quantify over variables x of the type of the focus F .

(ii) The restriction is the background B .

(iii) The nuclear scope is the focus F .

(iv) The function of the particle is expressed by a quantificational relation between the focus and background.

1.7.2 Focus-sensitive particles and presuppositional effects

The particle *only* is quite peculiar in that its interpretation involves truth-conditional effects. The semantics of most focus-sensitive particles changes the presupposition of a sentence rather than its truth conditions.¹² This can be illustrated by the particle *also* in (50). While the particle does not contribute to the assertion of the sentence, it presupposes that Sam introduced someone else to John. Sentence (51) expresses the same assertion, but a different presupposition: Sam had introduced Mary to someone else.

- (50) Sam also introduced MARY_F to John.
 Assertion: Sam introduced Mary to John
 Presupposition: Sam had introduced someone else to John.
- (51) Sam also introduced Mary to JOHN_F.
 Assertion: Sam introduced Mary to John
 Presupposition: Sam had introduced Mary to someone else.

Given appropriate settings, one sentence could be felicitous while the other would suffer from presupposition failure (e.g. Sam had already introduced Sue to John, but did no other introduction. (50) is fine, but (51) would be strange because of the presupposition failure).

The class of focus-sensitive particle includes besides *only* and *also* the particles *even*, *too*, *either*, *just* and *not*. The interaction between negation and focus is illustrated in (52)-(54). While the assertion is the same in all the sentences, namely that it is not the case that Maxwell killed the judge with a silver hammer, focus changes the presupposition of the variants:

- (52) Maxwell did not kill the JUDGE with a silver hammer (, but the cop).
 Presupposition: M. killed someone with a silver hammer.
- (53) Maxwell did not kill the judge with a silver HAMMER (, but with a cudgel).
 Presupposition: M. killed the Judge with a silver something.
- (54) Maxwell did not kill the judge with a SILVER hammer (, but with a golden hammer).
 Presupposition: M. killed the judge with a hammer.

¹² Bos (1999, 122): "In general, there are two kinds of focusing effects. In the first, focus determines the *meaning* of an utterance; in the second, focus determines the *presupposition* of the utterance (and not the meaning). Examples of the first kind correspond to what König (König 1981) classifies as *exclusive* particles: the English *alone*, *just*, *only*, and the German *bloß*, *erst*, *gleich*, *lediglich*, *nur*, *wenigstens*, *zumindest*, to name just a few. Examples of the second kind, the so-called *inclusive* particles, are in English *also*, *even*, *too* and in German *auch*, *noch*, *sogar*. This list is not exhaustive; more can be found in König's papers (König 1981, 1991) that discuss the syntax and semantics of scalar particles."

On the basis of such semantic criteria, the following expressions can be classified as focus particles in English (56) and in German (57):¹³

- (56) also, alone, as well, at least, even, especially, either, exactly, in addition, in particular, just, merely, only, let alone, likewise, as much as, solely, still, purely, too etc.
- (57) allein, auch, auch nur, ausgerechnet, ausschließlich, bereits, besonders, bloß, einzig, eben, erst, gar, genau, gerade, geschweige denn, gleich, insbesondere, lediglich, (nicht) einmal, noch, nur, schon, selbst, sogar, wenigstens, wieder(um), zumal, zumindest.

1.7.3 Free focus

The cases of association with focus discussed so far are also known under the term *bound focus* since the focused constituent is bound by a focus-sensitive operator. As discussed in section 1.6 (examples (25a)-(25d)) there are cases of focus in the absence of any overt focus-sensitive operator, which are called *free focus*. Jacobs (1984) extends the formal description of bound focus to that of free focus. He assumes that every utterance comes with an illocutionary operator standing for the speech act, e.g. *ASS* for assertion. Thus sentence (58) with the informational or contrastive focus can be described as a case of bound focus. The operator *ASS* requires two arguments: the background *John introduced someone to Sue* and the focus *Bill*. The definition of the operator does not affect truth conditions but the felicity conditions of the utterance, as indicated in (59) (Krifka 1991, 130):¹⁴

- (58) John introduced BILL to Sue.
 background: x [John introduce x to Sue]
 focus: Bill
 logical form: ASS(x [John introduce x to Sue], Bill)
- (59) Felicity condition of *ASS(Background, Focus)*
- (i) *informativity*: Asserting the focus value to the background value adds information to the common ground.
 - (ii) *consistency*: The truth of the sentence must not already be excluded by the context.
 - (iii) *focal impact*: There are alternatives to the focus value which might have been asserted of the background yielding a different propositional content. But no such alternative is asserted, except the focus value.

¹³ Compare Kratzer and König (1981, 107). König distinguishes between *scalar particles* as listed and *modal particles* like *aber, denn, doch, eigentlich, einfach, etwa, halt, ja, nun, vielleicht, wohl* etc.

¹⁴ Krifka (1991, 130): "As usual, if the felicity conditions are not satisfied, they may give rise to accommodation in the sense of Lewis (1979)."

1.7.4 Recursiveness of focus

So far we have described association with focus as a relation between a focus-operator, the focus and the background. Focus-sensitive particles are translated into operators that take the focus and the background as their arguments. This structural description allows us to account for recursive structures that we find in cases of association with focus. We find different configurations as illustrated in (60) (cf. Krifka 1991, 130f). The *simple focus* configuration with one particle and one focus is the classical case for investigation and illustration (see above). One focus particle can also be associated with more than one focus, which is called a *complex foci* configuration, as illustrated in (61). It is still controversial whether complex foci constitute two foci or one that ranges over two constituents. However, in cases of *multiple foci* one has to admit that there is more than one focus in a sentence. The simplest case is the *subsequent foci* configuration, in which one simple focus configuration follows another, as in (62). A more subtle case is presented by *embedded foci*, where one association with focus is embedded within another one. The context in (63) should motivate the intended reading. It is also possible that two focus particles associate with the same focus, so to speak, they *share the same focus*, as in (64). Finally, we also find cases in which one particle associates with another focus-sensitive particle, as illustrated in (65).

(60) Possible particle-focus configurations:

simple focus	Part ₁ (... F ₁ Phrase)
complex foci	Part _{1,2} (... F ₁ Phrase... F ₂ Phrase...)
multiple foci	
subsequent foci	Part ₁ (... F ₁ Phrase...) Part ₂ (... F ₂ Phrase...)
embedded foci	Part ₁ ... Part ₂ ... (... F ₂ [Phrase...F ₁ [Phrase]]...)
shared focus	Part ₁ ... Part ₂ ... (... F ₂ [F ₁ [Phrase]]...)
focus on focus-particle	Part ₁ (... F ₁ [Part ₂]... (... F ₂ Phrase...)) ...)

(61) John only_{1,2} introduced F₁BILL to F₂SUE.

(62) Even₁ F₁JOHN drank only₂ F₂WATER.

(63) [John, who is quite notorious as a party guest, did not only behave well at yesterday's party,]
he even₁ [only₂ F₂[drank F₁[WATER]].

(64) [At yesterday's party, people stayed with their first choice of drink. Bill only drank WINE, Sue only drank BEER, and]
John even₁ only₂ drank F₂[F₁[WATER]].

(65) [Most people drank water at some time during yesterday's party]
John even₁ F₁[ONLY₂] drank F₂[water].

Cases of multiple foci are not so rare as one might think. In particular, if we assume the analysis of free focus presented in section 1.7.3 as bound by a non-overt speech act operator, then we find multiple focus constructions with every other overt focus operator. Krifka (1991, 131) discusses the following example of Jacobs, given in (66). The sentence can vary with respect to the informational focus, which can either be the NP *Goethe* or the whole constituent *nur einen Roman von Goethe*. Since the focus particle *only* associates with *Goethe*, the sentence varies in the association of the speech act operator *ASS* with the two possible foci. (66a) illustrates a shared focus and (66b) an embedded focus configuration. The assertion (66c) of both structures is the same since the operator *ASS* does not affect the assertion. However, the felicity conditions differ in the two cases as illustrated in (66a') and (66b'):

- (66) Peter kennt nur einen Roman von GOETHE.
"Peter only knows a novel by GOETHE."
- (66a) ASS_1 Peter kennt nur₂ einen Roman von $F_2[F_1[GOETHE]]$.
- (66b) ASS_1 Peter kennt $F_1[nur_2$ einen Roman von $F_2[GOETHE]]$.
- (66c) Assertion: Peter knows a novel of no one, except Goethe.
- (66a') Felicity condition: Those persons x are under discussion such that Peter knows only a novel by x
- (66b') Felicity condition: Those objects x are under discussion such that Peter knows x

1.7.5 Adverbs of quantification

Rooth (1985, 164f) observes that sentences with so-called adverbs of quantification receive different truth conditions depending on the position of the focus. He illustrates this with the contrast of (67) and (68) in the following setting: If some officers ever escorted some non-ballerinas, (67) is false but (68) may still be true. If some non-officers ever escorted some ballerinas, (68) is false but (67) may be true:

- (67) In Saint Petersburg, officers always escorted BALLERINAS.
- (68) In Saint Petersburg, OFFICERS always escorted ballerinas.

Rooth notes further that even though examples with bare plurals and universal quantification are the clearest cases, we find the same contrast with ordinary individuals as in (69)-(70), and with other frequency adverbs as in (71)-(72):¹⁵

¹⁵ Compare this with temporal adverbs as in (i)-(iii), where there is only a contrast in the felicity conditions:

- (69) MARY always takes John to the movies.
 (70) Mary always takes JOHN to the movies.
 (71) MARY usually takes John to the movies.
 (72) Mary usually takes JOHN to the movies.

Rooth (1985, 164) extends Jackendoff's term *association with focus* to these phenomena, i.e. to the interaction of focus with adverbs of quantification. Before sketching the interaction of the focus with the adverb, I first have to say something about the general semantics of adverbs of quantification without focus. Adverbs of quantification are translated into operators with a restrictor and a nuclear scope. The sentence content is mapped into these two arguments according to syntactic structure, as illustrated in (73). In the semantic form (73a), the adverb *always* is translated into a quantifier *Always* that take a restriction *R* and a nuclear scope *S*.¹⁶ The restriction of the operator contains all the material from the if-clause, while the nuclear scope also contains material from the matrix sentence. The operator *Always* for the adverb *always* expresses in (74) that the restriction is contained in the scope, i.e. for all pairs *x,y* such that the farmer *x* owns the donkey *y* it holds that the farmer *x* beats the donkey *y*.

- (73) If a farmer owns a donkey, he always beats it.
 (73a) R: {<*x, y*> | farmer(*x*) & donkey(*y*) & owns(*x, y*)}
 S: {<*x, y*> | farmer(*x*) & donkey(*y*) & owns(*x, y*) & beats(*x, y*)}
 (74) Most(*R, S*): *R* is contained in *S*

Unlike focus-sensitive particles, adverbs of quantification do not require a focused constituent.¹⁷ However, if no syntactic clue is given and some constituent is focused,

-
- (i) Mary took JOHN_F to the movies yesterday.
 (ii) Mary took John to the MOVIES_F yesterday.
 (iii) MARY_F took John to the movies yesterday.

¹⁶ The question of what kind of variables are quantified over is very controversial. Lewis (1975) argues that we have to quantify over *cases*. Heim (1982) generalize this insight to quantifying over assignment functions, which is equivalent to quantifying over any free variable. Thus, adverbial quantifiers are *unselective*. The claim of unselective binding was challenged, in particular by arguing that focus does influence the binding possibility. For the argument in this section, we assume an informal mechanism of unselective binding of the variables in the restriction.

¹⁷ There are, however, cases where the adverb requires a focused constituent as in (i), while (ii) and (iii) without a focused constituent are infelicitous:

- (i) Ich fahre immer JAPANISCHE Autos.
 I drive always Japanese cars "I always drive JAPANESE cars"
 (ii) *Ich fahre immer Autos.

the focus-background structure determines which material is copied into the restriction of the operator and which not (cf. Rooth 1985). The restriction is formed by the background, while the focus *and* the background constitute the nuclear scope, as illustrated in (75a) and (76a). The restriction in (75a) collects all pairs of individuals and time points such that the individual is an officer and has escorted someone at the time t . This must be contained in the set of all pairs x,t such that the officer x escorted some ballerina at t . If there is a time point t at which an officer has escorted someone else, (75) is false. On the other hand, in (76a) the restriction consists of pairs y,t such that a ballerina y is escorted by someone at t . If this set is included in the set of pairs y,t such that a ballerina y is escorted by an officer at t , the sentence is true. If there is one pair y,t such that a ballerina y is escorted by someone who is not an officer the sentence is false.

(75) In Saint Petersburg, officers always escorted BALLERINAS.

(75a) R: $\{ \langle x, t \rangle \mid \text{At}(t) \ \& \ \text{officer}(x) \ \& \ y \ \text{escorted}(x, y, t) \}$

S: $\{ \langle x, t \rangle \mid \text{At}(t) \ \& \ \text{officer}(x) \ \& \ y \ \text{ballerina}(y) \ \& \ \text{escorted}(x, y, t) \}$

Most(R, S): R is contained in S

(76) In Saint Petersburg, OFFICERS always escorted ballerinas.

(76a) R: $\{ \langle y, t \rangle \mid \text{At}(t) \ \& \ \text{ballerina}(y) \ \& \ x \ \text{escorted}(x, y, t) \}$

S: $\{ \langle y, t \rangle \mid \text{At}(t) \ \& \ x \ [\text{officer}(x) \ \& \ \text{ballerina}(y) \ \& \ \text{escorted}(x, y, t)] \}$

Most(R, S): R is contained in S

Contrasting with the representation of focus particles in 1.7.1-1.7.3, in the case of adverbs of quantification, the operator standing for the adverb does not quantify over alternatives to the focused element. Moreover, the focused constituent is blocked from being quantified over. Only the background of the focus-background structure is copied into the restriction and provides variables that can be bound. The focus only contributes a variable to the restriction, which, however, is locally bound such that it cannot be bound by any other operator.

1.7.6 Nominal quantification

While association with focus of adverbs of quantification is investigated in a series of studies, a similar effect on nominal quantifier has not received much attention (but see Geilfuß-Wolfgang 1996, Eckardt 1999). In general, nominal quantifiers have a syntactically clear definition of restriction and nuclear scope. The N-complement of the quantifier phrase (QP) forms the restriction while the material of the matrix sentence is the nuclear scope, as in (77). The quantifier can also be defined as a relation between two sets: the set of students in this class and the set of people who learn a foreign language.

(iii) *Ich fahre immer japanische Autos.

- (77) [[Every [student in this class]_N]_{QP} learns a second language]_S.
 R: *x is a student in this class*
 S: *x learns a second language*
 $x [(x \text{ is a student in this class}) \rightarrow (x \text{ learns a second language})]$
 All(R, S): R is contained in S

There is no need to define the restrictor and nuclear scope with other means since they are clearly defined by syntax. However, focus induces a focus-background structure that contributes additional material to the restriction (Geilfuß-Wolfgang 1996, 26). Without the marked focus intonation sentence (78) and (79) mean that it holds for almost all students that they have learnt French as a second foreign language. In this reading, the sentence is false if there are 30 students of whom 10 have learnt French as second foreign language. However, with the focus intonation in (78) and (79), the sentences differ considerably in their meaning. As illustrated in the paraphrases, in the presence of a focused constituent the non-focused background contributes material to the restriction (marked in italics). In (78) we compare the set of students that have learnt a second language with the set of students that have learnt French as a second language. In (79), the restriction contains all students that have learnt French, which is then compared with the nuclear scope that comprises all students that have learnt French as second foreign language.

- (78) Fast alle Schüler haben FRANZÖSISCH als zweite Fremdsprache gelernt.
 (78a) "Almost all students *that have learnt a second foreign language* have learnt French (as their second foreign language)"
 (79) Fast all Schüler haben Französisch als ZWEITE Fremdsprache gelernt.
 (79a) "Almost all students *that have learnt French* have learnt French as their second foreign language."

A similar effect of the restriction of the nominal quantifier is shown in (81), where the sentence is pronounced with a hat-contour (cf. section 1.6.3). The correspondent sentence (80) with unmarked intonation can be paraphrased as (80a). However, the marked hat-contour in (81) strongly promotes the reading (81a), according to which most of the sold tickets were sold at checker 4.:

- (80) Almost all tickets were sold at checker 4.
 (80a) There are 1000 tickets, 950 tickets were sold at checker 4.

- (81) Almost all/ tickets were sold at checker 4\
 (81a) There are 1000 tickets, only 400 were sold and 350 of these were sold at checker 4.
 (paraphrase: almost all tickets *that were sold* were sold at checker 4.)

1.7.7 Other operators

The list of semantic operators that interact with focus can be further extended by the generic operator, modal operators like *must*, *could*, *need*, by counterfactuals etc. This list is in no way exhaustive and one should expect other kinds of interaction as well. In this section, I only give some hints towards such interactions between semantic operators and focus.

The dependence between the invisible generic operator and focus is illustrated by the following pair (cf. Krifka 1995, 239). (82a) makes a generic statement over after-dinner situations that contain Mary. Such situations are that Mary (generally) smokes. (82b) expresses the generic statement that when Mary smokes, it is usually in an after-dinner situation (for a detailed analysis see Krifka 1995):

- (82a) Mary SMOKES after dinner.
 R: (x = Mary & after_dinner(s) & in (x,s))
 S: (x = Mary & after_dinner(s) & in (x,s) & smoke(x,s))
 GEN[x,s] (x = Mary & after_dinner(s) & in (x,s), smoke(x,s))
- (82b) Mary smokes after DINNER.
 R: (x = Mary & smoke(x,s))
 S: (x = Mary & after_dinner(s) & in (x,s) & smoke(x,s))
 GEN[x,s] (x = Mary & smoke(x,s), after_dinner(s))

Halliday reports a person seeing the sign in (83) and being worried because he had no dog that he could carry. So instead of reading the sign in the normal way, as *Dogs must be CARRIED* with a logical form approximately as in (83b), he was reading the sign as *DOGS must be carried*, with a logical form approximately as in (83a), a focus structure and interpretation that would indeed be normal for a sign saying, for instance, *Shoes must be worn*.

- (83) Dogs must be carried.
 (83a) DOGS must be carried.
 Must(here(e)[?], a dog or dogs is/are carried at e)
 Must(you carry x here, you carry a dog here)
- (83b) Dogs must be CARRIED.
 Must(dog(x), & here(x), x is carried)

Again the focus determines which material can be copied into the arguments of the operator. The modal *must* expresses that the content of the sentence holds for all possible extensions of the given world (or situation). If the actual world (or situation) is already restricted to one in which we have a dog, then the sentence (83b) asserts that we have to carry it. However, in sentence (83a), the expression *dog* is focused and it is not part of the restriction. Here the meaning is: for all situations *e* (in the underground) we have to have a dog and it must be carried. Again the focus signals that it must not be copied into the restriction of the operator.¹⁸

Dretske (1972) observes a similar effect of focus on counterfactuals, where focus has an impact on the truth conditions. His examples are of the following kind:

- (84a) If Clyde hadn't married BERTHA, he would not have qualified for the inheritance.
- (84b) If Clyde hadn't MARRIED Bertha, he would not have qualified for the inheritance.

The first sentence suggests that there is a law "You inherit only if you marry Bertha" whereas the second sentence rather refers to a law like "You only inherit, if you marry". Since counterfactuals are evaluated with respect to a background, the two mean something different.

This cursory presentation of more data on the interaction of intonational structure and the interpretation of sentence should make clear that association with focus is not a phenomenon restricted to a particular group of operators. It is rather a very pervasive phenomenon that can be found in very different kinds of constructions. It is obvious from the range of data presented here that the list of instances of association with focus can be further extended.

¹⁸ See Geilfuß-Wolfgang (1996, 65ff) for a detailed analysis in the framework of Rooth. Another instance of such a reading is reported by Manfred Krifka (cf. Féry 1993, 42): When he read the sign (i) in a German library he imagined it with a focus structure (ii) instead of the intended structure (iii) and he laughed so loud that he had to leave the library.

- (i) Bitte leise reden 'Please speak softly'
- (ii) Bitte [leise reden]_F
- (iii) Bitte [leise]_F reden

It is interesting to note that this is an instance of the interaction of a speech act operator and focus. The interpretation of the imperative speech act differs according to the position of the focus. This effect is certainly more than only a difference in the felicity conditions for the assertive speech act discussed in section 1.7.3.

1.7.8 Problems of association with focus

The phenomena of interaction of intonational features and semantic operators presented in this section has received the cover term *association with focus*. The common structure of all the cases is that a focused element induces a focus-background structure that determines the restrictor and nuclear scope of the operator involved. We had further distinguished the presented data in two subgroups: *focus particles* and *focus effects on quantificational domains*. In all semantic theories of association with focus, focus particles are translated into operators that quantify over variables of the type of the focus (or over alternatives to the focused constituent). The background constitutes the restriction and the focus the nuclear scope. In cases of focus effects on quantificational domains, the operator quantifies over a different variable, but the restriction and nuclear scope is still constructed in the same way.¹⁹ This general picture is commonly accepted, not only in the semantic literature, but also in other areas of research on focus, as illustrated by the following quotation from É. Kiss (1995, 18f), who works on focus and configurationality:

As has been observed, the interpretation of a large set of operators (*only, even, must, not, always*, the generic operator, or the superlative) is sensitive to the focus-background structure of its sentence: the background is understood as the restrictor of the operator, and the focus is understood as its nuclear scope. Consider the logical paraphrase of (19), involving the universal adverbial quantifier *always*:

- (19) John always goes on vacation with MARY.
 always c, $\forall x(\text{John goes on vacation with } x \text{ in } c)$
 John goes on vacation with Mary

In (19) *always* quantifies over cases in which there is someone who John goes on vacation with, and the sentence means that in each such case it is Mary that John goes on vacation with.

However, I will argue in chapter 4 that this picture is based on two fundamental misconceptions: (i) the correspondence between restrictor and nuclear scope, on the one hand, and background and focus, on the other, and (ii) the assumption that focus-sensitive particles are interpreted as operators that quantify over variables of the type of the focus. The first misconception has been illustrated in the last section and is also visible in the above quotation. In the paraphrase, the restriction is formed by the background, but the nuclear scope consists of material from the focus *and* the background. I will argue that the function of the focus is not to form the nuclear scope, but to prevent that the focused constituent is copied into the restriction.

¹⁹ The influence of the focus-background structure on the domains of quantification is often explained by *pragmatic* principles of domain restriction also found for other operators. There is an extensive discussion of whether focus influences the interpretation of focus-sensitive particles directly (cf. Rooth 1985, Krifka 1991) or whether focus influences the interpretation indirectly by restricting the domain of quantification (Rooth 1992, von Stechow 1994).

The second misconception is that focus particles like *only*, *even*, *too* etc. always quantify over variables of the same kind as the focus. This view is correct for simple cases, but cannot be maintained for slightly more complex cases as illustrated in (85). Here, the particle *only* quantifies over professors, i.e. over variables of type e (or $\langle\langle e,t\rangle,t\rangle$). However, the focused adjective *artist* is of the different type $\langle\langle e,t\rangle,\langle e,t\rangle\rangle$.

(85) Sam only talked to the DUTCH professor.

The problems raised by these two observations will be discussed in detail in chapter 4 and 5, and they eventually will lead to a different analysis of the focus-background structure and their semantic impact, presented in chapter 6.

1.8 Summary

In this introductory chapter I have presented linguistic data that are related to both the structure of intonation and the structure of information. A rather informal discussion of these aspects has led to the following observations:

Intonational features

It was shown that intonation cannot be understood as a global feature that is added to segmental information of a sentence. Intonation itself comprises different features, such as pitch contour, prominence (accent), and phrasing. We have given some characteristics which distinguishes these intonational features from paralinguistic features, on the one hand, and from lexical features, on the other hand. Thus, intonational features constitute a distinct level of phonological representation.

Interaction of intonational features

They are two sides of interactions of intonational features: their interaction with other features and their internal interaction with each other. Even though intonational features are independent of lexical or paralinguistic features, their realization in speech interact with each other. The intonational features pitch contour, prominence, and intonational phrasing are to a great extent independent of each other, e.g., tune and stress can be freely combined yielding a cross-classification. Again, certain restrictions on this interaction have to be recognized. However, it is not clear whether these restrictions depend on the realization in speech or whether the function of intonational features determines the range of possible combinations.

Function of intonation

The intonational features contour, prominence (accent), and phrasing are associated with a wide range of functions. The contour primarily indicates the speech act of an utterance, phrasing separates an utterance from other utterances and divides it further into smaller units, which often correspond to syntactic constituents. Finally, stress or prominence express the very general concepts contrast and focus. Contrast can affect nearly any linguistic category, from segments to sentences and paragraphs. Focus induces an additional level of sentence organization, often called informational structure. This structure is often understood as a bipartition of the sentence into focus-background or topic-comment. Additionally, the focus-background structure plays a crucial role for the interpretation of focus-sensitive operators and for the domain restriction of quantifiers.

The various aspects of intonation and information structure presented in this chapter should have shown that one can not understand the very complex relation between intonational features and semantic function without understanding the complex phonological system of intonation, on the one hand, and the complex representation of their semantics, on the other. This will be the main tasks of the next two chapters.

Chapter 2

Intonational phonology

In this chapter I sketch the development of intonational phonology from a mere impressionistic description of intonation to a proper linguistic subfield with an abstract representation of the intonational features. This development is still very much in progress. The development of intonational phonology as a linguistic subdiscipline opened the way for using linguistic (i.e. abstract) representations and rules for analyzing the internal structure of intonational features and their interactions. Moreover, the advance in intonational phonology led to the discussion on the location of intonation in the overall grammatical system. This opened a debate on the general architecture of grammar and on the way the parts of grammar interact.

2.1 Intonation as linguistic research area

Intonation, which is sometimes referred to as prosody (see section 1.1), was for most of the time not an object for linguistic investigations. Language structure was mainly investigated on written texts and therefore, syntactic structure stood at the center of interest. Even though there have been notes on intonational phenomena from time to time, no serious investigation into this field has been undertaken before this century (for a comprehensive overview of earlier approaches, see Crystal 1969, 20-40). This lack of interest in intonation has lasting effects, as Pheby (1980, 33) formulates it. Even if intonation is now considered in linguistic research it is still put on a secondary position because intonation was not treated in linguistic theory for a long time:

Da die Intonation während der langen Geschichte sprachwissenschaftlicher Forschungen vor dem großen Aufschwung in der Entwicklung der modernen Linguistik im 20. Jahrhundert kaum berücksichtigt wurde und ihre Beschreibung zurückblieb, ist es verständlich, daß ihr in späteren Untersuchungen auch dann eine sekundäre Rolle zukommt, wenn sie in die Beschreibungen voll einbezogen ist.

Descriptions of intonation are found in textbooks for learning foreign languages. Like other textbooks of language learning, our model textbook explicitly notes that one cannot understand the essential facts of German sentence structure without intonation and accentuation. Learning German without the dynamic sound of language is as incomplete as learning Chinese without the meaningful tones of the segments:

Wesentliche Tatsachen der deutschen Satzlehre bleiben ohne Rückgriff auf Betonung und Intonation schlechthin unverständlich. Deutsch lehren ohne Bezugnahme auf den lebendigen Sprachklang ist ebenso unvollkommen, als wenn jemand Chinesisch lehren wollte, und nur die Buchstaben der Wörter beobachtete, nicht ihre bedeutungsstiftende Tonhöhe. (Drach 1940, 9f)

It is not controversial that intonational features convey additional information besides the content of the sentence, which is conveyed by the segmental features. As illustrated in chapter 1 these additional functions range on a wide scale from very accidental auditory effects indicated by the personal voice quality to more systematic functions such as speech acts. The definition of intonational phonology as an autonomous research area includes the characterization of intonational features as (i) suprasegmental, (ii) meaningful at a postlexical level, and (iii) linguistically structured (compare section 1.1). In the historical process of establishing intonational phonology, the first step was to separate intonational features from segmental features, and at the same time distinguish between auditory features that express paralinguistic functions from those that express linguistic functions. Closely related to this question is the methodological approach to intonation. Here we draw the contrast between acoustic and phonological theories of intonation. One central question of the controversy is the representational issue: can we link acoustic features directly to pragmatic-semantic functions, or do we need an abstract representation, i.e. a phonological level. In the latter approaches there arose a controversy over the kind of distinctive features of intonation. The American structuralists proposed atomistic level tones, while the British school took configurations like fall or rise as the basic units of description. The distinctive units of description were understood as intonational phonemes and their combinations as meaningful morphemes. The insights of both families of theories influenced the autosegmental-metrical theory of intonation, which was developed in the 70's and 80's. It gives an overall approach to intonation by including recent research results from other phonological domains.

2.1.1 Suprasegmental features

The investigation of written text has restricted the phonological awareness to lexical properties of words. The phoneme or segment was defined as the smallest unit that contributes to the meaning of a larger unit (morpheme), but is not itself meaningful. The phonemes were defined as expressing meaning differences. Each segment consists of or is associated with a bundle of features, which allows for the grouping of segments in different classes with equal properties. Language change is illustrated by changing segments or by changing the assignments of features to a segment. The segments of a word are arbitrary and, therefore, they must be stored in the lexicon. In general, there is no natural relation between the meaning of a word and its segments. Anything that could not be built up from this segmental and lexical information was not regarded as phonology proper.

In contrast, intonational phenomena are meaningful, non-segmental, and post-lexical: Intonational features, like pitch movement, stress, and duration, do not associate with a segment but typically span over several segments. Furthermore, there were "natural links" between the form of the intonation feature and its function. It is often said that a rising contour is naturally linked to a question, while the falling tune is associated with an assertion. However, we have already seen in section 1.3 that this picture does not even explain the most common question intonation in several languages: Even though a rising intonation is "naturally" associated with questions, constituent questions generally attract a final fall in their contour.

The concentration on segmental and lexical phonology restricted the view of phonologists working on language description. However, one must extend the domain of phonological research from the level of words to that of phrases, sentences and discourses. The same intuition is expressed by our sample textbook. Drach (1940, 8) says that phonetics was restricted to investigation of single sounds of words. Since the sounds (i.e. segments) are arbitrarily determined, they do not contribute to the meaning. We rather need a science of sounds ("Schall-Lehre") of the sentence. For the expressive means of speaking, including accent, intonation and phrasing, are essential part of the language as such.

Was man bisher in der Schule als Phonetik ansah, als Lehre von den Lauten und bestenfalls von der Artikulationsbasis, ist nur die Schall-Lehre des einzelnen Wortes. Dessen Laute liegen so gut wie vollständig herkömmlich fest und besagen nichts über das Bedeutungserlebnis. Notwendig ist eine Schall-Lehre des Satzes. Die Erkenntnis muß sich durchsetzen, daß die biologischen Ausdrucksmittel lebendigen Sprechens – die Betonung, die Intonation, die Einschnitte – als notwendiger Bestandteil zum Sprachganzen gehören.

2.1.2 Separating linguistics from paralinguistics

Once we have opened the box of non-segmental auditory effects we have to close it very fast because not all auditory effects are phonological in nature. The main criteria is the distinction into linguistic, paralinguistic and non-linguistic features (cf. section 1.1.2). Catford (1964, 35) instantiates this main categorization for the field of phonology and defines the categories by the way they express their function:

By *paraphonological* function we mean that the phonatory difference can be correlated directly (not via linguistic form) with contextual differences: an example is the difference between *voice* and *whisper* in English. This difference does not correlate with differences in linguistic form—but it does correlate with contextual difference: voice is related to 'normal' or 'unmarked' context, whisper to what may be termed 'conspiratorial' context. In both these types of function, the phonatory difference is *contrastive* in the linguistic sense.

By *non-phonological* function we mean that the phonatory feature of difference is directly related to the situation—as a characteristic of the speaker as an individual, or of the

language or dialect which the speaker is using: in this function, phonatory features may be indicative of the speaker's sex, ages, health, social class, place of origin, etc.—but they are not contrastive in the linguistic sense.

Ladd (1996, 36) following Bolinger formulates the distinction between linguistics and paralinguistics in terms of "*quantal* or *categorical* structure of linguistic signalling" in contrast to "*scalar* or *gradient* nature of paralanguage." Phonological categories differ categorically, e.g. the phonetically very similar phonemes /p/ and /b/ belong to different categories. Minimal pairs like *pub* and *pup* are semantically unrelated even though they are phonetically very close. In paralinguistic signaling, we not only find an iconic relation between the signal and the function, but also between similar signals. If raising the voice can be used to indicate anger or surprise, then raising the voice a lot signals great anger or surprise. Phonetically similar features signal similar functions, different kinds of rising the voice may indicate surprise or unbelief. Thus the relation between features and their meanings defines the contrast linguistic vs. paralinguistic.

Crystal (1969, 127) subsumes under linguistic features "[o]nly those features (...) which are judged to be significant, i.e. contrastive (...)." Crystal (1969, 124) illustrates this with voice-quality, which is non-linguistic:

Voice-quality is thus the permanently present person-identifying 'background' vocal effect in speech, constituted by the same set of acoustic-physiological parameters as constitute speech, but being distinguished from speech by a different set of parametric values which are never utilised for purposes of communication. Voice-quality is readily distinguishable from linguistic contrasts on almost all occasions by its being (a) contextually random, i.e. the occurrence of voice-quality does not correlate with non-physiologically determined categories (linguistic or non-linguistic), and consequently (b) wholly statistically predictable—a fact which would hold for the component parameters of voice-quality as well as the total phenomenon.

Paralinguistic features are often coordinated with the linguistic features in time, but they are realized at a different channel. This channel can further be coordinated with gestural channels like nods, hand gestures or eye contact. Levy and McNeill (1992) have shown that hand movements often coincide with stressed syllables, and gestures frequently accompany, for example, the introduction of a new entity into the discourse. The distinction between linguistic and paralinguistic features is not always easy and often depends on the method of investigation or the theoretical background, as we will see in the next section.

However, there are clear tendencies: linguistic features are categorial, discrete and arbitrary with respect to their function. They express their function indirectly via an abstract level. Paralinguistic features are iconic and gradient. They have a "natural" function directly related to their own nature. Ladd (1996, 36) summarizes the difference between language and paralanguage as "a matter of *the way sound-meaning relation is structured*."

2.1.3 Phonetic vs. phonological approaches to intonation

Like in other fields of phonology, the question of whether we need an abstract, i.e. phonological, representation for intonational feature or not is very controversial. There are two traditions in the study of intonation that fit into this dichotomy. They can be characterized by their methodological preferences: making measurements vs. constructing models.¹ On the one side of the dichotomy stand instrumental or phonetic approaches that focus on quantifying acoustic features. On the other are descriptive and theoretical studies of intonation and its interaction with other parts of grammar.²

The instrumental or phonetic tradition was formed by experimental psychologists and phoneticians. They were mostly interested in speech perception and in acoustic cues to intonational phenomena. An excellent review of this work up to the late 1960s is Lehiste (1970), and a comprehensive discussion of the more recent findings in speech production and speech perception can be found in Reetz (1996). The very extreme position in the family of phonetic approaches is taken by Lieberman (1967, 26), who reduced all linguistically relevant uses of intonation to a single, innate contrast between "marked and unmarked breath group", plus a prominence feature of increased subglottal pressure. Less controversial work has focused on discovering the acoustic cues to several specific intonational phenomena, such as syntactic-pragmatic notions like 'finality', 'continuation', and 'interrogation'; or emotional states such as anger, surprise, and boredom. These directions of research often assumes a close connection between the linguistic and paralinguistic domains of vocal expression. Since they do not assume an additional level of representation, they can not and need not make a clear cut difference between linguistic and paralinguistic functions.

In contrast to this position, the phonological family of approaches assumes an abstract level of representation for intonational features. Thus, these studies do not start from a fixed set of functions, but from an inventory of more abstract intonational categories. The roots of these studies are found in the 'impressionistic' or 'proto-phonological' approach of linguists and language teachers, who were primarily interested in describing intonation either for practical use or as part of the general

¹ This description is from Ladd & Cutler (1983, 1). But also compare section 2.3 "Auditory and Instrumental Analysis in Relation to Phomenics" of Pike (1945, 16f).

² Couper-Kuhlen 1986, 63: "As 't Hart/Collier (1975) have pointed out, there are three different levels at which intonation can be analyzed, each reflecting a different degree of abstraction. At a concrete, *acoustic* level intonation can be seen as a succession of fundamental frequency curves in time. Since, however, many of these acoustic phenomena are not perceived at all by the human ear or only selectively perceived, a second, *phonetic* level must be distinguished, at which intonation can be viewed as a succession of perceivable pitch 'events'. However, not even all the pitch events which are in principle capable of being distinguished by the human ear are necessarily relevant in understanding the utterances of a given language. That is, a third, more abstract *phonological* level of intonation analysis can be identified at which potentially distinct pitch events are grouped together into 'meaningful' categories."

development of phonemic theory. This approach is represented by the work of the American structuralist school and that of the British school. Intonation is described by a small number of categorically distinct elements such as pitch phonemes, etc. These studies can be regarded as the predecessors of intonational phonology, even though they did not intend a further development of a phonological theory. In particular, the representation itself is not the subject of further analysis. Generally, all these approaches do not go beyond an analysis that describes intonation by impressionistic pitch curves (cf. Ladd 1996, 12). However, these approaches have started from basic assumptions of phonology and paved the way for intonational phonology.

The main goal of the phonological approach is to build a formal representation of intonational form and function. On the other side, the primary concern of the phonetic tradition is not representation, but realization. They are investigating the physical or acoustical correlates to the function conveyed by intonation. This contrast in methodology also cast light on the assumption about where intonation is to be placed in linguistic theory. The phonetic approach seems to generalize the paralinguistic features discussed in the last section, where paralinguistic features were defined as directly expressing different kinds of communicative functions. Paralinguistic or paraphonological features are realized on a parallel channel to the linguistic one, comparable to the visual channel of gestures. Reducing all intonational features to such a close correlation with the acoustics allows a universal view: If the function iconically correlates with the acoustic means, one should expect that all or many languages use the same or very similar acoustic features for one and the same function. This close connection between acoustic feature and function also means that the features are kept on an extra channel outside of linguistics proper. Such a position does not account for interaction with other parts of grammar.

On the other hand, the phonological approach assumes an abstract model of intonational features and an indirect relation to their functions. Such a model not only includes particular rules that determine the structure of such a representation, but also allows for a description of the interaction with other parts of grammar. Here, intonation belongs to the center of grammar. In this study, I refer to the phonological approach since it accounts for intonational phenomena that are closely connected with discourse structure and association with focus (see sections 1.6-1.7). Since these intonational phenomena show a wide interaction with discourse structure and semantic operators, it does not seem plausible that a direct relation between acoustic features and function can be established. And last but not least, a theory which adopts an abstract level of representation is a stronger theory, and therefore, more interesting. Before I present such a theory, namely the autosegmental-metrical theory of intonation, I will sketch two branches of the "impressionistic" or phonological tradition, which can be regarded as its historic and systematic predecessors.

2.1.4 Intonational features as phonemes

Bolinger (1964, 282f) compares the complex of intonational features with the up and down motions of waves at the surface of the ocean:

The surface of the ocean responds to the forces that act upon it in movements resembling the ups and downs of the human voice. If our vision could take it all in at once, we would discern several types of motion, involving a greater and greater expanse of sea and volume of water: ripples, waves, swells, and tides. It would be more accurate to say ripples *on* waves *on* swells *on* tides, because each larger movement carries the smaller ones on its back (...) In speech (...) the ripples are the accidental changes in pitch, the irrelevant quavers. The waves are the peaks and valleys that we call *accent*. The swells are the separations of our discourse into its larger segments. The tides are the tides of emotion.

This very powerful metaphor corresponds to the findings that pitch movement is closely related to the F_0 contour, which is also depicted as a wave. Certain aspects of the F_0 contour can be represented by this model, in particular local perturbations or the global level of the voice. The metaphor illustrates the so-called *overlay* or *superposition model* of Bolinger, which was developed among others by Fujisaki (1983) and Möbius (1993) for German. This model will not be discussed here, since it is not so clear in its theoretical implications for an abstract level of *representation*, it is rather a theory of *realization* in the sense discussed above (but compare the discussion in Ladd 1996, 24-30).

The question investigated in this section is rather how we can extract the meaningful features of intonation from the ocean of waves. As defined above, "linguistic" means that the features are discrete and express categorical distinctions. Furthermore they must be represented at an independent level from their functions. In the remainder of this section, we first describe the relation between segmental and suprasegmental phonology and then present two families of theories: the configuration theories of the British school (Halliday 1967a, Crystal 1969; and von Essen 1964, Pheby 1980, Kohler 1977 for German) and the level-theories of the American structuralists (Pike 1945, Trager & Smith 1951, Wells 1945). The former take the movements or configuration of the contour as distinctive features whereas the latter extract points out of the contour.

The acceptance of a set of linguistic intonational features was especially difficult because intonational and segmental features are co-occurring. Segmental phonology is conceived as the prototypical domain illustrating linguistic methodology. The units of the domain are defined by contrast: If the replacement of one sound by another in a lexical item results in a difference of meaning of the new lexical item, we speak of two different segments or phonemes (/pub/ vs. /pup/). Such a contrast often corresponds to a segmental feature, like [\pm voiced] in the given example. We have two distinct phonemes /b/ and /p/ and we can also state that the feature [\pm voiced] has a distinctive

function.³ In this way, the methodology of segmental phonology has set a very high standard towards the requirement for being a linguistic research domain. Intonation on the other hand, was conceived rather vague in its function, and not very suitable for theoretical description. Thus intonation was conceived as being superimposed on the segmental string expressing extra meanings superimposed on the lexical meanings of the words. The American structuralist Pike (1945, 21) characterizes the picture as follows:

The intonation meaning is quite the opposite [to lexical meaning, KvH]. Rather than being a stable inherent part of words, it is a temporary addition to their basic form and meaning. Rather than being carried by permanent consonants and vowels, it is carried by a transitory extrinsic pitch contour. Rather than contributing to the intrinsic meaning of a word, it is merely a shade of meaning added to or superimposed upon that intrinsic lexical meaning, according to the attitude of the speaker. (...) In English, then, an INTONATION MEANING modifies the lexical meaning of a sentence by adding to it the SPEAKER'S ATTITUDE towards the contents of that sentence.

Pike applied methods of finding contrasts to intonational features as well.⁴ He was influenced by the American structuralists tradition and by the knowledge of the tone system of Amerindian languages (Pike 1945, 26):

The pitch levels appear to be nearly or completely meaningless by themselves. It is the intonation contour as a whole which carries the meaning while the pitch levels contribute end points, beginning points, or direction-change points to the contours--and as such are basic building blocks which contribute to the contours and hence contribute to the meaning. (...) In determining the pertinent level or levels of contour, one does not classify the pitch of every syllable or part of a syllable, but only those points in the contour crucial to the establishment of its characteristic rises and falls; they may be called CONTOUR POINTS (...). In any rising or falling contour, two contour points are present: the pitch level at its beginning and the pitch level at its end.

³ Pike (1945, 16): "On the other hand, no investigator can determine from a physical record what certain sound waves mean or whether they have any meaning, whereas in auditory analysis an investigator by questioning the native speaker may discover--even if vaguely--the meaning of the linguistic signals. This is an extremely important factor, since by discovering two utterances which differ (1) by meaning and (2) by sound, the investigator obtains a differential analysis of the units significant to the language, that is, its PHONEMES or distinctive units of sound. If it is of any value to our culture to analyze our units of communication and to determine the method of their systematic functioning, then an auditory technique is essential, since only by such an approach can these units be isolated through concomitant contrasts of meaning and phonetic form."

⁴ Pike (1945, 10): "Leonard Bloomfield in 1933 made a great forward step when he attempted to apply to intonation the principles which had proven so effective in the analysis of significant units of sound." Bloomfield (1933, ch. 7) discusses intonational features under the heading of "Modifications", after he had introduced the phonemes of segmental phonology. In particular he describes intonation as "secondary phonemes": "In English both stress and pitch, then, are used only as secondary phonemes (...)" (Bloomfield 1933, 116; §7.7). Thus, primary phonemes are segmental, while the secondary ones are suprasegmental.

The American structuralists divided intonation into three independent domains or subsystems, which they called *pitch*, *stress* and *juncture*, and for which they describe phonemic entities. Pike (1945, 25) describes the intonation contour (or pitch) as consisting of four *level tones*:

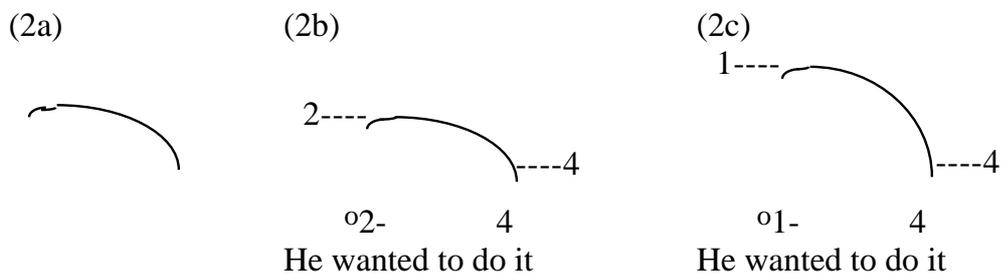
- (1) Pitch phonemes or *level tones* of Pike (1945, 25)
- | | |
|------|------------|
| /1/: | extra high |
| /2/: | high |
| /3/: | mid |
| /4/: | low pitch |

The contour in (1a) starts with a high pitch on the stressed *I*, and has another high on the stressed *one*. The first *man* before the break has a low and a mid pitch. The second part of the utterance has an extra high on *this* and a final low on the second *man* (Pike 1945, 47):

- (1a) I didn't say one man, I said this man.
 °2- -3 °2- -4-3/ °2- 3- °1- -4//

The level tones do not express meaning by themselves, but they express meaning differences in the contour. In other words, the level tones are understood as phonemes. The pitch phonemes combine in different ways yielding *intonation morphs*, linguistic units with meaning: "For intonation, this use of the morpheme is helpful, since the meaningful contours are composed of meaningless subunits, the pitch levels (and so paralleling the meaningful parts of words made up of meaningless sounds.)" (Pike 1945, 177, fn. 40).

If we imagine an utterance such as *He wanted to do it* with a fall like in (2a), Pike would describe this as a /2-4/ contour, as in (2b). However, this contrasts with a /1-4/ contour, as in (2c):⁵



⁵ The particular diagrams are quoted from Couper-Kuhlen (1986, 65).

Level /1/ and level /2/ are distinct because replacing /2/ by /1/ results in a different contour, and both contours, /2-4/ and /1-4/ are also distinct in meaning: /2-4/ marks the normal assertive function of the sentence, while /1-4/ expresses 'insistence', 'excitement', or 'conviction'. This effect can also be observed in example (1a), where the first clause has a /2-4/ contour expressing the normal assertion, and the second clause has a /1-4/ contour marking the contrast or the correction.

Trager & Smith (1951, 46) extended the inventory of intonational phonemes with *terminal junctures*, i.e. pitch transitions from phrase to phrase and from phrase to silence:⁶

- (3) Terminal junctures of Trager & Smith (1951, 46)
- # a quick fall down to silence
 - || a terminal rise in pitch
 - | sustension of pitch

Finally, Trager & Smith (1951, 35ff) represent stress in a system of four *stress phonemes*: primary (˘), secondary (^), tertiary (˙), and weak stress (˘). Contrasts between minimal pairs like the verb *réb˘el* vs. the noun *r˘ebél*, the adjective *án˘im˘ate* vs. the verb *án˘imàte* were the basis to the phonemic character of these stress levels. Stress phonemes were assumed to function independently from the pitch phonemes. The strict separation between stress and pitch is still one of the fundamental assumption in theories of intonation in generative grammar (see section 2.4).

Bolinger (1951) attacked the system of four level tones for representing intonation with two main arguments. First, he showed that stress and pitch are not independent of each other, but closely related: pitch accent is the main phonological means to express stress (see section 2.4.1). Second, he argued that the system of contours is too rich and not rich enough at the same time. It predicts contours that do not exist, and it cannot describe several existing contours. For example, the system predicts that the contours /123/ and /234/ are distinct. However, in the absence of any context, both contours are indistinguishable, since the level tones are relative and not absolute. Bolinger concluded that it is not the pitch level or pitch range that is distinctive, but the configuration (fall, rise etc.) as such. This also corresponds nicely to his general wave metaphor, quoted above.

In contrast to the discrete level-picture of intonation, the British school (Halliday 1967a, Crystal 1969, Pheby 1980 and others) analyses intonation in a holistic way, in accordance with Bolinger's criticism. Furthermore, they recognize the interaction of stress and pitch accent. The stressed syllable indicates the *nucleus* of the intonation

⁶ Thus the combination of four pitch level and three terminal juncture phonemes yields 12 pairs (see Trager & Smith 1951, 47).

contour, while the string before the stressed word is the *prenucleus*. The distinctive units are the complex moves of the contour rather than level tones. These configurations or moves (fall, rise, fall-rise etc.) are associated with an intonational phrase as a whole. The phrase itself has an internal structure indicated by stress, i.e. by the prominent pattern of the text.

Halliday (1967a, 29f) distinguishes three intonational domains: (i) *tone* (= contour), (ii) *tonicity* (= relative prominence), and *tonality* (= phrasing or the division of the utterance into tone groups).

The set of phonological systems in English that are referred to collectively as "intonation" can be summed up in broad terms as follows:

Tonality marks one kind of unit of language activity, and roughly where each such unit begins and ends: one tone group is as it were one move in a speech act.

Tonicity marks the focal point of each such unit of activity: every move has one (major), or one major and one minor, concentration point, shown by the location of the tonic syllable, the start of the tonic.

Tone marks the kind of activity involved, by a complex pattern built out of a simple opposition between certain and uncertain polarity. If polarity is certain, the pitch of the tonic falls, if uncertain, it rises.

Halliday (1967a, 12f) assumes the following hierarchy of phonological units:

(4) Phonological units or constituents (Halliday)

tone group (= intonational phrases)
 foot
 syllable
 phoneme

Like the foot, the tone group has an internal structure consisting of an obligatory *tonic* element (or *nucleus*) and an optional *pretonic* element (or *prenucleus*). The tonic element associates with the stress of the text and it is the place where the movement is realized, forming what today is called the *nuclear (pitch) accent*. The movement is described by a system of 5 primary tones and further systems of secondary tones (not illustrated here).

(5) The primary tone system (Halliday 1967a, 16)

Term in the system	Visual Symbol	Tonic movement (= pitch movement)	Terminal tendency
1	\	falling	low
2	/	rising	high
2	∨	falling-rising	high
3	—/	rising	mid
4	∩	(rising-)falling-rising	mid
5	∪	(falling-)rising-falling	low

The meaning of the tones are extracted by the contrasts that results from applying different tones to one and the same syntactic structure. For example, tone 1 (falling) combines with a declarative sentence yielding a neutral assertion, while the same structure with a tone 2 (rising) marks a contradictory statement. One of the major problems of the "configuralists" is that they have to make reference to the F_0 contour, or to some phonological equivalent. However, that equivalent is what they are intending to explain.

Another problem of the holistic picture of the British school is that they do not distinguish between pitch accents and edge tones. In English, a rising-falling-rising tune can be used to express a contradicting echo question as in (6) and (7). This configuration corresponds to tone /4/ in Halliday's system quoted above. In (6) the whole tune is realized on the one syllable of *Sue*.

(6) A: I hear Sue's taking a course to become a driving instructor



B: Sue!?

Example (7) shows that this is not a holistic rise-fall-rise shape that can be applied to phrases of different sizes. In that case the contour would be stretched over the six-syllable utterance. In contrast to this expectation, the contour is formed by two discrete events, an accentual feature consisting of a rise through a prominent syllable (here *driv-*) followed by a fall, and an edge tone consisting of a rise on the last syllable. The low level tune on *-ing instruct-* can be understood as the transition between these two events:

(7) A: I hear Sue's taking a course to become a driving instructor



B: A driving instructor!?

For over thirty years the levels-vs.-configuration debate was a very controversial issue for research in intonational phonology. It can be said that it was solved by the *autosegmental-metrical* approach by combining insights from both schools and forming a new kind of theory.

2.2 Autosegmental-metrical approaches

Beginning in the late 1970s, an explicitly phonological approach to intonation began to develop, based on dissertations by Liberman (1975), Bruce (1977), and Pierrehumbert (1980): the autosegmental-metrical theory of intonation. The theory was formulated for English by Pierrehumbert (1980) and Beckman & Pierrehumbert (1986). The model is based on research in theoretical problems in phonology, particularly on tonal phenomena, which led to the autosegmental theory of phonology. It further incorporates insights from the level-approach and the configuration-approach to intonation: the contour is represented by abstract tones, and one accent, the pitch accent, is associated with the most prominent syllable of the corresponding phrase. Ladd (1996, 42f) summarizes the four main assumptions of the theory:

(i) *Linearity of tonal structure*

Tonal structure is linear, consisting of a string of local *events* associated with certain points in the segmental string. Between such events the pitch contour is phonologically unspecified and can be described in terms of *transitions* from one event to the next. In languages like English, the most important events of the tonal string are *pitch accents*, which are associated with prominent syllables in the segmental string, and *edge tones*, which are associated with the edges of prosodic domains of various sizes.

(ii) *Distinction between pitch accent and stress*

Pitch accents, in languages that have them, serve as concrete perceptual cues to stress or prominence. However, they are in the first instance *intonational* features, which are *associated with* certain syllables in accordance with various principles of prosodic organization. The perceived prominence of accented syllables is, at least in some languages, a matter of *stress*, which can be distinguished from pitch accent.

(iii) *Analysis of pitch accents in terms of level tones*

Pitch accents and edge tones in intonational languages can be analysed as consisting of primitive *level tones* or pitch targets, High (H) and Low (L).

(iv) *Local sources of global trends*

The phonetic realization or *scaling* of any given H or L tone depends on a variety of factors (degree of emphasis, position in utterance, etc.) that are essentially orthogonal to its identity as H or L. Overall trends in pitch contours (e.g. gradual lowering of overall range) mostly reflect the operation of *localised* but *iterated* changes in scaling factors."

2.2.1 Autosegmental phonology

The description of tone languages had influenced the American structuralist approaches to intonation at the beginning of the century in assuming level tones for the representation of intonation. However, these level tones were understood as non-segmental or secondary, and therefore only indirectly integrated in the phonological system. The representation itself was never studied in a more abstract approach.

The progress in theoretical models of tone languages gave a second impulse to intonational phonology. Problems in describing certain properties and phenomena of African tone languages could not be handled in the classical linear theory of Chomsky & Halle (1968), where the segmental information is linearly ordered. Features are associated with exactly one segment, and phonological processes take place between adjacent segments. Goldsmith (1976), Leben (1976), and Williams (1976) developed the autosegmental framework, in which they propose that tones are represented at an independent level or *tier*. Both the tonal tier and the segmental tier are autonomous; they constitute different locations for representing the lexical information. However, the information on these tiers must be synchronized. The phonological model assumes *association lines* linking tones and selected segments of the segmental tier called *tone-bearing units* (TBUs), which must be prominent elements. Hence, the association often holds between tones and vowel.

Autosegmental phonology introduces two new elements in the phonological model: (i) the tonal tier, and (ii) the association lines between the tiers (cf. Kenstowicz 1993, 315f). One would also expect new rules operating on these representations. In fact, the success of autosegmental phonology is based in rules operating on these levels, which overcome the problems of linear phonology. The general architecture of such a model is very flexible, since it allows *multiple linking*. Goldsmith (1976, 27) restricts this flexibility by the two principles in (8) (cf. Odden 1995, 456). However, this still allows the possibility of mapping two tones on one unit or one tone on two units, as illustrated in (9):

- (8) Restriction on autosegmental association
- (i) All vowels are associated with at least one tone.
 - (ii) All tones are associated with at least one vowel.
 - (iii) Association lines do not cross.

- (9) The structure of autosegmental phonology

segmental tier	V... V... V... V...V
association lines	\ \ /
tonal tier	T...T.....T..T....T

The type of phonological rule applying to the new domains should be illustrated by two examples concerning possibilities of association, and the configuration of tone at the tonal tier: In Yoruba like in many other African languages, the vowel of a syllable may be elided phonetically while leaving its tones to be realized. In (10) the high tone of the segment *o* is not eliminated by the deletion of the segment, but associated with the preceding segment according to the *stranded tone principle*. The TBU is associated with two tones after elision (cf. Ladd 1996, 62).

(10) Vowel deletion in Yoruba

Ayo	(o)	lo		Ayo	lo	"Ayo goes"
					\	
M	L	H	M	M	LH	M

Other principles are that tones can be unassociated or that tone bearing units can exist without tones associated with them.

The possibility of multiple linking allows for different representations of the same string. E.g., a CVCV string with the same tone on the vowels can either be represented as (11a) with two tones or (11b) with one tone spreading over two tone bearing units:

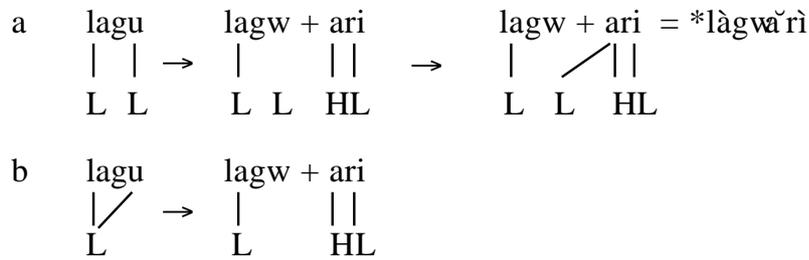
(11a) CVCV	(11b) CVCV
	\ /
T T	T

This representational difference between (11a) and (11b) can have empirical consequences. Consider the way in which disyllabic low-toned nouns in the Chadic language Margi behave with the definite suffix *àrì* (cf. Kenstowicz 1993, 322f):

(12)	làgù	"road"	làgwàrì	"the road"
	màlà	"woman"	màlárì	"the woman"

If *làgù* has the singly linked representation of (11a), then in the course of the derivation of (13) devocalization creates a floating low. By the Stranded Tone Principle, this floating tone links to the suffixal vowel, creating a rising tone. To derive the correct form *làgwàrì*, we must postulate an additional rule to delete a floating low after a low tone. But if *làgù* is assigned the multiply linked representation (11b), then upon devocalization no floating tone is created, because the L remains anchored to the first syllable. No rising tone develops and the correct *làgwàrì* is derived directly, as in (13b):

(13) Multiple linking in the Chadic language Margi



In order to restrict the generation of too many contours that are not distinguishable, the *Obligatory Contour Principle* (OCP), originally due to Leben (1973) was formalized by Goldsmith (1976, 36). It restricts lexical sequences of tones such that adjacent tones must be different or contrast with respect to at least one tonal feature, i.e. a sequence HHL is not allowed and is simplified to HL (cf. Kenstowicz 1993, 323; Odden 1995, 461), however, multiple linking is possible.

(14) Obligatory Contour Principle

Adjacent identical tones are banned from the lexical representation of a morpheme

Thus, the OCP does not allow a structure like (15a), but it allows a structure as in (15b):



Goldsmith introduced the new phonological units, the autonomous tonal tier and the association lines, in order to continue research in phonology according to a clearly defined methodology. Goldsmith (1976, 165) summarizes this at the end of his dissertation:

Throughout this thesis has run one tension: that between the analysis of phonological phenomena in terms of distinctive features, and seeing phonological representations as composed of atomic, indivisible units. The motive force has been the belief that both of these are correct, and therefore ultimately reconcilable. But such occurrences as contour tones on short vowels seemed to threaten these assumptions; and the autosegmental hypothesis arose as a way to save these two basic principles and also save the appearances.

2.2.2 The structure of the tune

While autosegmental phonology was studying tones that are provided by the lexical information of words, intonational phonology is concerned with postlexical melody or contour. Following the autosegmental approach, Pierrehumbert (1980, 10) proposes a description of intonation that consists of three parts (i) the grammar of phrasal tunes, (ii) the metrical representation of the text, and (iii) the rules of assigning association lines:

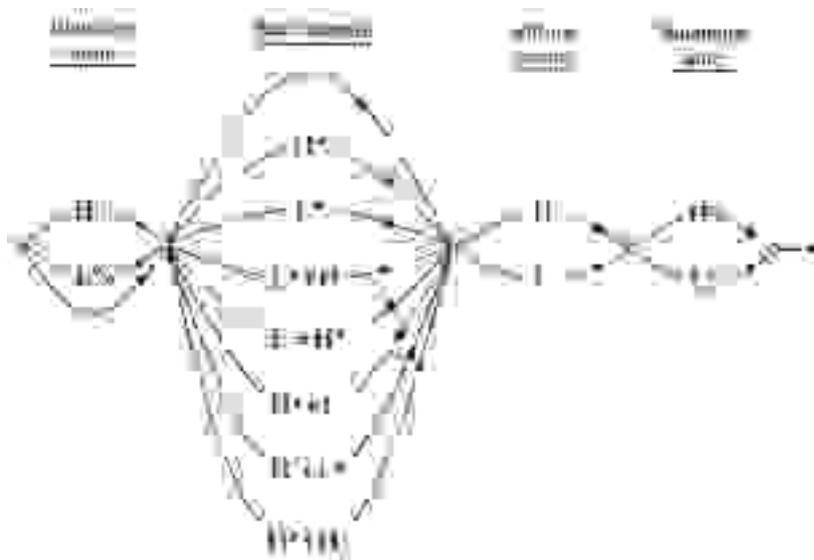
The phonological characterization of intonation has three components. The first is a grammar of allowable phrasal tunes. This grammar generates sequences of L and H tones (...) The second component is a metrical representation of the text. (...) Lastly, we have rules for lining up the tune with the text. The complete phonological representation for intonation is thus a metrical representation of the text with tones lined up in accordance to the rules.

Pierrehumbert (1980) proposes a finite state grammar for generating the structure of the tunes. She assumes two distinct level tones, H (high) and L (low), which are instantiated as *pitch accents*, *phrase accents*, or *boundary tones*, as listed in (16). The tones combine to an abstract sequence of tones or the *tune* according to the finite state grammar described in (17):

(16) *Phonological tones* (Pierrehumbert 1980)

- (i) Each phrase requires at least one *pitch accent* (for English: H*, L*, or bitonal as H*+L, H+L*, L*+H, L+H*, and H*+H)
- (ii) Each phrase receives a *phrase accent* (H⁻, L⁻) at the end of the word that is associated with the last pitch accent
- (iii) Each phrase ends with a *boundary tone* (H%, L%).

(17) The finite state grammar generating tunes

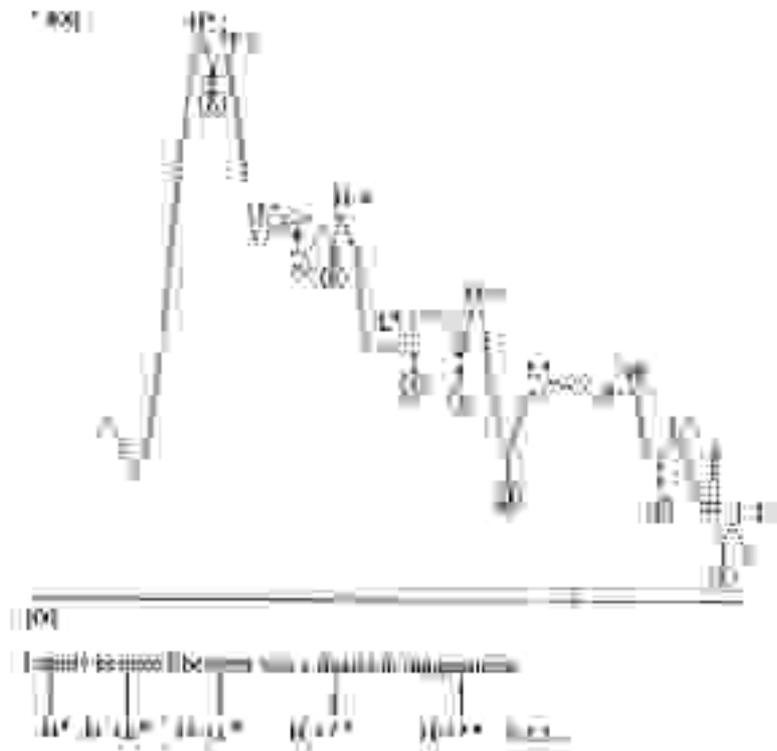


The three types of tones have different positions and are aligned to different structural units: *Pitch accents* are realized on prominent syllables on the basis of the metrical pattern of the text. *Phrase accents* are realized after the pitch accents and after a certain amount of time. In Pierrehumbert (1980), the phrase accents determine the melody between the nuclear tone and the boundary. *Boundary tones*, high (H%) or low (L%), are realized on the last syllables of an Intonational phrase and determine the phrasing.

The grammar generates tunes that consist of one or more pitch accents, followed by an obligatory phrase tone and an obligatory boundary tone. This elegant and clear description of English intonation contours does not give the nuclear tone a prominent structural place. Since there is no constituent structure of the intonational phrase corresponding to head and nucleus as in the British tradition, there is no distinction between prenuclear and nuclear pitch accents. The only difference is their position: the nuclear accent is the last pitch accent in the phrase. Following Bolinger (1958), Pierrehumbert (1980) assumes that the tonal units are morphemes of different kinds (see section 2.5 for discussion of the intonational meaning).

Phonetic rules translate these abstract representations into concrete F_0 -contours. These rules can be quite complex and interact with other principles, like downstepping. As seen in the terraced downstepping contour of the text *I really believe Ebenezer was a dealer in magnesium.*, L tones can be realized by a higher pitch than an H elsewhere in the same utterance (cf. Pierrehumbert 1980, Liberman & Pierrehumbert 1984; figure from Ladd 1996, 86):

(18)



The difference between the bitonal pitch accent H^*+L and the monotonal H^* is illustrated by (19). The first half of the utterance has the accent sequence $H^*+L...H^*$, with the peak on the H^* downstepped from the peak of the H^*+L . The second half of the utterance has two H^* accents, with peaks of approximately the same height (figure from Ladd 1996, 87; originally from Pierrehumbert 1980):



- (19) John studied Mary, and Bill studied Jane
 | | | |
 H^*+L^- $H^*L^-H\%$ H^* $H^*L^-H\%$

The original partition into pitch accents, phrase accents and boundary tones was later modified, since the status of phrase tones were controversial (see Ladd 1996, 89-98). The solution proposed in Beckman & Pierrehumbert (1986) was to assume two kinds of boundary tones: one marking the end of the *intonational phrase* (IP), and another kind signaling the end of the smaller *intermediate phrase* (ip; see section 2.3.2).

Besides this boundary tone (the old phrase accent), the intermediate phrase contains at least one pitch accent. The system of abstract tones can be simplified to the following system, where abstract tones are realized either as pitch accents or as boundary or edge tones. The latter can mark an intonational or an intermediate phrase.

- (20) Phonological tones for English
- H^*, L^* pitch accents (or bitonal as H^*+L , $H+L^*$, L^*+H , $L+H^*$, and H^*+H)
 - $H\%, L\%$ boundary (or edge) tones, namely
 - H_{IP}, L_{IP} for intonational phrases or
 - H_{ip}, L_{ip} for intermediate phrases

2.2.3 Tune-text alignment

The principles of autosegmental phonology (see section 2.2.1) are applied to the tune-text alignment. This can be illustrated by the simplified example in (21). The L H L tune in English indicates surprise or emphasis. It can be linked to four different texts as follows (cf. Hayes & Lahiri 1991, 48f):

(21)a	Alexánder!	b. Theóphilus!	c. Ábernathy!	d. Tólm!
	\	/	\ /	\
	L H L	LH L (L) H	L (L) H L	

According to these data, the following rules of association between the tune L H L and text can be formulated:

- (22) (i) Associate H to the main stressed syllable
 (ii) Associate the first L to syllables preceding the main stress, if there are any
 (iii) Associate the second L to all syllables following the main stress; if there are none, associate L to same syllable as the H tone.

These particular rules of association can be generalized in order to cover other tune-text alignments, as well. For example, we can replace the L H L tune by the question tune H L H yielding the association lines in (23):

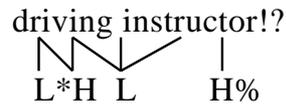
(23)a	Alexánder?	b. Theóphilus?	c. Ábernathy?	d. Tólm?
	\	/	\ /	\
	H L H	HL H	(H) L H (H) L H	

In the system of Pierrehumbert, the pitch accent that associates with the most prominent syllable in the intonational phrase receives a "*" (and is called *starred*). Example (6) and (7) from section 2.1.4, repeated as (24) and (25) can be assigned the surprise tune L*H...L...H% (rise-fall-rise). In (24) all four tones are realized on the one syllable available, while they are spread over the sequence of syllables in (25) (cf. Ladd 1996, 132):

- (24) A: I hear Sue's taking a course to become a driving instructor



(25) A: I hear Sue's taking a course to become a driving instructor



Following the American structuralist tradition, stress and pitch accent are based in two different domains: pitch accent is part of the contour that is generated by the finite state grammar. Stress, on the other side, is a prominence relation of the intonational phrase. It is assigned to the phrase by lexical stress and its projection rules. The particular rules can be quite complex (see for example Goldsmith 1976, Selkirk 1984).

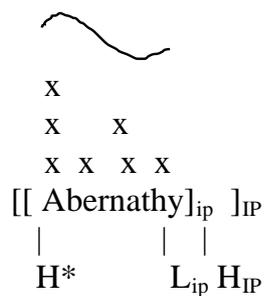
We can state the rules for association of tune and text (Hayes & Lahiri 1991, 54):

(26) Association of tune and text

- (i) Pitch accents associate with stressed syllables within their phrasal domain.
- (ii) Boundary tones associate with the boundary for which they are diacritically marked.

For instance, for an intonational phrase that is made from one single word as in (27), the pitch accent is associated with the main stress of the word *Abernathy*, which is on its first syllable. The prominence pattern is indicated in grid notation (Prince 1983). Since the intonational phrase (IP) consists of only one intermediate phrase (ip), both boundary tones are associated with the end of the phrase. They are realized as a rapid excursion from L to H (Hayes & Lahiri 1991, 54).

(27)



The sentence (28) shows that in English sentences, there exists a strong-weak distinction not only word internally but also between words. While the first syllable *Ab-* of *Abernathy* is strong with respect to the other syllables of that word, it is weak with respect to the strong syllable of *gesticulated*. Thus the *-ti-* of *gesticulated* is the most prominent syllable in sentence (14) and is therefore aligned with the pitch accent. This syllable *-ti-* may be said to bear main sentence or phrase accent (cf. Selkirk 1984, 44):

2.3.1 Sense unit condition

Selkirk (1984) has argued that the intonational phrase (IP) constitutes a domain relevant to various aspects of the phonetic implementation of the sentence, including timing effects like constituent-final lengthening. A purely phonetic definition of the IP as "marked and unmarked breath group" was suggested by Lieberman (1967, 26). This idea, however, goes back to Sweet (1906, 45):

The only division actually made in language is that into 'breath-groups'. We are unable to utter more than a certain number of sounds in succession with renewing the stock of air in the lungs.

Other researchers rather suggest that the material contained within an intonational unit must constitute a *sense unit*. Kingdon (1958, 162f) claims that the intonational units correspond to the *sense-groups*, i.e. "groups of words that have a semantic and grammatical unity – not necessarily complete". This view had already be formulated by Klinghardt & Klemm (1920, 33). They define the intonational unit ("sprechtakt") by the intonational sense-group ("intonatorischen sinntakt"):⁷

Was ist es dann aber, das auch unter solchen umständen den sprechtakt deutlich zu gehör bringt? Die antwort kann m. e. nur lauten: die tonbewegung, die intonation des schlusses eines jeden sprechtakts. Darum genügt zu dessen genauer bezeichnung nicht nur das wort 'sinntakt', sondern wir müssen vom **intonatorischen** sinntakte als der grundlage aller takteinteilung unserer rede sprechen.

Selkirk (1984, 286) employs the notions of *sense unit* since she argues that the intonational phrase cannot be defined by phonetics or by syntax alone, but it needs additional semantic constraints:

Our position, then – again following Halliday 1967a,b – is that there are no strictly syntactic conditions on intonational phrasing. Any apparently syntactic conditions on where 'breaks' in intonational phrasing may occur are, we claim, ultimately to be attributed to the requirement that the elements of an intonational phrase must make a certain kind of semantic sense.

⁷ Klinghardt & Klemm (1920, 33) define the basic unit of speech by (i) the close meaning relation of the word in the unit, and (ii) by the boundary tone at the end: "Nachdem ich nun so, wie ich hoffe, mit ausreichender beweiskraft nachgewiesen habe, daß der sprechtakt ein intonatorischer sinntakt ist, erübrigt nur noch, daß ich eine förmliche definition des begriffs zu geben versuche. Und zwar möchte ich ihn dahin bestimmen, daß 'sprechtakt' ein unterteil des begriffs 'satz' ist und aus einer gruppe von worten besteht, die 1. durch ihren gemeinschaftlichen sinn enger miteinander verbunden sind als mit einer der beiden sie umgebenden wortgruppen, und die 2. mit der tonbewegung ihrer letzten silben andeuten, ob die rede fortgesetzt wird oder nicht. Ein sprechtakt kann auch aus einem einzigen worte bestehn."

She then (1984, 286ff) defines the correlation between intonational phrase and the sense unit in (32), and in (33) she determines the sense unit as a complex of constituents that stand either in a modifier-head or argument-head relation:

- (32) The Sense Unit Condition on intonational phrasing
The immediate constituents of an intonational phrase must together form a sense unit.
- (33) Two constituents C_i , C_j form a sense unit if (a) or (b) is true of the semantic interpretation of the sentence:
- a. C_i modifies C_j (a head)
 - b. C_i is an argument of C_j (a head)

This can be illustrated with (34). The first intonational phrase *Mary prefers* does not correspond to one syntactic constituent. However, its two constituents stand in the relation of argument-head, since the NP *Mary* is an argument of verb *prefers*. Thus, they form a sense group and can license the intonational phrase:

- (34)
- | | | |
|-------|------------------------|--------------------------|
| NP | V | NP |
| | | |
| (Mary | prefers) _{IP} | (corduroy) _{IP} |

Since the Sense Unit Condition is very closely related to argument structure, it does not cover cases where material is preposed or in nonrestrictive modifiers such as nonrestrictive relative clauses (Selkirk 1984, 295f). The latter is a typical instance of backgrounding, which expresses a discourse relation rather than an argument-head relation.

2.3.2 Intermediate phrases

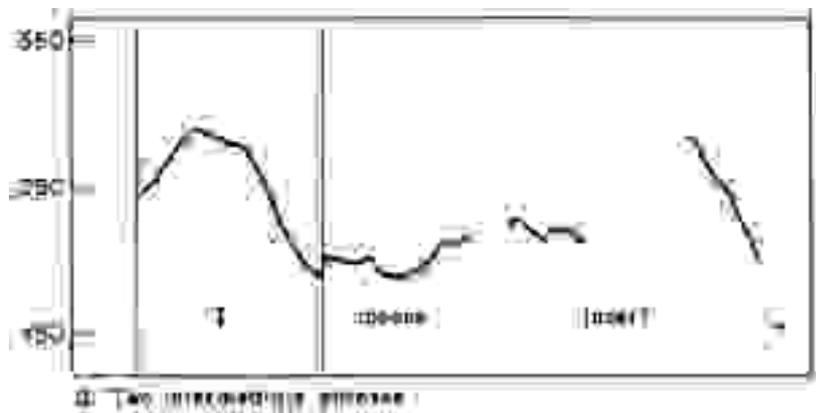
Beckman & Pierrehumbert (1986) suggest that the intonational phrase consists of smaller constituents, which they call *intermediate phrases*. Ladd (1986) distinguishes between *major phrases* (= intonational phrases) and *tone group* (= intermediate phrases). He argues that the break or pause after *brother* and after *geologist* in (35c) is much bigger than a possible break in (35a). Therefore, a possible division in (35a) cannot be a division into two intonational phrases.

- (35a) //My brother / lives in Denver//
 (35b) //My brother lives in Denver//
 (35c) //My brother // who is a geologist // lives in Denver//

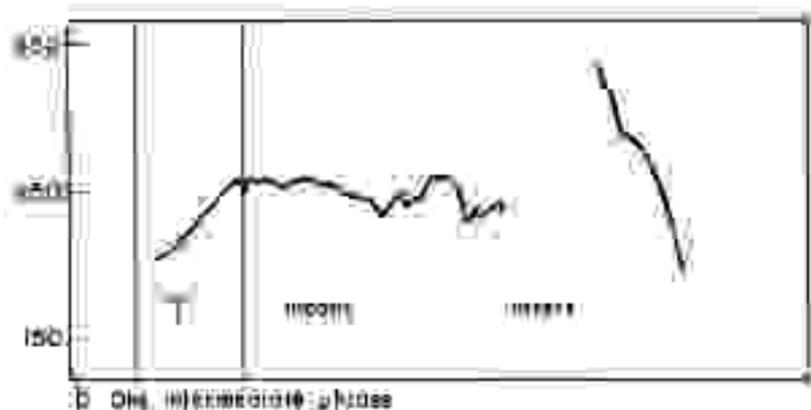
Beckman & Pierrehumbert (1986, 289ff) discuss other contexts in which the phrasing into two units is intonationally indicated, but where a partition into intonational phrases is not adequate. Therefore, they assume the smaller intermediate phrase for this structuring process. They discuss (i) definitional utterances, (ii) multi-phrasal yes/no questions, (iii) sequences of modifiers, and (iv) the treatment of tags. The utterance (36) can be realized as (36a) with two intermediate phrases or as (36b) with one intermediate phrase that covers the extension of the intentional phrase (Beckman & Pierrehumbert 1986, 289):

(36) 'T means insert.

(36a)



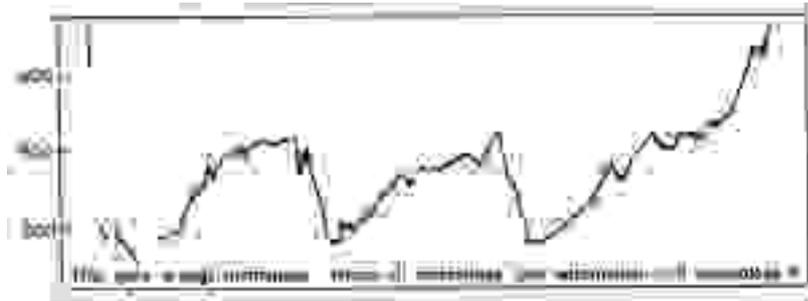
(36b)



In (37), which is a list answer to a question like *What did they give?*, each NP in the list has a rise, but the final rise is by far the largest. Only the final rise shows an upturn at the end. The two others have a fast rise just after the stress followed by a gradual rise up to the end of the phrase, but the gradual rise is very similar to the medial portion of the contour on the last list item and there is no further upward inflection at the end. This contour is best explained by assuming that the whole utterance consists of three parallel intermediate phrases with a final H_{ip} of the boundary tone of the intonational phrase.

- (37) [IP They gave [IP orange marmalade] [IP lemon oil marmalade] [IP and watermelon-rind marmalade ?]]

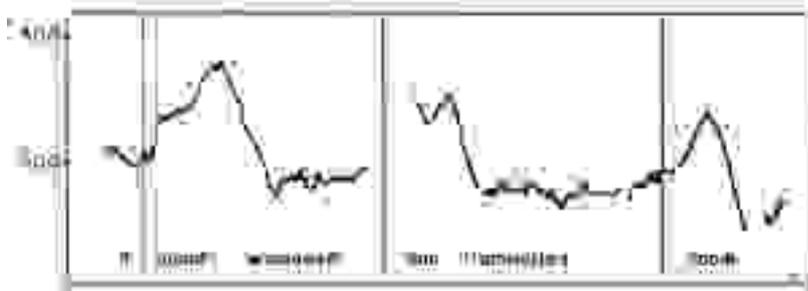
(37a)



In (38) a sequence of modifiers which are to be interpreted in parallel are organized in intermediate phrases. (39) separates the vocative *Manny* from the matrix sentence, whereas the lack of a boundary in (40) signals that *Manny* is the object of *marry*.⁸

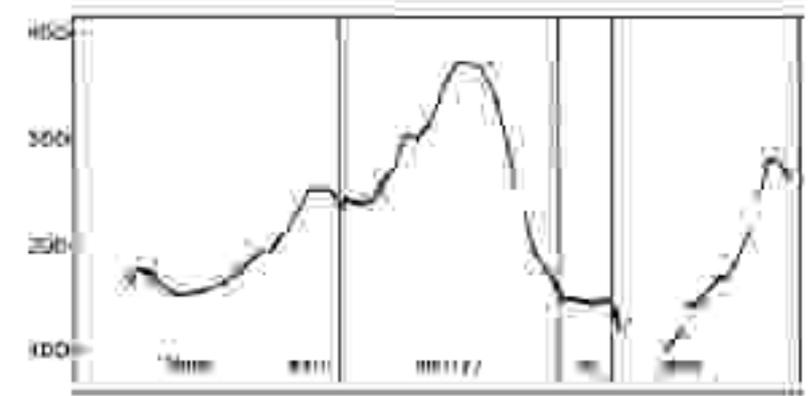
- (38) [IP [IP a round-windowed] [IP sun illuminated room]]

(38a)



- (39) [IP [IP Mary will marry] Manny]

(39a)



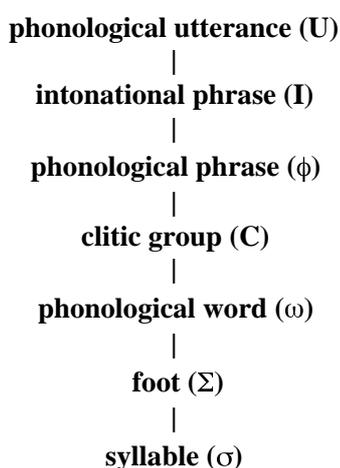
⁸ Selkirk (1995, 567): "At present, the principles governing intonational phrasing are not well understood. Certain syntactic constructions - vocatives, appositives, parentheticals, preposed clauses, nonrestrictive relative clauses - are necessarily set off in separated IPs."

2.3.3 Prosodic hierarchy

In this section, I present two different views regarding the relation between intonational phrasing and phonological (or prosodic) phrasing. Hayes & Lahiri (1991) argue that both kinds of phrasing relate to the same underlying structure, while Gussenhoven (1990) claims that they are related but independent.

The phonologically relevant units of intonation were defined as syllable, foot, intermediate phrase and intonational phrase. This hierarchy partly overlaps with another phonological hierarchy: the *prosodic hierarchy*, which was proposed to account for different kinds of juncture phenomena (Nespor & Vogel 1986, 16; also Selkirk 1984, 26ff; Selkirk 1986, 384):

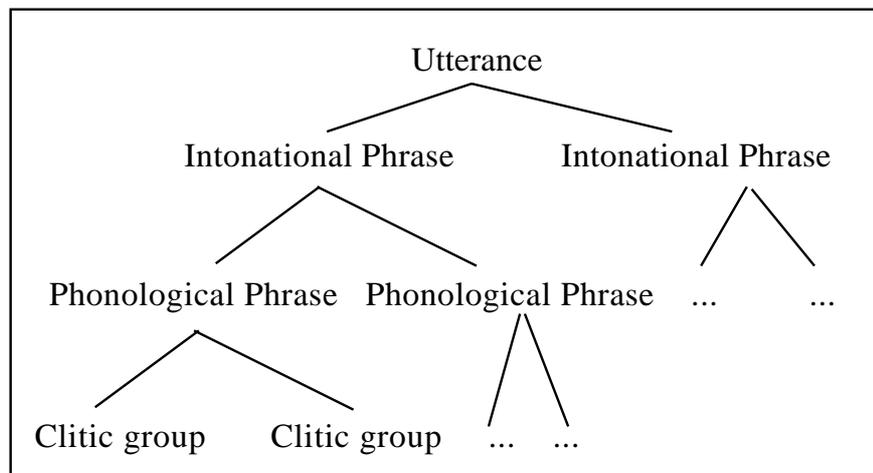
- (43) The prosodic hierarchy (Nespor & Vogel 1986, 16)



Selkirk (1986, 384) defines the prosodic structure as part of phonological representation with the following properties as in (44). These properties lead to a structure of phonological constituents as in (45):

- (44) *Properties of prosodic structure*
- (i) It consists of prosodic (phonological) categories of different types, e.g. syllable, foot, prosodic word, phonological phrase, intonational phrase, utterance.
 - (ii) For any prosodic category, the sentence is exhaustively parsed into a sequence of such categories
 - (iii) The prosodic categories are ordered in a hierarchy (in the order given above), and in phonological representation they are strictly organised into layers according to that hierarchy (cf. the Strict Layer Hypothesis of Selkirk 1984), i.e. prosodic constituents of the same category are not nested.
 - (iv) The hierarchical arrangement of prosodic categories forms a well-formed bracketing.

(45) Phonological constituents



The main interest in the research into the prosodic hierarchy is the relation to syntactic constituents: "I think it is fair to say that up to now there has been no general theory of the mapping between syntactic structure and prosodic structure to accompany this theory of prosodic structure *qua* representation." (Selkirk 1986, 384). The question is whether phonological constituents directly correspond to syntactic constituents or not. Selkirk (1986, 385) excludes phonological constituents higher than the phonological phrase from the investigation:⁹

Furthermore, among the higher order prosodic constituents, intonational phrases will be excluded from consideration. The reason is that intonational phrasing appears to be subject to semantic well-formedness conditions rather than to conditions based on surface syntactic structure and is located in the input to the syntax-phonology mapping.

The constituents of the prosodic hierarchy are defined with respect to pauses and juncture phenomena and for their relation to syntax. On the other hand, the intonational units are defined by their boundary tones and their discourse-pragmatic function. The question arises whether we have here two sides of the same coin or different coins.

Hayes & Lahiri (1991) suggest that there is only one structure, which has an intonational aspect and a prosodic aspect. But both aspects refer to the same kind of phrasing. They argue that the intermediate phrase of the intonational hierarchy is to be identified with the phonological phrase of the prosodic hierarchy. They show evidence

⁹ Inkelas & Zec 1995, 539: "The two smaller domains in the Prosodic Hierarchy, namely the phonological word and the phonological phrase, have been studied in a variety of languages, and the results are quite encouraging. The morpho-syntactic characterizations of these two domains exhibit impressive cross-linguistic similarities; moreover the attested range of variation appears sufficiently small to be viewed as parametric in nature (...). Unfortunately, this cannot be said of the larger domains. While the intonational phrase is viewed by some researchers as directly related to s-structure (Rice 1987), others, such as Selkirk (1984) and Vogel and Kenesi (1990), question this assumption and assume a more semantic or even pragmatic role of intonational phrasing."

from Bengali, where the focus is marked with a low pitch accent L^* and an intermediate boundary tone H_P at the end of the focus-phrase.¹⁰ Since the focus-phrase is always an intermediate (or phonological) phrase, one should be able to observe juncture effects corresponding to the domain of the focus. In fact, Hayes & Lahiri (1991, 81ff) report such effects. In Bengali, the approximant /r/ can optionally assimilate totally to any following coronal consonant. This process can apply across word boundaries if the words are constituents of the same phonological phrase. In (46), the sequence $ra\grave{a}-r \check{c}^hobi-r$ is focused and forms a single phonological phrase. Therefore, the /r/ assimilation can apply yielding the $[\check{c}\check{c}^h]$ for $/r\check{c}^h/$. In contrast, the /r/ of \check{c}^hobi-r belongs to a different phonological phrase from the /j/ of $\grave{a}onno$. Here, no assimilation is possible:

(46)		L^*		H_P		L_I
	[a \grave{a}]	ami	[ra \grave{a}]a-r	\check{c}^hobi-r] _P	$\grave{a}onno$	t.aka anlam] _I
			[\check{c}	\check{c}^h]	[r]	[j]
	today	I	king's	pictures	for	money brought
	"Today, I brought money for <i>the king's pictures</i> ."					

In (47), we find the opposition situation: The focused phrase $ra\grave{a}-r \check{c}^hobi-r$ forms a phonological or intermediate phrase and allows for assimilation, while $ra\grave{a}-r$ and \check{c}^hobi-r are in two distinct phrases such that no assimilation is possible:

(47)			L^*		H_P	L_I
	[a \grave{a}]	ami	ra \grave{a}]a-r] _P	[\check{c}^hobi-r	$\grave{a}onno$] _P	t.aka anlam] _I
			[r]	[\check{c}^h]	[j]	[j]
	today	I	king's	pictures	for	money brought
	"Today, I brought the king's money <i>for pictures</i> ."					

In contrast to this view, Gussenhoven (1990, 27) claims that "the tonal association domain is not co-extensive with any one prosodic constituent, and an account of prosodic phrasing is given in which the prosodic hierarchy and tonal association domains play separate, though interdependent, roles." He illustrates his point in examples (48)-(50), which present a dilemma for intonational analysis. On the one hand, the vocative in (48), the reporting clause in (49), and the tag in (50) tend to be divided by a pause into two phrases; but on the other hand, the second phrase in each example does not appear to be accented and thus does not have a nuclear tone. According to the first observation, a phrasing into two units is called for, while the

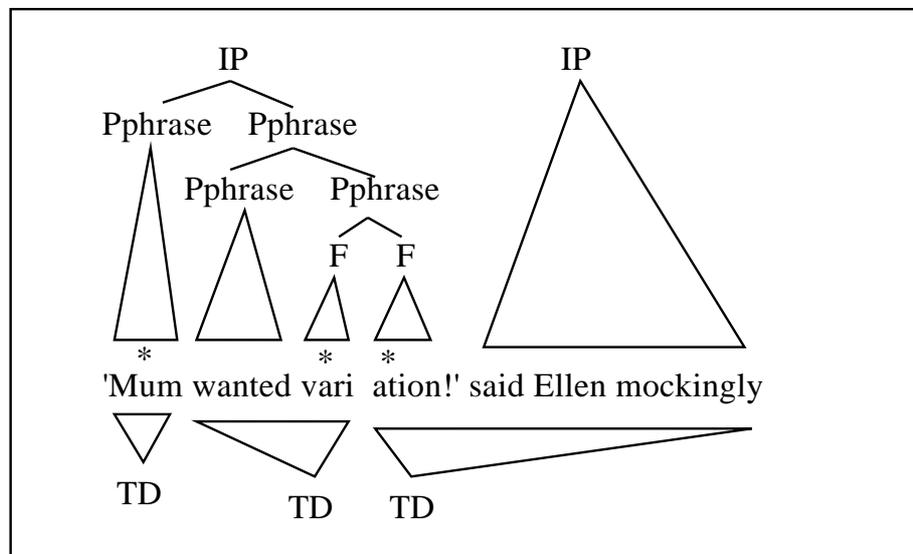
¹⁰ Hayes & Lahiri (199) index intermediate boundary tones with a *P* for phonological phrase.

second observation suggests an analysis as a single tone unit would be more appropriate:

- (48) Were you THERE, Jonathan?
 (49) 'We are not GOing', he said
 (50) Missed the BUS, has he

Gussenhoven proposes to abandon the assumption that the association domain of intonational phrasing should be a constituent of the prosodic tree in the same sense that the Foot or the IP are. Instead, let us assume that Tone Domains (TDs) are built in parallel to the prosodic hierarchy, as is illustrated in (51)

- (51) Intonational and prosodic phrasing in parallel (Gussenhoven 1990)



To conclude, the first three sections of this chapter have drawn a picture of the development of intonational phonology from the beginning until the actual state of art. In the beginning, it was difficult to argue that intonational effects are grammatical and therefore to be investigated in linguistics. Once accepted in linguistics, they still had a live on the edge as "secondary" kinds of structure and vague in description. Eventually, the development of autosegmental-metrical theory allowed us to describe intonational phenomena with all the linguistic elaborateness necessary for a modern science. The mapping of the intonational hierarchy onto the prosodic one indicates the possibility of integrating the autonomous (or "secondary") field of intonation into phonology proper, even though this is still controversial.

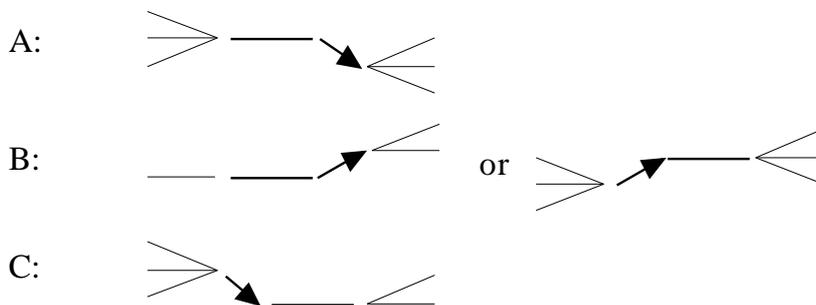
2.4 Pitch accent, stress, and focus

Pitch accent, *sentence accent*, *neutral accent*, *stress*, and *focus* are notoriously unclear or even undefined concepts. They are often used in different – sometimes in contradictory – ways by different authors. They are applied in phonological, semantic and syntactical descriptions. Their functions are closely related to each other, and often one notion is based on another, without having defined the latter properly. In particular, the relation between focus and sentence accent is very controversial, and it has important implications for the general architecture of the whole grammar.

2.4.1 Pitch accent and stress

There are basically three views of stress: *stress-as-loudness*, *stress-as-accent*, and *stress-as-rhythm* (Couper-Kuhlen 1986, 33). The view that stress is realized by loudness or intensity was held by the American structuralists, who separated pitch contours from stress. They represented both by independent phonemes (see section 2.1.4). Bolinger, the first to formulate *stress-as-accent*, on the other hand, criticized this separation. He argues that the main means to express stress is pitch, and therefore, the two things are not distinguishable: "I shall offer evidence that (...) pitch is our main cue to stress" (Bolinger 1958, 111). He proposes the term *accent* for prominence in the utterance: "To avoid unwanted associations, it is better to speak of pitch accent and leave the term stress to the domain of word stress" (Bolinger 1958, 149). The syllable is perceived as accented only if it has pitch prominence, i.e. a considerable pitch change at that place. In English, this pitch change can have three different shapes, which Bolinger names *A*, *B*, *C*. The accent *A* is a pitch movement *down from*, the accent *B* stands for a movement *up to* (or *from*), and the accent *C* represents a shift *down to the accented syllable*, as illustrate in (52):

(52) Forms of pitch accents (Bolinger 1958, 143f)



He then assigns meanings to the accents.¹¹ The accent A is assertive, C is anti-assertive and B means something like 'connectedness' and 'incompleteness'. In assuming full fledged meanings for the accents, he gives them morphemic status, rather than phonemic status as in the American structuralist tradition. However, Bolinger's view of stress cannot explain the existence of other phonetic cues to stress than pitch accent, such as duration, intensity, and spectral composition.

The view of autosegmental-metrical theory can be dubbed as *stress-as-rhythm*. The distinction of the American structuralists are reinterpreted: both stress and pitch are independent. But stress is not a binary feature of a syllable, but the whole text is assigned a stress- or prominence-pattern. In the *metrical theory of stress* of Liberman & Prince (1977), a text is assigned a prominence pattern that results from the lexical prominence patterns in terms of *weak* vs. *strong* syllables, and the combination of the constituents. This prominence pattern is represented as a rhythmical grid (Prince 1983), as illustrated in section 2.2.3 above.

The relation between stress and pitch accent is a more abstract one. Since the tune is generated independently of the text, and the text builds up its rhythmical grid independent of the pitch, the two structures must be associated or aligned. The prominent locations for this alignment is the pitch accent (the place of the strongest pitch movement) on the one hand, and the most prominent position in the stress-pattern (the stressed syllable). In this view, both stress and pitch accent are formed at different domains, but in their realization they depend on each other.

2.4.2 Pitch accent and focus

"It is now generally accepted that sentence accentuation reflects – in some way – the intended *focus* of an utterance." (Ladd 1996, 160). But what is the *focus*, or even the *intended focus* of an utterance? Bolinger (1985, 120) defines focus in very general terms as the expression which is highlighted: "My position is that accents are *prima facie* iconic, responding to the speaker's sensation of INTEREST in what he is saying plus a general desire to impress" This very general concept seems to have at least two more concrete instantiations: a broader concept of *information focus* and a more technical one *focus* in contrast to *presupposition*. The broader concept of information focus assumes that the intonational pattern expresses some additional information besides the sentence content. Since there is a clear picture of what the (ordinary) semantics of a sentence is built from, the additional function of intonation has to find its own domain. In the same way as the description of intonation was secondary to

¹¹ In fact, he does exactly the opposite. Bolinger (1958, 145) first determines certain functions and then assigns pitch contours to these functions: "The procedure that I have followed in grouping the accents about certain norms has been first to look for similarities and differences in meaning, and then to try to match them with similarities and differences in form. This reverses the approved order of business, but had to be adopted because pitch contours are if anything more fluid than meanings."

segmental or lexical phonology, the domain of intonational function is secondary to ordinary semantics. Halliday (1970, 22), for example, argues that focus expresses a *pragmatic-text-function*:

In general, tone expresses speech function, while tonic prominence [pitch accent, KvH] expresses the structure of information. [...] The choice of tonic prominence—where to put the tonic; also in fact, where to divide up into tone groups—relates to how the message is divided into units of information, where the main 'new information' lies, and how it ties up with what has been said before: anything that contributes to the structure of the discourse, in other words." (Halliday 1970, 22)

Halliday (1967b) coined the term *informational unit*. His concept of information structure can be understood as an adaptation of the *thematic structure* of the Prague school. However, he transcends the terms *theme* and *rheme* and introduces instead the terms *given* and *new* to the American research society. Chomsky (1971), Jackendoff (1972) and others used the term *focus* in a more technical way as the complement to *presupposition*. In this view, the sentence can be divided into focus and presupposition (see section 3.2.4 for a detailed account). For all these studies, the definition of focus refers to the semantic-pragmatic domain. However, it is not clear at all what it is that constitutes focus on the semantic side: "The speaker's decision about what to focus is subject to all kinds of contextual influences which are at best poorly understood" (Ladd 1996, 164).

Focus is understood as a semantic-pragmatic concept, indicating a certain relation of the focused expression to the discourse context. Jackendoff (1972) introduced the syntactic focus-feature *F* at the level of syntactic structure in order to describe the syntactic correlate to the semantic notion of focus. Thus, the focus concept is understood as a hypothetical construct that has a phonological correlate (the sentence accent), a semantic-pragmatic correlate (the new information), and a syntactic correlate (a syntactic feature [+F]). In the short history of the development of a comprehensive theory of focus, each correlate has been chosen from different schools of thought as a conceptual starting point.

Most theories assume that the syntactic constituent with the focus feature correlates with the semantic scope of the focus. However, the relation between the accent and the focused constituent (in its semantic or syntactic guise) is highly controversial. We can distinguish three families of theories on the focus-accent relation: (i) a syntactic or structured-based approach, (ii) a semantic or highlighting-based approach, and (iii) information structure approach. The information structure approach of Halliday (1967b) will be discussed in chapter 3 in some detail. Since Bolinger's semantic approach to the focus-accent relation is a reaction of the syntactic approach, both will be presented together in the next section.

2.4.3 Focus projection

The linguistic description of accent patterns involves two complementary aspects: a description of which part of the utterance is focused and a description of how this focus is conveyed by the location of the accent. The problem is illustrated with the sentence (53) with final accent on *bats*. The final accent can be associated with different focus structures:¹² In (53a), only *bats* is in focus, in (53b) the NP *a book about bats*, in (53c) the VP, and (53d) the whole sentence (cf. Selkirk 1995, 554f). However, if the subject *Mary* or head of the object *book* is accented as in (54) and (55), the focus cannot be extended to other expressions.

- | | | |
|-------|--|--------------------------------------|
| (53) | Mary bought a book about BATS. | (What did Mary buy a book about?) |
| (53a) | Mary bought a book about [BATS] _F . | (What kind of book did Mary buy?) |
| (53b) | Mary bought [a book about BATS] _F . | (What did Mary buy?) |
| (53c) | Mary [bought a book about BATS] _F . | (What did Mary do?) |
| (53d) | [Mary bought a book about BATS] _F . | (What happened?) |
| (54) | [MARY] _F bought a book about bats. | (Who bought a book about bats?) |
| (55) | Mary bought a [BOOK] _F about bats. | (What related to bats did Mary buy?) |

The relation between the phonologically marked word *bats*, its syntactic position, and the extension of the focus are related to each other by rules of *focus-projection*. In the generative tradition, focus projection is determined by the surface structure:

Once the speaker has selected a sentence with a particular syntactic structure and certain lexical items (...), the choice of stress contour is not a matter subject to further independent decision. That is, he need not make a choice among various "stress phonemes" or select one or another "superfix". With marginal exceptions, the choice of these is as completely determined as, for example, the degree of aspiration. (Chomsky & Halle 1968, 25)

Focus projection rules determine the accent of compositions by the stress patterns of their parts. For example the contrast between the focus projection potential in (53), on the one hand, and (54) and (55), on the other, must be taken in consideration when formulating such a rule. The most basic and known rule of this kind is the *Nuclear Stress Rule* (NSR) (56) of Chomsky & Halle (1968), which operates on the syntactic surface structure. If a constituent that consists of two sister constituents is focused, the right sister received the accent. In sentence (57), first each word gets a lexical stress. Then the NSR is applied to the VP *hit Bill*, where the right constituent *Bill* receives the

¹² As already mentioned, the focus domain is generally indicated at the level of syntactic form. Since a one-to-one mapping from syntactic form and semantics is assumed, this correlates with the semantic form.

main stress (marked by *I*). Then the NSR is applied to the subject and the VP, where the latter receives main stress, such that the rightmost lexical element *Bill* gets the main stress:

(56) Nuclear Stress Rule

$[_F X Y] \rightarrow [_F X Y]$

(57) $[_S \text{John} [_{VP} \text{hit BILL}]_{VP}]_S$

1	1	1	lexical stress
	2	1	NSR
2	3	1	NSR

The NSR has been often criticized, in particular by Bolinger (1972), who argues that the relation between focus and accent is one-to-one and that no projection rules are necessary. In his classical article *Accent is Predictable (if You are a Mind-Reader)* from 1972, he argues that it is the speaker who decides which expression is in focus. The speaker *highlights* the focused constituent as the most informative one by giving it intonational prominence.

The distribution of sentence accents is not determined by syntactic structure but by semantic and emotional highlighting. Syntax is relevant indirectly in that some structures are more likely to be highlighted than others. But a description along these lines can only be in statistical terms. Accents should not be mashed down to the level of stresses, which are lexical abstractions. In their zeal to reverse Trager-Smith phonology, transformationalists have fallen into the same trap. Whether one tries to set up prosodic rules for syntax or syntactic rules for prosody, the result is the same: two domains are confused which should be kept apart. (Bolinger 1972, 644)

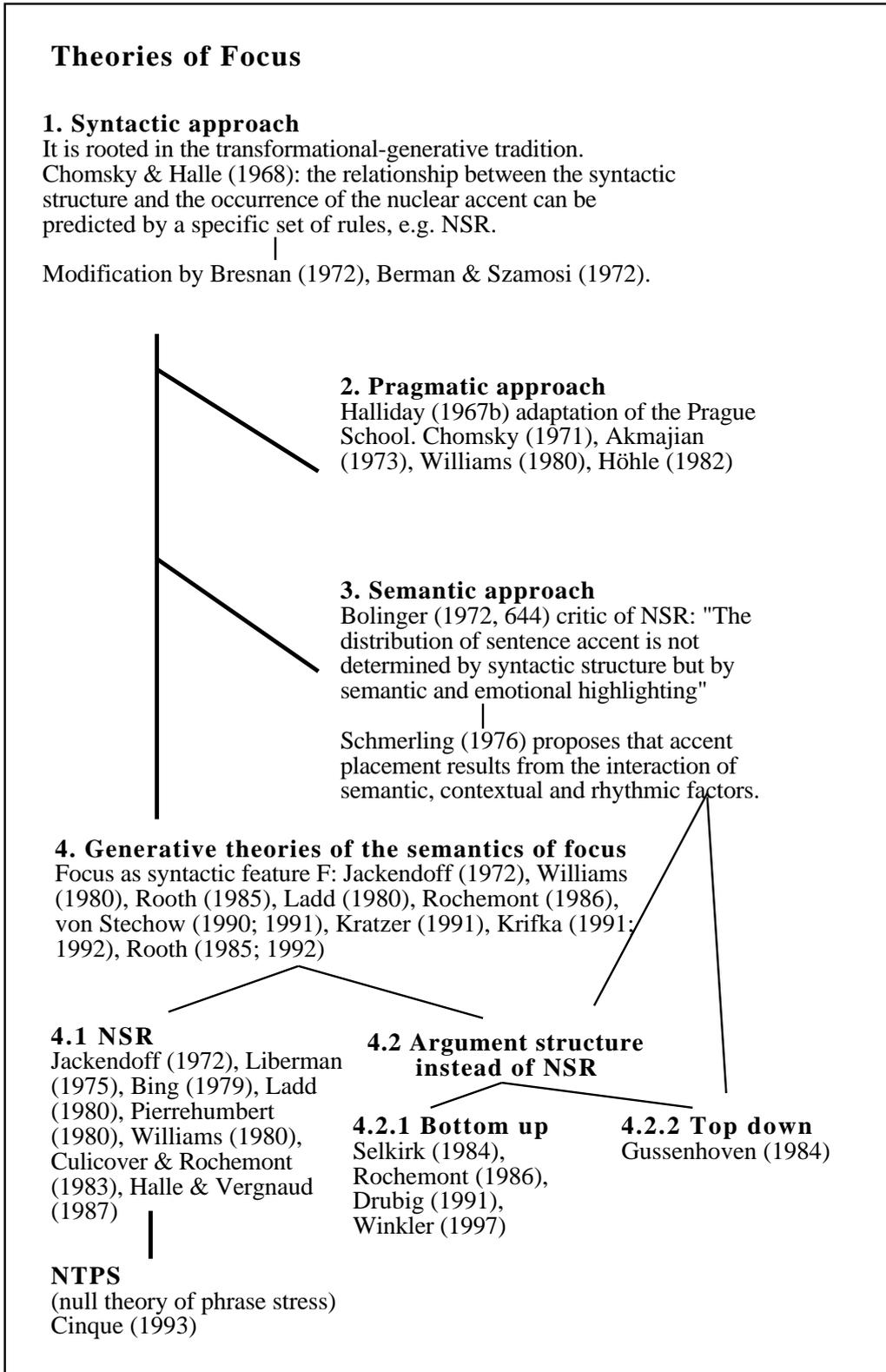
Bolinger (1972, 634) illustrates this with the following example. In (58a), the verb *elucidate* contains more information than its argument *topics*, and therefore it receives the main accent. In (58b) the verb *cover* does not contain much information and is quite predictable, such that the argument gets the accent.

(58a) I can't finish in an hour – there are simply too many tòpics to elúcidate.

(58b) I can't finish in an hour – there are simply too many tópics to cover.

His main idea is that the accented word constitutes the focus and the focus expresses the relevant information in the sentence. In this framework, no focus projection is necessary. In reaction to this criticism of the NSR several modifications have been proposed.

(59) Overview of theories of focus (-accent relation)



The overview (59) describes different theories of focus (-accent relation) and their historical and systematic relation.¹³ The syntactic approach of Chomsky & Halle (1968) introduced the NSR. They were influenced by the notion of *focus* and *information structure* of the pragmatic approach (Halliday 1967b). The syntactic approach was criticized by the semantic approach of Bolinger (1972) and Schmerling (1976). This led to a modification of the syntactic approach (Bresnan 1971 and others).

Theories in the generative tradition keep to the view that the accent location and the focus domain are not necessarily identical. Therefore, they must assume projection rules for describing the relation between accented syllables and the scope of the focus. Semantic theories (Rooth 1985, von Stechow 1990, Krifka 1991) assume that the focus feature is provided by the syntax. They are interested in the compositional semantics of focus and focus particles, rather than in the particular formulation of the projection rules (see chapter 4).

Gussenhoven (1984), Selkirk (1984), and Rochemont (1986) – building on initial insights of Schmerling (1976) – argue that the theory of focus projection must be framed in terms of syntactic notions and in particular makes appeal to the *argument structure* of the sentence. For example, Selkirk (1984) proposes a set of principles for the *licensing* of F-marking, i.e. for the relation between focus and intonational structure. The basic focus rule establishes a direct link between a pitch accent and focus: a word carrying a pitch accent is assigned a focus feature. The second rule, the *phrasal focus rule* controls the percolation of the focus feature by a recursive definition that is based on argument structure (Selkirk 1984, 207):

(60) Basic Focus Rule

A constituent to which a pitch accent is assigned is a focus

(61) Phrasal Focus Rule

A constituent may be a focus if (i) or (ii) (or both) is true:

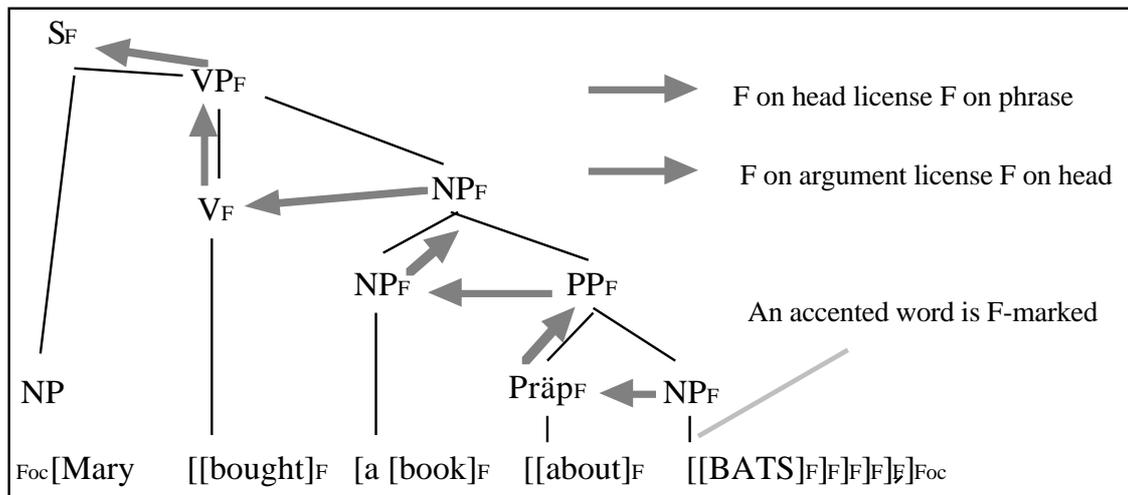
(i) The constituent that is its *head* is a focus

(ii) A constituent contained with it that is an argument of the head is a focus.

To illustrate the focus projection, let us reconsider our example (53), repeated as (62). The basic focus rule assigns focus to *bats* since it bears the main accent. The phrasal focus projects the focus feature *F* in the syntactic tree giving rise to other potential domains for the focus.

¹³ This chart is partly based on the excellent discussion in Winkler (1997, 93-192)

(62) Focus projection via argument structure based on (Selkirk 1984)



A constituent with a focus feature is interpreted as new information, according to the Focus Interpretation Principle (Selkirk 1984, 213). But what is new information?

Selkirk (1995, 563) has changed her mind and proposes that sentence accent is assigned due to information structure, rather than syntactic surface structure. She introduces the Pitch Accent Prominence Rule as a purely discourse-semantic determination of sentence accent assignment:

(63) Pitch Accent Prominence Rule (PAPR)

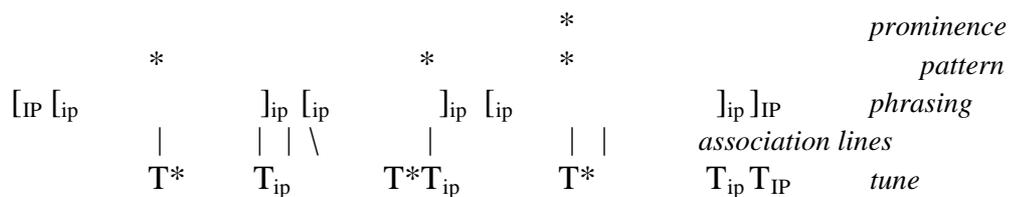
A syllable associated to a pitch accent has greater stress prominence than a syllable which is not associated to a pitch accent.

This rule has precedence over the NSR, which is only applied if the sentence does not exhibit an information structure (in Selkirk's term a *given-new* contrast) "Given the Pitch Accent Prominence Rule, the Nuclear Stress Rule has the status of a default principle, applicable only when 'all else is equal.' It will indeed be responsible for the phrasal stress pattern (...) but only when all words are accented (as in an all-new utterance), or when all are unaccented (because given in the discourse)." Selkirk (1995, 563). This move from a syntactically defined location of sentence accent towards a discourse-semantic view of assigning sentence accents brings us to the issue of intonational meaning.

2.5 Intonational meaning

In the course of this chapter, I have discussed the development of a phonological theory of intonation. It was shown that such a theory describes the three independent subsystems of intonational pattern, tune, prominence, and phrasing, at abstract levels of representation, which are linked by association lines, as illustrated in (6), repeated as (64):

(64) Overall schema of the intonational subsystems



The development started with the definition of intonation as a linguistic research domain and the "phonemicizing" of the features involved. The assumption that intonation expresses a function or a meaning is one of the basic methodological fundamentals of this research tradition. The separation between a linguistic and a paralinguistic or non-linguistic meaning was essential to establish the proper domain of intonational data. And the contrast in meaning between minimal pairs defined the smallest units of the intonational systems. Thus, many aspects of intonational phonology are based on the assumption that intonational patterns convey meaning. However, there is no agreement of what kind of meaning. Unlike the elaborate phonological systems, the semantic background for defining the basic units is very poorly developed.

There are two main questions with respect to intonational meaning: (i) what are the meaningful units of intonation, and (ii) what kind of meanings are associated with these units (cf. Gussenhoven 1984, 194ff). With regard to the meaningful units, we can distinguish between holistic and compositional views. According to the holistic view (Bolinger 1964, Liberman 1975, Liberman & Sag 1974), the whole intonation-contour expresses one function, which cannot be decomposed into meaningful elements. If the contour is composed of smaller units like the movements in the British School or the level tones in the American structuralist view, these units have only phonemic status. In other words, the meaning of the contour cannot be composed from the meaning of its parts, since phonemes do not contribute to meaning. The compositional view, however, assumes that the elements of the intonation contour, the abstract tones, are morphemes and therefore carry meaning. Thus the meaning of the contour can be derived from the meaning of its elements (cf. Pierrehumbert & Hirschberg 1990; Hayes & Lahiri 1991). With respect to the second question, there are approaches that assign a very vague function to the intonational feature, e.g. a rise is associated with the notion *open* or

non-finality (Bolinger 1964). Other theories assign quite specific meanings, e.g. Liberman & Sag (1975) describe the *tilde*-contour (fall-rise) as indicating *contradiction*. The directions taken with respect to the two question are additionally cross-classified by the domains of intonational patterns: tune, phrasing, and pitch accent.

In this section, I discuss the meaning types that are associated with each of the mentioned domains: The tune is often correlated with speech acts, phrasing is mostly associated with information structure, and the pitch accent is linked with the semantic notion of focus. Furthermore, the particular shape of the pitch accent is said to express the way the object referred to is presented. Finally, the question of the composition of meaningful units will be addressed.

2.5.1 Tune and speech acts

O'Connor & Arnold (1973) and Liberman (1975) assume that the tune conveys the speaker's *attitude* (politeness, judiciousness, surprise, or seductiveness) or *emotion* (hate or anger). Liberman & Sag (1974) and Sag & Liberman (1975) ascribe *speech acts* to the tune (statements, requests, or contradictions), while Ward & Hirschberg (1985) see the proper function of tunes as expressing propositional attitudes (belief, ignorance, or uncertainty).¹⁴

However, none of these functions has been successfully established for particular tunes, and it is not clear at all whether one or the other kind of function covers the different uses of tunes. Pierrehumbert & Hirschberg (1990, 284) criticize each of the mentioned functions. They argue, for example, that one and the same personal attitude can be derived from different tunes and one and the same tune can give rise to different attitudes. Since pitch range and voice quality are also associated with personal attitudes or emotions, this seems not to be a useful way of characterizing tune. They argue that the same holds for propositional attitudes and speech acts since certain tunes can be associated with different speech acts. The "assertive" tune H* L L% is not only associated with the speech act *assertion* but also with the speech act *question* in constituent questions.

What these different approaches share is that they – at least implicitly – assign a function to a holistic contour. Such a non-compositional account, however, seems not to be necessary, in particular in the light of the development of intonational phonology. It was demonstrated that the tune itself consists of different tones with different

¹⁴ Compare also Halliday (1970, 22): "In general, tone expresses speech function, while tonic prominence expresses the structure of information. That is to say, the choice of tone—tone 1, tone 2, etc.—relates to mood (kinds of statement, question, etc.), modality (assessment of the possibility, probability, validity, relevance, etc. of what is being said) and key (speaker's attitude, of politeness, assertiveness, indifference, etc.); in other words all the factors which go to make up the relation between the speaker and the hearer, in a speech situation."

phonological functions: the pitch accent associates with the most prominent syllable in the text, while the boundary tones associate with phonological phrasing. According to this architecture one would expect not only that the phonological representation of the tune is composed of different tones associated with different phonological domains, but also that the function of the tune is composed of different functions. In contrast to the noncompositional or holistic view, Pierrehumbert & Hirschberg (1990, 286) suggest the following research direction:

Our idea of the compositionality of tune meanings is based upon a hierarchical model of phonological domain, in which the scope of interpretation of tones is the node to which they are attached. So, the components of tune—pitch accents, phrase accents, and boundary tones—are each interpreted with respect to their distinct phonological domains. Pitch accents, phrase accents, and boundary tones each operate on a (progressively higher) domain of interpretation. Not only is each of these types of tone interpreted over a distinct domain, but each contributes a distinct type of information to the overall interpretation of a tune.

Pierrehumbert & Hirschberg (1990, 286ff) characterize the function of the different tones as follows: "Pitch accents convey information about the status of the individual discourse referents" and their relative salience indicated by the speaker. Phrase accents (or boundary tones for intermediate phrases) "convey the degree of relatedness" of intermediate phrases to preceding or succeeding intermediate phrases. The boundary tones (i.e. the boundary tones for an intonational phrase) "contribute information about the intonational phrase as a whole. (...) We believe that boundary tones convey information about relationships among intonational phrases—in particular, about whether the current phrase is to be interpreted with particular respect to a succeeding phrase or not." These very general remarks will be discussed in the next section in a more precise way.

2.5.2 Intonational phrase and discourse structure

The boundary tones of an intonational phrase (final fall: L_{IP} or final rise: H_{IP}) are often associated with the speech act or the propositional attitude of the speaker towards the content of the intonational phrase. This function is sometimes believed to be a universal feature of intonation. However, as it was already pointed out in section 1.3, it is not always the case that a final rise indicates a question or a "non-finality" etc. In section 1.3 a modified view was presented, according to which the function of the final pitch movement is rather a modification of the sentence mood determined by syntactic structure. Table (7) from section 1.3 is repeated as (65):

(65) Relations between speech act and sentence function in German

Sentence Type (Mood)	Tone	Speech Act
Declarative	Fall Rise	Assertion Echo question Uncertain statement
Imperative	Fall Rise	Command Request, plea
Interrogative (auxiliary inversion)	Fall Rise	Peremptory question Neutral question
W-question <i>wer, wie, ...</i>	Fall Rise	Neutral question Interested or echo question

Even this modified view makes the implicit assumption that the intonational phrase is associated with a text that expresses a proposition. This is often the case, as in full sentence-, clause- and even in one word-utterances. However, we also find cases in which the text associated with one intonational phrase does not express a proposition, as in (30) from section 2.3, repeated here as (66):

(66) [Fred,]_{IP} [who's a volunteer fireman,]_{IP} [teaches third grade]_{IP}
 | | |
 H% H% L%

It is uncontroversial that the boundary tone associates with the edge of an intonational phrase. As pointed out in section 2.3, boundary tones are not the only means to express intonational breaks. This can also be indicated by pauses, vowel lengthening etc. Besides the signaling of the phrase boundary, the shape of the tones carries an additional function, which is assumed to have scope over the whole phrase.¹⁵

Pierrehumbert & Hirschberg (1990, 308) propose a general discourse function for boundary tones: "Boundary tones convey information about the directionality of interpretation for the current intonational phrase—whether it is 'forward-looking' or not." They (1990, 305) illustrate the point with the contrast between (67) and (68) (their (59) and (60), the unmarked tone L corresponds to the phrase accent in their terminology): "In a sequence like (59), for example, the **H** boundary tone on (59b) conveys that (59b) is to be interpreted with respect to a succeeding phrase, (59c)—not that (59b) itself is particularly intended to elicit a response:"

¹⁵ This is another implicit assumption about the meanings of intonational patterns. It is assumed that the parts of the intonational phrase are composed in such a way that the boundary tone takes scope over the whole content. However, in morphology we find other cases, where a final morpheme does not take scope over the whole construction, but rather over a part of the construction. These cases are discussed under the heading *bracketing paradoxes*.

- (67=59)a My new car manual is almost unreadable
L L%
- b It's quite annoying
L H%
- c I spent two hours figuring out how to use the jack
L L%

In contrast to this, the use of the H boundary tone in (68a) indicates that sentence (68a) is to be interpreted with respect to the following (68b):

- (68=60)a My new car manual is almost unreadable
L H%
- b It's quite annoying
L L%
- c I spent two hours figuring out how to use the jack
L L%

They add that this contrast can also be detected by anaphora resolution for the pronoun *it* in the middle sentence. In (67) the pronoun is likely to be interpreted as *my new car manual*, while in (68) it is likely to be linked to the whole event of spending two hours figuring out how to use the jack.

2.5.3 Intermediate phrase and sentence structure

Intermediate phrases (ip) are the immediate constituents of intonational phrases (IP). According to Beckman & Pierrehumbert (1986), Ladd (1986) and others, the intermediate phrase is marked by a final boundary tone L_{ip} or H_{ip} (the old phrase accent of Pierrehumbert 1980). The break between intermediate phrases is not as strong as between intonational phrases (see section 2.3.2 above). Like intonational phrases, intermediate phrases are used to structure the linear sequence of words into larger units. Besides the other characteristics an intermediate phrase boundary can block certain junctural processes as illustrated by the Bengali examples in section 2.3.3. The breaks between intermediate phrases can promote certain grammatical options in ambiguous contexts. Examples (37)-(40), repeated as (69)-(72), illustrate this point. In (69) the break between the two intermediate phrases blocks a possible modification of *sun* by the directly preceding modifier *a round-windowed*. Similarly, in (70), the parallel elements are structured in independent intermediate phrases. And the contrast between the tag reading (71) and the object reading (72) of *Manny* is marked by the intermediate phrase.

- (69) [IP [IP a round-windowed] [IP sun illuminated room]]
 (70) [IP they gave [IP orange marmalade] [IP lemon oil marmalade] [IP and
 watermelon-rind marmalade ?]]
 (71) [IP [IP Mary will win] Manny]
 (72) [IP Mary will win Manny]

Thus, like intonational phrases, intermediate phrases comprise expressions that are more closely related to each other than to elements outside their phrase. Selkirk (among others) has dubbed this principle the *sense unit condition* (see section 2.3.1). Like intonational phrases, intermediate phrases in English are represented by a boundary tone L or H. According to Pierrehumbert & Hirschberg (1990, 308), these tones (their phrase accents) "convey information about the relatedness of intermediate phrases—in particular, whether (the propositional content of) one intermediate phrase is to form part of a larger interpretative unit with another."

For example, the choice of the boundary tone in (73) influences the reading of *and* as either simple co-ordination, as in (73a), or as implying a causal link, as in (73b).

- (73a) [[George ate chicken soup] [and got sick]]
 | | | | | | \\
 H* H* H* L_{ip} H* L_{ip} L_{IP}
 (73b) [[George ate chicken soup] [and got sick]]
 | | | | | | \\
 H* H* H* H_{ip} H* L_{ip} L_{IP}

2.5.4 Prominence and focus

The stress pattern of an utterance was defined in terms of relative prominence. Word stress is assigned by lexical-phonological rules. Sentence accent, realized as the nuclear pitch accent, reflects the information structure of the sentence, in particular the "focus of the sentence" (see section 2.4.2 and section 3.2 below). For example, sentence (74) would usually be produced with the main phrasal stress (the nuclear stress) on the word *vitamins*, if the sentence is uttered *out of the blue*:

- (74) Legumes are a good source of VITAMINS.

If, however, the sentence is the reaction to another sentence, contradicting that legumes are a bad source of vitamins, the stress falls on the contrasting element *good*:

- (75) A: Legumes are a pretty poor source of vitamins.
 B: No, Legumes are a GOOD source of vitamins.

As mentioned before, Bolinger (1972) describes the semantic-pragmatic function of prominence as *highlighting*. He correlates the phonological prominence with informational prominence (this view will be discussed in section 3.2 in detail). Depending on the embedding context, Culicover & Rochemont (1983, 152) "distinguish at least three types of focus: contrastive, informational and presentational." *Contrastive focus* indicates that the speaker believes that the hearer believes that another value than the focus holds. *Informational focus* specifies an already given focus, i.e. it is the answer to a constituent question. And *presentational focus* introduces a new referent that cannot be extracted from the context, i.e. that is the case of *out of the blue* assertions.

While phrasing divides an utterance in equal units, the prominence patterns are mostly interpreted with respect to their *discourse anchoring* or *salience* in the discourse:

All pitch accents render salient the material with which they are associated. This is true regardless of the type of accent in question. (...) Accented material is salient not only phonologically but also from an informational standpoint. And items that are deaccented, by extension, do not undergo this salience marking—although they may already be salient or become salient by other means. (Pierrehumbert & Hirschberg 1990, 288f)

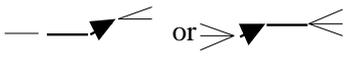
Even though it is not clear what it means to render *accented* by *salient* (rather than *focused*), the important point to note here is that prominence is to be distinguished from the pitch accent (see section 2.4.1). While prominence marks certain phrases, pitch accents indicates the operation we apply to them.

2.5.5 Pitch accent and the way of presentation

The prominence pattern selects a particular phrase of the sentence. At the same time the prominent syllable is also the place for the pitch accent, i.e. the location where the greatest pitch movement takes place. Most theories assume that the focus indicates new or unexpected material. However, this view does not correspond to the different pitch patterns that can be associated with the prominent syllable. In dividing the tune into abstract tones, the pitch accent in English received a more prestigious position compared to boundary tones. For it is the only abstract location of the tune that allows for complex tones. Boundary tones have only two realizations limiting their functional potential to maximal two discrete meanings. Pitch accents, on the other hand, are much richer in their shape allowing for more functions. This picture holds for English and German, but not for Bengali, where we have more complex boundary tones (see section 2.5.6).

In section 2.4.1 Bolinger's three pitch accents had been introduced in section 2.4.1. He assigns them a particular meaning as illustrated in (76):

(76) Meaning of configurational pitch accents (Bolinger 1958)

	configuration	description	function
A		down from	assertive
B		up to (or from)	'connectedness', 'incompleteness'
C		down to the accented syllable	anti-assertive

Gussenhoven (1984, 201) defines the meaning of his three pitch accents in terms of the contribution to the background – or what he calls "manipulations of the Variable" as in (77):

(77) Function of pitch accents (Gussenhoven 1984)

		description	function
1	fall	HL	addition
2	fall-rise	HLH	selection
3	rise	LH	testing

- 1 The speaker may add the Variable to the background. (ADDITION)
- 2 The speaker may select a Variable from the background. (SELECTION)
- 3 The speaker may choose not to commit himself as to whether the Variable belongs to the background. Since by far the most common purpose for which this option is employed would appear to be characterisable as the speaker's testing whether a Variable belongs to the background, this option is referred to as (RELEVANCE) TESTING. It should be remembered, therefore, that the term strictly refers to the meaning given earlier.

However, Gussenhoven is not very explicit about his discourse model or representation. His "manipulations" are merely descriptive terms, and like in the case of Bolinger, one does not see an elaborate representation. Bolinger describes the function of the pitch accent in terms of speech acts or operations on propositional contents. Gussenhoven is more careful in doing so. His "manipulations" do not necessarily operate on propositional contents, but can also operate on smaller units. In fact, the prototypical case for Gussenhoven is an argument and its discourse referent, which can be added, selected or tested.

Pierrehumbert & Hirschberg (1990, 289) define the function of pitch accents with respect to a variable in a logical form, following the general approach sketched in Jackendoff (1972). As quoted in the last section, they assume that accent as such

produces salient locations in a logical form. For illustration, they represent these locations by variables:¹⁶

For purpose of illustration, we will view the logical form corresponding to an intonational phrase as an open expression in which accented items are replaced by variables:

(9) George likes pie
 \mathbf{H}^* $\mathbf{H}^* \mathbf{L} \mathbf{L}\%$

(10) x like y
 $x(\mathbf{H}^*)$ $y(\mathbf{H}^*)$
 $x = \text{George}$ $y = \text{pie}$

The open expression is x like y . The instantiation of x is *George*, a pointer to an individual. The instantiation of y is *pie*, a pointer to a class. Both the individual and the class in question are marked as salient by the mere fact that the lexical items pointing to them are uttered with an accent.

The functions of pitch accents are defined as different kinds of operations of assigning values to the variables or linking values to already established values:

(78) Function of pitch accents (Pierrehumbert & Hirschberg 1990, 289-302)

pitch	<i>discourse function</i>	<i>typical environment, or e.g.</i>
\mathbf{H}^*	items are new	neutral declarative intonation
\mathbf{L}^*	items are not to be instantiated in the open expression	yes-no questions and others
$\mathbf{L}+\mathbf{H}$	convey the salience of some <i>scale</i> linking the accented item to other salient items	$\mathbf{L}^*+\mathbf{H} \mathbf{L} \mathbf{H}\%$: uncertainty $\mathbf{L}+\mathbf{H}^* \mathbf{L} \mathbf{H}\%$: correction
$\mathbf{H}+\mathbf{L}$	instantiations of the accented items should be inferable	$\mathbf{H}^*+\mathbf{L} \mathbf{L} \mathbf{L}\%$ "teaching" $\mathbf{H}+\mathbf{L}^* \mathbf{H} \mathbf{L}\%$: confirming a reaction previously recognized

Unfortunately, Pierrehumbert & Hirschberg (1990, 308) describe these functions in the discourse model of centering theory, in which the beliefs of the speaker and hearer interact: "We propose that S chooses an intonational contour to convey relationships between (the propositional content of) the current utterance and previous and subsequent utterances—and between (the propositional content of) the current utterance

¹⁶ They mention in a footnote (fn. 5, p. 309) that the status of the logical form is purely illustrative and metaphorical: "We are not yet prepared to propose a particular representation for intonational meaning, and so this depiction should be understood as metaphorical only. In particular, we do not intend that these open expressions represent presuppositions of an utterance, as previously suggested by Jackendoff (1972), and Wilson and Sperber (1979)."

and beliefs H believes to be mutually held."¹⁷ If the intonational meaning of pitch accents can only be understood with respect to the beliefs of the discourse participants, we must first have a theory of beliefs before we can understand intonational meaning. However, it may emerge that a theory of beliefs is even more complex and less understood than a theory of intonational meaning.

Nevertheless, explaining the function of pitch accents by operations on variable assignments is the first step in the right direction. Pitch accents do not indicate speech acts or parts of speech acts, they express the relation of the phrase with respect to a discourse environment. The term could be new, old, inferable etc. In such a view, the function of pitch accents is very close to the function of indefinite NPs, definite NPs, and anaphoric pronouns. So, it might be wise to use the same semantic devices for describing intonational functions one uses for describing (in)definiteness. Discourse Representation Theory is one of the most elaborate semantic theories that accounts for definiteness as discourse relations between discourse referents. In fact, this will be the starting point of my account of intonational meaning in chapter 5. In order to lay the systematic and methodological ground, I discuss in the next two chapters traditional theories of information structure and semantic approaches to focus.

2.5.6 Compositionality

A somewhat different approach to the compositionality of intonational features is taken by Hayes & Lahiri (1991), who keep to a more traditional view of morphemes as meaningful units in the lexicon. In the classical view, morphemes are conceived as parts of words, either as stems or as affixes. They are listed in a lexicon and they can combine according to particular rules. Liberman (1975) suggested such a structure for intonational features, perhaps inspired by his analysis of lexical tones in African languages, where they are associated with the stem or the affix of a word. Following this approach, Hayes & Lahiri (1991, 77) describe the intonational lexicon in terms of *stems*, *suffixes* and *prefixes*:

¹⁷ Hobbs (1990) intends to rephrase this theory in more formal terms. However, the only thing he formally reconstructs is the function of variables. He assumes, following Heim (1982) and Kamp (1981) that NPs are interpreted as sentences that assign their descriptive content a referent: "Every morpheme in an utterance conveys a proposition. In the sentence

George likes pie

the information conveyed can be represented

e,x,y (Present(e) & like'(e,x,y) & George(x) & pie(y))"

(Hobbs 1990, 313). Unfortunately, he does not develop this reconstruction further.

(79) The intonational lexicon of Bengali (Hayes & Lahiri 1991)

a	Accents ("stems"):	L*	question accent
		H*	declarative accent
		L*H _p	focus accent
b	Boundary Tones ("suffixes"):	L _I	neutral
		L _I H _I	continuation rise
		H _I	offering
		H _I L _I	yes/no
c	Prefix:	L+	finality marker (forms L+H* when attached to H*)

Hayes & Lahiri (1991, 77) add the following remark: "These morphemes combine fairly freely, (...). We believe that further decomposition of the contours, especially the boundary tone sequences, may be possible, but to do this will require a better understanding of their meanings."

Summing up, there are three main aspects to the meaning of intonational features discussed in this section: (i) Boundary tones indicate the relation of the phrase they are assigned to other parts of the discourse. (ii) Pitch accents mark the kind of variables that stand for the focused expression. They also may indicate how this variable is linked to the discourse. (iii) Tones are represented as morphemes in an intonational lexicon. They combine by compositional rules to form tunes, which express a complex meaning.

All these aspects of intonational meaning make crucial use of some kind of semantic representation. However, no clear picture of this representation is drawn. In the remainder of this book, I discuss some semantic theories of information structure and focus and then develop a new semantic representation of information structure. The semantic functions of intonational features can be linked to this representation. Chapter 3 presents the development of and the classical approaches to information structure. Chapter 4 summarizes two of the most important semantic approaches to focus, LF-movement theories and Alternative Semantics. Chapter 5 shows that these theories cannot explain the interaction of certain semantic operators with focus. Chapter 6 develops a representational theory of information structure, and Chapter 7 sketches the connection between this semantic representation and the autosegmental representation of intonation. The place of this interaction is the intonational lexicon.

Chapter 3

Information structure and the partition of the sentence

The term *information structure* was introduced by Halliday (1967b, 200). It informally describes the organization of a spoken sentence, which is independent - and sometimes even orthogonal to - syntactic constituency:

Any text in spoken English is organized into what may be called 'information units'. (...) this is not determined (...) by constituent structure. Rather could it be said that the distribution of information specifies a distinct structure on a different plan.

This level is motivated as the functional correlate of the intonational phrases of an utterance, which are Halliday's "tone groups" (see section 2.3):

The distribution into information units represents the speaker's blocking out of the message into quanta of information, or message blocks. Each information unit is realized as one tone group, in the sense that the information structure specifies the boundaries of the tone group to within certain limits (...). (Halliday 1967b, 202)

This description of information structure as blocks or units of information is the most neutral one in the literature. So far, information structure is defined by (i) the general concept of information units and (ii) by correlation to intonational phrasing.

Halliday himself adds further aspects to this concept, such as a *thematic organization* and the primacy of a division into two parts. The combination of these two additional aspects yields the common picture of information structure as a dichotomy of the sentence: The information structure of a sentence consists of two parts, one more informative and one less informative. The contrast is either marked by word order or by intonation. For example, the more informative part is generally believed to follow the less informative part (often referred to as *theme-rheme* or *topic-comment* structure). Or the most prominent intonational feature, the pitch accent, is correlated with the most informative part, while the rest of the sentence is less informative (often referred to as *focus-background* partition).

During the last 100 years a confusing proliferation of terminology has been used to capture this dichotomy. Most of the terms are used by different theories in different ways. To list only a few:

(1) Terminology for informational dichotomy

<i>psychological subject</i>	
<i>-psychological predicate</i>	(von der Gabelentz 1869, Paul 1880)
<i>theme-rheme</i>	(Ammann 1928: Thema-Rhema, Mathesius 1929, Prague School (Daneš, Firbas), Halliday 1967b)
<i>topic-comment</i>	(von der Gabelentz 1869, Reinhart 1982)
<i>topic-focus</i>	(modern Prague School: Sgall & Hajičová & Benešová 1973)
<i>presupposition-focus</i>	(Chomsky 1971, Jackendoff 1972)
<i>background-focus</i>	(Chafe 1976 for contrastive focus, Jacobs 1982)
<i>old/given-new</i>	(Halliday 1967b, Chafe 1976)
<i>open proposition-focus</i>	(Prince 1981)
<i>notional subject-notional predicate</i>	(É. Kiss 1995)

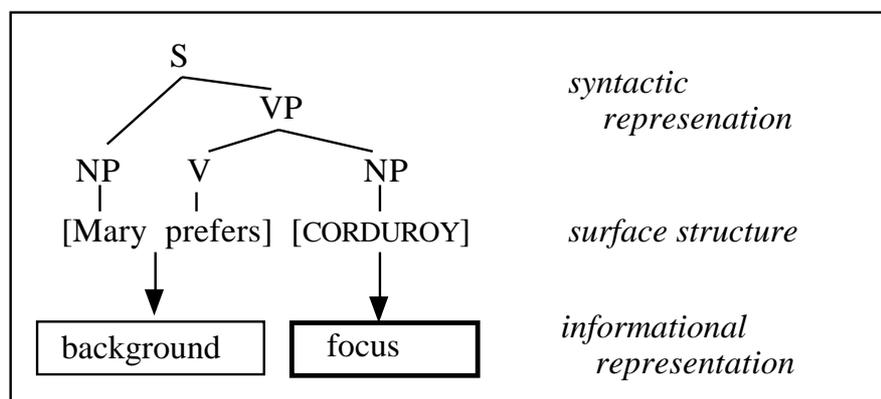
In general, it is assumed that this dichotomy of the sentence constitutes an independent level of description. However, there is no agreement where to locate this level. For some researchers, this dichotomy belongs to pragmatics and text linguistics, for others it is part of the psychological states of the participants in a conversation, and others integrate it into grammar proper. What most researchers agree on is that the defining criteria for the partition is a contrast in informativeness. The evaluation of informativeness has at least two aspects: The information given in a sentence can be evaluated with respect to either the sentence or the textual environment or the discourse. In the sentential aspect, informational units are described as the part *the sentence is about* and the part *what is said about it*. In the discourse aspect, the contrast is expressed in *already known* or *given* vs. *not known* or *newly introduced*. I will refer to the two aspects as *aboutness* and as *discourse anchoring*. The former dichotomy is often described in terms of an additional subject-predicate structure, while the latter is treated under categories of *givenness*. The effect of the interaction of informational units with the embedding discourse is often illustrated by anaphoric relations. Furthermore, discourse anchoring often leads to a *scale of givenness*, rather than to a binary distinction between given and new. Finally, the concept of *informational prominence* is understood in two contradictory ways: In the sentence perspective, information can be prominent because it is new and most informative; in the discourse perspective, information is prominent if it is already established or activated, i.e., if it licenses anaphoric relations. Prominent information in the latter sense would be expressed in the non-prominent part of the sentence in the former sense.

Theories differ in whether they distinguish aboutness and discourse anchoring or not, and whether they treat both aspects or only one, or whether they mix them. The pairs *theme-rheme* and *topic-comment* are typically used to refer to the aspect of aboutness, while the pairs *presupposition-focus*, *background-focus*, *open proposition-focus*, *old/given-new* are typically used to refer to the aspect of discourse anchoring.

The terms *topic-focus*, *psychological subject-psychological predicate* are not determined with respect to this distinction. There are cross-classifications of these two aspects, which lead to other categorizations, like Vallduví's (1990) *link-focus-tail*.

Nevertheless, the general picture can be illustrated with figure (2). The surface structure of the sentence *Mary prefers CORDUROY* receives a constituent structure at the level of syntactic analysis, and an informational representation as *background* and *focus*. Here, I use *background* as a neutral term referring to the complement of the *focus*. The term should not indicate any commitment to a particular theory of information structure. The partition reflects the idea that the focused phrase is more informative or provides new information, a fact which also seems to be reflected in the phonological prominence of the focused phrase *corduroy*. Furthermore, it is obvious that the information structure (following the phrasing of the sentence) does not correspond to the constituent structure.

(2) Information structure



In the following sections, I discuss three groups of theories of information structure: (i) the early approaches from the end of the 19th century, (ii) the Prague School, and (iii) the structuralist approaches following Halliday. In the course of the presentation of these theories, I try to make several implicit assumptions explicit. In particular, most approaches rely more or less on the following four poorly defined or scientifically obsolete notions: (i) the "Aristotelian" subject-predicate structure, (ii) the simplistic dichotomy of *figure-ground* from psychological gestalt theory, (iii) the one-to-one relation between intonational highlighting (stimulus) and informative content, and (iv) the communicative basis of linguistic methodology. These four unexpressed assumptions are discussed in section 3.1 while presenting the early models of information structure, which were expressively influenced by the contemporary psychological theory. It will be shown that none of the four mentioned assumptions is compatible with modern linguistic methodology or theory. Then I present the development of information structure in the course of this century: The Prague School redefined the psychological background into a configurational one. Halliday

reformulated it into an informational basis, Chafe anchored it in terms of consciousness, while Chomsky intended a semantic definition of these concepts in terms of inference, which eventually lead to semantic theories of focus presented in chapter 4.

3.1 Early models of information structure

3.1.1 Subject-predicate structure

The contrast between subject and predicate is not only a linguistic distinction, it also plays an important role in traditional philosophical disciplines such as epistemology, logic, and metaphysics, i.e. ontology, and in more recent fields such as psychology or information theory. The nature of the contrast is still very controversial and confusion only arises in the attempt to define the concepts at one level, more often confusion is caused by relating the distinction of one level with the distinction on another level. In what follows, I present some of the main concepts of the subject-predicate structure in linguistics, epistemology, logic and metaphysics.¹

The *linguistic* use of predicate and subject as constituents in a sentence goes back to Plato and Aristotle. The two categories indicate two different functions in the sentence and they are often associated with the noun and the verb in a simple sentence. Since typological research showed that subject and predicate are not universal categories, some linguists have proposed to replace this contrast by the contrast between *topic* and *comment*.² However, topic and comment cannot be regarded as purely grammatical, i.e. syntactic, categories since they have more to do with the knowledge or understanding of the participants of what is being discussed, i.e. the aboutness aspect mentioned before, than with the constituent structure. Problems in the definition of a sentence in terms of subject-predicate structure caused the abolishment of these concepts in syntactic theory proper.³ However, the basic notion survived in the generative rule of expanding a sentence to an NP and a VP (S → NP VP). The present situation in linguistics can be summarized by saying that subject and predicate are useful descriptive terms, but they do not have a clear grammatical definition.⁴

¹ The presentation of the subject-predicate structure in these four fields are motivated by the lexicon article of Garver (1967).

² There is an extensive literature on the categorization of a language as topic-prominent or as subject-prominent (cf. Li 1976).

³ Ries (1894) gives a very critical evaluation of traditional and logical definitions of the sentence. Ries (1931) collected more than 140 definitions for a sentence and showed that none of them can be used as a basic tool for defining syntax.

⁴ Keenan (1976) undertakes a linguistic definition of subject by listing more than 30 features that a subject prototypically has.

In *epistemology*, the contrast between subject and predicate is defined in terms of which part of the sentence serves to identify what is being discussed, and which part serves to describe or to characterize the thing so identified. Often the grammatical and epistemological subject and predicate are identical, in particular in simple sentences. However, there are several instances in which they differ, e.g. passive constructions, sentences with dummy subjects etc. More complex sentences, in which a relation between two objects is described, cause other problems for the epistemological view of the sentence structure. In the sentence *Bill was hit by John* the context has to decide which is the epistemological subject. In other words, the epistemological view is as context dependent in its determination as the use of topic in linguistic theory.⁵

In *logic*, there are two main conceptions of sentence structure: (i) the traditional subject-predicate view, which goes back to Aristotle's pioneering work, and (ii) Frege's view of the functor-argument structure of the sentence. The Aristotelian or traditional view assumes that subject and predicate are both general terms (i.e. *concepts* or *predicates* in the modern view) connected by the copula, schematically as *S is P*. The sentence asserts a quantificational relation between the subject and the predicate, which is expressed in the copula *some...is*, or *all ... are*.

- (3a) Some Athenian is big. (A is B for some A)
 (3b) All Athenians are Greeks. (A is G for all A)

This view treats the subject and the predicate symmetrically and allows the inversion of the expression for certain inference rules (*Some big person is Athenian, Some Greeks are Athenians*). However, this view was criticized since (i) the symmetry does not hold with negation, (ii) there is no simple way to describe sentences with singular terms, and (iii) multiple quantification, as in *Every Athenian hates some king*, is not possible.

Frege's new view is based on the concept of the *atomic sentence*, which consists of a functor and an argument: *F(a)*. Singular (or atomic) sentences like (4a) are represented by the application of the predicate to the argument, while general sentences are represented by complex sentences with quantifiers as in (4b):

⁵ Chafe (1976, 29), who uses the term *cognitive* instead of *epistemological*, lists several non-linguistic notions of subject: "But it might also be held that the grammatical subject performs some sort of cognitive function. Perhaps it is a conditioned stimulus (...), the figure of a figure-ground relation or an 'interest-object' (...), the 'conceptual focus' (...), the most prominent or important element in the sentence (...), the focus of attention (...) and so on. Perhaps some of these characterizations are more appropriate to the psychological than the grammatical subject, and perhaps, in fact, the grammatical subject is only a syntactic phenomenon, lacking in cognitive significance altogether. The only thing that seems clear is that the syntactic considerations (or at least some of them) are easier to sort out and agree on. The cognitive considerations lead us into a morass of uncertainty from which psychological experiments have not yet, at least, succeeded in extricating us."

- (5) Frege's view of the logical and ontological structure of a sentence
- | | |
|---|---|
| (i) traditional description | subject-predicate |
| (ii) Frege's logical form
corresponds to | argument-function
singular term-general term |
| (iii) ontological type | saturated-unsaturated |
| (iv) extension | individual-class of individuals |

It was only Frege's definition of the sentence structure as function-argument structure that gave the fundamental semantic definition of a sentence. Since this definition is not dependent on syntax, pragmatics or psychology, semantics was able to establish its own research domain.

To sum up, subject and predicate are useful descriptive terms for describing sentence structure. However, there is no clear definition of these concepts, but rather a bundle of historically related claims from as different fields as syntax, epistemology, logic, and metaphysics. In particular, the Aristotelian concept of subject-predicate in grammar has created more problems than it has solved. These two points, the vagueness of the notion of the subject-predicate structure, and its highly problematic use in linguistic theory, should be borne in mind when this concept is transferred to or used in other domains such as psychology or information theory. In other words, it does not help the understanding to apply the notion of subject-predicate at any level, but it rather adds more confusion.

3.1.2 The early psychological model: Hermann Paul

During the course of the last century, psychology became the epistemological basis for linguistics. Hermann Paul's "Prinzipien der Sprachgeschichte" is not only one of the most influential books on general linguistics, but also one of the nicest examples of the influence of psychological theory on general linguistics and linguistic foundations. Since the first edition of the Prinzipien from 1880, there were repeatedly new editions, which however did not change the overall view of Paul's system.

Paul (1880, 121) defines the sentence as the linguistic expression that connects several (psychological) concepts or groups of concepts in the mind ("Seele") of the speaker. Furthermore, the sentence is the tool to generate these concepts and their connection in the mind of the hearer:

Der Satz ist der sprachliche Ausdruck, das Symbol dafür, dass sich die Verbindung mehrerer Vorstellungen oder Vorstellungsgruppen in der Seele des Sprechenden vollzogen hat, und das Mittel dazu, die nämliche Verbindung der nämlichen Vorstellungen in der Seele des Hörenden zu erzeugen.

In his extensive discussion of sentence structure, Paul (1880, ch. 15-16) introduces most of the relevant aspects of the relation between the psychological subject-predicate structure and the grammatical subject-predicate structure:

- (6) The main aspects of Paul's conception of sentence structure
 - (i) the psychological fundamentals of linguistics
 - (ii) the partition of the sentence into two parts
 - (iii) the question test as criteria for thematicity
 - (iv) the observation that thematic structuring can even effect one single semantic component of a word
 - (v) the relation between thematic structure and intonation
 - (vi) the Thematic progression
 - (vii) the treatment of neutral elements with respect to the thematic structure
 - (viii) the discourse anchoring of thematicity

(i) The psychological fundamentals of linguistics

The terms *psychological subject* and *psychological predicate* had been introduced by von der Gabelentz (1869), who compared the sequence of thoughts or psychological concepts with the sequence of linguistic expressions in a sentence. He then distinguished two levels: the grammatical level and the psychological level of composition. Von der Gabelentz defines the psychological subject as "that about which the hearer should think", and the psychological predicate as "that what he should think about".⁸ It is interesting to note that the distinction between the two parts is defined with respect to the mental or cognitive state of the hearer. Paul (1880, 263) adopted the terminological distinction easily, since he conceives every grammatical category on the basis of a psychological one: "Jede grammatische Kategorie erzeugt sich auf Grundlage einer psychologischen."

(ii) The partition of the sentence into two parts

One of the main assumptions of Paul is that the sentence is divided into (at least) two parts. Paul (1880, 124) says that each sentence consists of at least two elements. These elements are not equal but differ in their function. They are termed *subject* and

⁸ Von der Gabelentz (1869, 378): "Was bezweckt man nun, in dem man zu einem Andern etwas spricht? Man will dadurch einen Gedanken in ihm erwecken. Ich glaube hierzu gehört ein Doppeltes: ersten, daß man des anderen Aufmerksamkeit (sein Denken) auf etwas hinleitet, zweitens, daß man ihn über dieses Etwas das und das denken läßt; und ich nenne das, woran, worüber ich den Angeredeten denken lassen will, das psychologische Subject, das, was er darüber denken soll, das psychologische Prädicat." Compare also the quotation of Jespersen (1925) - cited in section 0.1 - where Jespersen translates a paragraph from von der Gabelentz (1901, 369) using the metaphor of a telegraphic apparatus.

predicate. These grammatical categories are based on a psychological relation. We have to distinguish between psychological and grammatical subject and predicate because they do not always coincide. But the grammatical relation is always formed on the grounds of the psychological relation.

Jeder Satz besteht demnach aus mindestens zwei Elementen. Diese Elemente verhalten sich zu einander nicht gleich, sondern sind ihrer Funktion nach differenziert. Man bezeichnet sie als Subjekt und Prädikat. Diese grammatischen Kategorien beruhen auf einem psychologischen Verhältnis. Zwar müssen wir unterscheiden zwischen psychologischem und grammatischem Subjekt, respektive Prädikat, da beides nicht immer zusammenfällt, wie wir noch im Einzelnen sehen werden. Aber darum ist doch das grammatische Verhältnis nur auf Grundlage des psychologischen aufbaut.

(iii) *The question test as criteria for thematicity*

The clearest test for the psychological predicate is the constituent question. As already quoted in section 1.6, Paul illustrates this with the simple assertion (7), which can be the reaction to the different questions (7a)-(7d). Depending on the question, the psychological predicate of the sentence differs, while the grammatical structure remains the same. In (7a) the psychological predicate is the locative *Berlin*, in (7b) it is the time adverbial *morgen*, and in (7d) it is the grammatical subject *Karl*:

(7)	Karl fährt morgen nach Berlin.	"Karl goes to Berlin tomorrow."
(7a)	Wohin fährt Karl morgen? Karl fährt morgen nach BERLIN.	"Where does Karl go tomorrow?"
(7b)	Wann fährt Karl nach Berlin? Karl fährt MORGEN nach Berlin.	"When does Karl go to Berlin?"
(7c)	Wie reist Karl nach Berlin? Karl FÄHRT morgen nach Berlin.	"How does Karl travel to Berlin?"
(7d)	Wer fährt morgen nach Berlin? KARL fährt morgen nach Berlin.	"Who goes to Berlin tomorrow?"

The question test is still one of the most fundamental tests for information structure. However, it is not clear whether the question test illuminates the information structure in its sentential or its discourse aspect. For Paul, who does not distinguish these two aspects, there is no difference between the *aboutness* and the *discourse anchoring* of the psychological predicate. In more recent approaches, the question test is generally associated with the *focus*, i.e. with the new information given in a discourse.

(iv) The observation that thematic structuring can even effect one single semantic component of a word

Paul notes that the thematic structure of a sentence can single out even a semantic feature of a word. In (7c), the corresponding question focuses on the mode of transportation; it is asked *how* Karl traveled to Berlin (walking, driving, riding, etc.), i.e. only one semantic feature of the verb of transportation is the psychological predicate. Although neither Paul nor other researchers have worked on this observation, it is very important. It shows that the thematic structure does not effect the expressions proper, but their parts. This observation should be kept in mind if a mapping from the surface form onto a level of information structure is assumed as in (2). The mapping, however, does not effect (only) words but must effect their lexical representation, which can consist of a complex of smaller elements. In other words, information structure is not only another way to organize the sequence of words in a sentence, but it is also a way to organize the smallest elements of the representation of sentences in a different way.

(v) The relation between thematic structure and intonation

Von der Gabelentz (1869) introduced the terms psychological subject and predicate in order to distinguish between the sequence of thoughts or psychological concepts and the sequence of linguistic expressions in a sentence. Paul used the terms, but interprets them differently, since he defines the psychological predicate not only by position or word order (as von der Gabelentz), but also by intonational signaling. The psychological predicate is separated most clearly from the rest of the units. It is the most important, and it contains the essential communicative content of the sentence. Therefore, it receives the strongest tone: "Am schärfsten von den übrigen Gliedern des Satzes sondert sich zunächst das psychologische Präd. ab als das wichtigste, dessen Mitteilung der Endzweck des Satzes ist, auf welches daher der stärkste Ton fällt" (Paul 1880, 283).⁹

(vi) The thematic progression

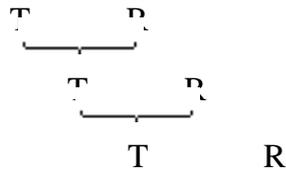
In cases where the whole sentence is new, Paul seems to suggest that the thematic relation is incrementally built up by processing the sentence bit by bit. For example,

⁹ Von der Gabelentz (1901, 376) claims the primacy of the psychological order or the element, and states that intonation (stress) does not play a role for word order: "Nicht die Betonung, sondern die psychologischen Subjects- und Prädicatsverhältnisse entscheiden über die bevorzugte Stellung der Satzglieder, und das seelische Verhalten, das sich in der Betonung äussert, hat mit jenem Verhältnisse nichts zu tun." Von der Gabelentz (1901, 373) observes that the psychological subject as the theme (in its non-technical sense) (also) receives emphasis: "Denn erstens ruht natürlich ein gewisser Nachdruck auf demjenigen Theile der Rede, der als ihr Thema vorangestellt wird, als auf dem psychologischen Subjecte."

sentence (7) uttered out of the blue (or as a reaction to the general question *What happened*) could be understood as having increasingly larger thematic domains:¹⁰

(8) Incremental thematic structure in a sentence

Karl fährt morgen nach Berlin



Thematic progression is generally associated with texts, but not with sentence internal structure. This, again, is an interesting remark that deserves some attention.

(vii) *The treatment of neutral elements with respect to the thematic structure*

Paul (1880, 293ff) discusses cases in which a linguistic expression belongs to neither the psychological predicate nor the psychological subject. They are neutral with respect to the thematic relation. He terms them *connection words* ("Bindeglieder"), and defines them as words that express a relation between two concepts. Such a word is not independent and therefore receives a secondary status. A typical instance is the copula, which defines the relation between subject and predicate.

(viii) *The discourse anchoring of thematicity*

Besides the question test (see (iii)), Paul (1880, 283) also mentions that the psychological subject is that part which is already known in a discourse. Since Paul does not distinguish between the sentential and the discourse aspect of information structure, he mixes both aspects.

To sum up, Paul discusses the notion of psychological structure vs. grammatical structure very informally. However, it was shown that he already recognizes most of the relevant aspects of information structure. In the course of this chapter it will be illustrated that even most of the more recent theories do not overcome the informality of Paul's presentation. For if they were more explicit, they would have to acknowledge that the basic concepts like subject-predicate are not linguistically well defined.

¹⁰ This particular point is discussed in Eroms (1986, 6).

3.1.3 The communicative model

At the beginning of this century, the interest in the communicative (or social) function of language had increased, which was most obviously manifested in the "Cours de linguistique générale" of Ferdinand de Saussure (1916). The meaning of a sentence is evaluated with respect to its contribution to the communication between the participants.

For example, Ammann (1928, 2) focuses on two points: first that a sentence is primarily a message ("Mitteilung"). Due to its nature, a message consists of two parts, which closely correspond to the sentence organization into subject and predicate.¹¹ Ammann then argues that the informational structure of the message is the basis for dividing the grammatical structure into subject and predicate, rather than assigning primacy to the dichotomy of psychological subject and predicate. Thus, he notes that it is not important that psychological structure does not always coincide with the grammatical structure, but what counts is that it is the information unit that causes the dichotomy of subject and predicate.

Daß psychologisches und grammatisches Subjekt, psychologisches und grammatisches Prädikat nicht immer zusammenfallen, ist unwesentlich; worauf es allein ankommt, ist, daß der Begriff der Mitteilung an sich schon auf etwas hindeutet, wovon die Rede ist (Subjekt) und auf etwas, was davon gesagt wird (Prädikat) — auf Gegenstand und Inhalt der Mitteilung. (Ammann 1928, 2)

In order to distinguish between the grammatical structure of the sentence, the psychological structure of concepts or ideas, and the informational structure of the message, Ammann introduces a new pair of terms: *theme* and *rheme* ("Thema" and "Rhema"). Rheme is borrowed from the Greek grammatical tradition, where it refers to the verb, in contrast to *onoma* which refers to the name or subject. Ammann (1928, 3) concludes that these terms do not carry any connotations since the classical concepts are only used in the Latin translations.

Auf einen früher von mir eingeführten Ausdruck zurückgreifend, werde ich den Gegenstand der Mitteilung im Folgenden gelegentlich auch als 'Thema' bezeichnen; das Neue, das was ich dem Hörer über das Thema zu sagen haben, könnte man entsprechend mit dem (scheinbaren) Reimwort 'Rhema' belegen. Da der antike Gegensatz ὄνομα — ῥήμα uns nur in der lateinischen Übersetzung geläufig ist, scheint mir diese Neuerung terminologisch unanstößig zu sein.

Thus, Ammann refers with theme and rheme to the ontological structure of the message that is conveyed by the sentence. Eventually, Ammann (1928, 123ff) introduces an additional cognitive level of structure in his theory of judgment for

¹¹ Ammann (1928, 2): "Und in der Tat läßt sich aus dem Begriff der Mitteilung heraus auch eine Deutung jener Zweiheit gewinnen, die wohl am engsten mit dem Begriff des Satzes zusammenhängt: der Zweiheit von Subjekt und Prädikat — wie dies zuerst wohl G. von der Gabelentz getan hat."

which he uses another pair of terms borrowed from the Greek tradition: *hypokeimenon* and *kategoroumenon*. Both terms were used in grammatical theory and translated into Latin as *subject* and *predicate*.

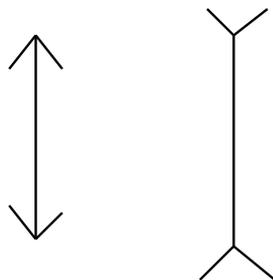
Ammann and others have recognized that the sentence is organized not only by syntactic structure, but also by other principles. However, they were unable to locate this organizational level in linguistic theory proper. Instead they referred to other fields like psychology and information theory. One reason may have been that semantics as a proper subfield of linguistics was not yet established. It was only the work of Frege, Russell, Carnap, Montague and their followers that established semantics as one of the core disciplines of linguistics with independent levels of representations, abstract objects, and rules operating on them.

3.1.4 Linguistics, psychology, and information structure

In the course of the last century, the syntactic definition of the sentence became more elaborate. At the same time it became obvious that the syntactic description does not cover all aspects of sentence meaning. Differences in the presentation of the sentence content were attributed to an underlying psychological structure (as the contemporary epistemological basis for language function). The meanings of words were assumed to be psychological concepts or mental ideas, and sentence meaning was understood in terms of operations on those ideas. In particular, the dichotomy of the sentence was understood as expressing a dichotomy of mental ideas. If conjoined they would yield the content of the sentence as their product.

One important movement in psychology was the so-called *Gestalt theory*. According to this school, perception functions as a whole gestalt and not by constructing something out of small units. The gestalt perception includes two different parts: *figure* and *ground*. The figure is recognized only against the ground, which is the principle for many optical illusions as in (9), where one and the same stimulus (the line) is perceived differently depending on the ground. In (10), one and the same stimulus is structured differently into figure and ground, giving rise to two ways of conceiving it. Here, we can either see a chalice or two faces, but not both at the same time.

(9)



(10)



Another feature of Gestalt theory is the direct relation between stimulus and perception. There is no intermediate level of representation. Even though Gestalt theory was mainly developed on vision, it was also used for the explanation of other perceptual channels, such as speech. Thus the idea of the dichotomy of the sentence organization not only found additional support in this psychological movement, it also inherited the terms *figure* and *ground* from it. The figure represents the prominent or highlighted part, while the ground represents the given or less informative material of the sentence. The idea of a direct correspondence between stimulus and function was instantiated by the direct correspondence between intonational highlighting and communicative highlighting.

Later, communication and information theory replaced psychology as the epistemological background for linguistic research.¹² Sentences are analyzed with respect to their communicative functions. However, the dichotomy of figure and ground was adopted and the idea of highlighting and of the direct relation between intonational prominence of an expression and its information content were inherited from the earlier psychological treatments. This one-to-one relation is assumed without any more abstract level or representation. Hirst & Di Cristo (1998, 28ff) summarize the situation and draw the connection to the Prague School as follows:¹³

¹² Another more recent epistemological basis for linguistics is the theory of databases, which are held, for example, by Blok (1991, 156): "So, if the topic-focus partition is not the distinction between what is semantically presupposed and what is not, nor the distinction between 'old' and 'new' information in a more pragmatic sense, what kind of function does it have? I think it should be stated in terms of **search-strategies** rather than in terms of information content. The databases of my conversational partner and me are conceivably rather big, if I state something, there are two possibilities: either I assume that my partner does not have any opinion on the matter, or I assume that he or she has one opposed to mine. In the latter case, I will help my partner to find this opinion opposed to my utterance in his or her database by means of intonation, sentential construction, or in general by means of the topic-focus articulation."

Compare also the recent volume *Focus: Linguistic, Cognitive, and Computational Perspectives* by Bosch & van der Sandt 1999, where the computational processing is stated as an additional background interest.

¹³ The concept or the metaphor of *figure-ground* is very pervasive in several disciplines such as linguistics and philosophy, to name only the most relevant for this study:

Givón (1982, 128) uses it for describing his understanding of language: "The central fact that epistemology must eventually contend with, I believe, is the rise of temporary, illusive but nevertheless 'real' islands of relative firmament and order out of the inherently chaotic universe of experience. Ultimately, I believe, figure-ground pragmatics – the idea that the picture is stable and 'real' only as long as the frame remains fixed – must play a central role in such an enterprise."

Reinhart (1984, 779) explains the structure of narration with this concept: "The distinction between foreground and background in narrative has for its counterpart the figure-ground distinction proposed in gestalt theory."

Dretske (1972, 411) uses this metaphor in his description of contrastive focus (see also section 6.2 for the context): "What distinguishes contrastive statements is that they embody a dominant contrast, a contrastive focus, a featured exclusion of certain possibilities. Something similar to a figure-ground distinction is at work in these statements."

The basic idea behind all work in this area is that communication takes place against a background of shared knowledge so that the way a listener interprets an utterance will be partly dependent on the (situational) context in which the utterance occurs.

This idea follows a more general principle which had been proposed in the beginning of the century by the Czech psychologist Wertheimer [1886-1943], one of the founders of the Gestalt School of psychology, according to which the perception of a stimulus, particularly in the case of vision, generally consists of attributing a structure in which one part of the stimulus, called the **figure**, seems to stand out against the rest of the stimulus, called the **ground** (...). Under different conditions, the same stimulus can be structured differently into figure and ground, giving rise to a number of familiar optical illusions.

The first person to apply a similar idea to language was another Czech, the linguist Mathesius [1882-1945], founder of the Prague Linguistic Circle, whose theory of **Functional Sentence Perspective** was taken up and developed by other linguists of the Prague School such as Daneš and Firbas." (...)

3.2 Classical models of information structure

3.2.1 The Prague School

At the end of the last century the psychological foundation of sentence structure led to an additional level of descriptions for the organization of the sentence using contrasts like *psychological subject* and *psychological predicate* (von der Gabelentz 1869). Paul (1880) developed this contrast and Ammann (1928) shifted the point of interest from psychology to communication and introduced the terms *theme* and *rheme*. At the same time, Mathesius (1929) used these terms for describing word order phenomena in Czech and other Slavic languages. Unlike the approaches discussed so far, the Prague School integrated the distinction between theme and rheme into the grammatical system. The most characteristic feature of the Prague structuralists, in contrast to other structuralist schools, was the functional approach. Language is understood as a tool for communication and the information structure is important for both the system of language and for the process of communication.¹⁴

And finally Caffi (1997, 437) employs this notion to illuminate the structure of presupposition (see section 6.4 for the full quotation): "In order to clarify the concept of presupposition, some authors have compared speech with a Gestalt picture, in which it is possible to distinguish a ground and a figure. Presuppositions are the ground; what is actually said is the figure.

¹⁴ There is, however, a certain connection between a psychological and a purely communicative and linear ordering. The psychological subject is often identified with the "just-heard", while the psychological predicate is identified with the "expected" (von der Gabelentz 1901, 369): "Offenbar ist es dies, dass ich erst dasjenige nenne, was mein Denken anregt, worüber ich nachdenke, mein psychologisches Subject, und dann das, was ich darüber denke, mein psychologisches Prädicat, und dann wo nöthig wieder Beides zum Gegenstande weiteren Denkens und Redens mache."

Mathesius reformulates the contrast between the grammatical subject-predicate and the organization of the message of a sentence in his *functional sentence perspective*. Weil (1844) had already noted that the sequence of words and the sequence of thoughts do not always correspond. Thus, Mathesius working on word order in Slavic languages proposes the *thematic structure* of a sentence as a linguistic level of analysis, which is independent of the subject-predicate relation. The functional sentence perspective was further developed by a series of researchers. Firbas (1964), argues that information structure is not a dichotomy but rather a whole scale, or hierarchy, or what he calls *communicative dynamism*. Similar scales were later developed under the headings of *Scale of Familiarity* (Prince 1981), the *Givenness Hierarchy* (Gundel & Hedberg & Zacharski 1993) or the *Accessibility Marking Scale* (Ariel 1990).

Daneš (e.g. 1970) extends the thematic relation of the sentence to one of a text, and the newer Prague School (Sgall & Hajičová & Benešová 1973) and Sgall & Hajičová & Panevová (1986) uses the contrast of *topic* and *focus* and gives an account of how to integrate this structure into a grammatical model. Peregrin (1995) attempts a formalization of the topic-focus articulation in terms of structured proposition and dynamic logic. Hajičová & Partee & Sgall (1998) give a comparison between the Prague School and the semantic tradition since Montague. It was Halliday (1967b) who introduced the Praguian distinction of theme and rheme into American structuralist linguistics (see next section).

For lack of space, I cannot present an adequate discussion of the Praguian theory of functional sentence perspective of the topic-focus-articulation. Excellent overviews and comparisons with contemporary grammatical theory are presented in Sgall & Hajičová & Benešová (1973), Sgall & Hajičová & Panevová (1986) and Hajičová & Partee & Sgall (1998). Here, only two aspects should be touched upon: first the two sides of information structure, the sentence internal aspect and the textual aspect; and second the extension of the theme-rheme structure to texts.

Daneš (1970, 134) describes the two faces of information structure or what he calls "utterance organization" or "utterance perspective":

- (1) Taking for granted that in the act of communication an utterance appears to be, in essence, an enunciation (statement) about something (question should be treated separately), we shall call the parts THEME (something that one is talking about, TOPIC), and RHEME (what one says about it, COMMENT).
- (2) Following the other line, linking up utterance with the context and/or situation, we recognize that, as a rule, one part contains old, already known or given elements, functioning thus as a 'starting point' of the utterance, while the other conveys a new piece of information (being thus the 'core' of the utterance). But, as in most cases, the two aspects coincide, we shall, in our following discussion, disregard the said distinction.

Daneš (1970, 137f) notes that the two aspects are not independent, since one can extend the idea of the topic of a sentence to the discourse. He introduces three ways sentential topics can be concatenated in a discourse: (i) simple linear progression as in (11), a progression with a continuous theme, and (iii) the exposition of a split theme.

(11) simple linear progression of a theme

T₁ R₁

T₂ (= R₁) R₂

T₃ (= R₂) R₃

...

In the simple linear progression (11), the rheme of the first sentence becomes the theme of the following sentence and so on. This progression is suspiciously similar to Paul's incremental development of the theme in the sentence in example (8) above.

3.2.2 Halliday and the American structuralists

While the Praguian approach builds information structure into the grammatical system in the syntax-semantics interface, Halliday postulates an independent level for information structure. He is in fact the first who uses the term *information structure* and establishes an independent concept of it. His main preoccupation was to account for the structure of intonation in English. Since phrasing does not always correspond to syntactic constituent structure, Halliday (1967b, 200) postulates a different structural level as the correlate to phrasing (his "tonality"):

Any text in spoken English is organized into what may be called 'information units'. (...) this is not determined (...) by constituent structure. Rather could it be said that the distribution of information specifies a distinct structure on a different plan. (...) Information structure is realized phonologically by 'tonality', the distribution of the text into tone groups.

The utterance is divided into different tone groups, which are roughly equivalent to intermediate phrases. These phrases exhibit an internal structure. Analogously, Halliday assumes two structural aspects of information structure: the informational partition of the utterance, and the internal organization of each informational unit. He calls the former aspect the *thematic structure* (theme-rheme) and the latter aspect is treated under the title *givenness*. The thematic structure organizes the linear ordering of the informational units, which corresponds to the Praguian view of theme-rheme (or topic-comment, or topic-focus) and is organized according to the principle of aboutness. The theme refers to that informational unit that comprises the object the

utterance is about, while the rheme refers to what is said about it. Halliday assumes that the theme always precedes the rheme. Thus theme-rheme are closely connected with word order, *theme* being used as a name for the first noun group in the sentence, and theme for the following:¹⁵ "The theme is what is being talked about, the point of departure for the clause as a message; and the speaker has within certain limits the option of selecting any element in the clause as thematic." (Halliday 1967b, 212). This is the aspect that is determined by the "ontological structure" of the message as described by Ammann (see above).

The second aspect refers to the internal structure of an informational unit, where elements are marked with respect to their discourse anchoring: "At the same time the information unit is the point of origin for further options regarding the status of its components: for the selection of point of information focus which indicates what new information is being contributed" Halliday (1967b, 202). Halliday calls the center of informativeness of an information unit *information focus*. The information focus contains new material that is not already available in the discourse. The remainder of the intonational unit consists of given material, i.e. material that is available in the discourse or in the shared knowledge of the discourse participants. Halliday (1967b, 202) illustrates the interaction of the two systems of organization with the following example (using bold type to indicate information focus; // to indicate phrasing). Sentence (12a) contrasts with (12b) only in the placement of the information focus in the second phrase. The phrasing, and thus the thematic structure, is the same. On the other hand, (12a) contrasts with (12c) in phrasing, but not in the placement of the information focus. However, since the information focus is defined with respect to the information unit, the effect of the information focus is different.

(12a) //**Mary**//always goes to **town** on Sundays//

(12b) //**Mary**//always goes to town on **Sundays**//

(12c) //**Mary** always goes to //**town** on Sundays//

Phrasing and its correlate thematic structure is independent of information focus: "But the interpretation of information focus depends on where it is located relative to the information unit, so that it is the distribution that partially determines the focus and not the other way round" (Halliday 1967b, 202).

Halliday's information structure is the most explicit system with very close connections to the intonational features: Intonational phrasing is correlated with informational units which are organized by the thematic structure. Pitch accents are the nuclei of the tone

¹⁵ Here as in the case discussed for Paul, it is not clear how to define information units in terms of theme and rheme if there are more than two. Furthermore, it is not clear whether a definition of theme in terms of information structure *and* in terms of linear precedence makes sense. It seems rather that linear precedence is sufficient.

groups, and they mark the informational foci of the informational units. Informational foci indicate the givenness of the expression with respect to the discourse. Halliday's system consists of different levels that are all related by one-to-one relations, as illustrated in (13):

- (13) Halliday's system of intonation and information structure
- | | | |
|-------------------|---|----------------------------------|
| * | * | <i>pitch accent</i> |
| // Mary // | always goes to town on Sundays// | <i>phrasing</i> |
| [Mary] | [always goes to town on Sundays] | <i>theme-rheme</i> ("aboutness") |
| [Mary] | [..... town] | <i>information focus</i> |
| [Mary] | [..... town] | <i>new</i> ("discourse |
| [.....] | [always goes to on Sundays] | <i>given</i> anchoring") |

Halliday does not connect the sentence perspective with the discourse perspective, even though he makes some vague comments on it:

The difference can perhaps be best summarized by the observation that, while 'given' means 'what you were talking about' (or 'what I was talking about before'), 'theme' means 'what I am talking about' (or 'what I am talking about now'); and, as any student of rhetoric knows, the two do not necessarily coincide. (Halliday 1967b, 212)

The main progress initiated by the work of Halliday is the assumption of an independent level of information structure. This structure is closely related to the discourse and assigns the features *given* or *new* to the expressions in a sentence. However, what was still not solved is the definition of given vs. new. Halliday (1967b, 211) himself defines "given" information as being treated by the speaker as "recoverable either anaphorically or situationally". New information, on the other hand, is characterized by at least three formulations: (i) "new" information is said to be focal "not in the sense that it cannot have been previously mentioned, although it is often the case that it has not been, but in the sense that the speaker presents it as not being recoverable from the preceding discourse" or (ii) new information is "contrary to some predicted or stated alternative", or (iii) new is what is "replacing the WH-element in a presupposed question", as illustrated in the examples (14)-(16), respectively:

- (14) A. Why don't you have some French TOAST?
B. I've forgotten how to MAKE French toast.
- (15) (John's mother voted for BILL.)
No, she voted for JOHN.
- (16) Who did John's mother VOTE for?
She voted for JOHN.

These three characterizations of *new* suggest three different kinds of focus, as in (17):

- (17) Three kinds of focus
- | | |
|----------------------|----------------------------|
| (i) informative | in assertion/addition |
| (ii) contrastive | in assertion/contradiction |
| (iii) focus-question | in question/answer pairs |

Since it is not clear whether there is one coherent definition of *new* or of *focus*, it seems more plausible to find a definition of *given* (cf. Schwarzschild).¹⁶ Halliday himself relates givenness to "anaphorically recoverable".

There have been other directions in which the concept of givenness was characterized. For example, Chafe (1976) and others reinterpreted the givenness of Halliday as a cognitive or psychological category which is applied to the objects in the mental states of the speakers. Another direction is represented by Chomsky (1971) and Jackendoff (1972), who replaced the concept of given-new by presupposition-focus. The notion of presupposition was already a basic concept in semantics even though not fully understood. In the next two subsection, both positions are briefly reviewed.

3.2.3 Chafe on givenness

In his seminal paper *Givenness, Contrastiveness, Definiteness, Subjects, Topics, and Point of View*, Chafe (1976) discusses aspects – or "statuses" as he calls them – of nouns. Chafe is interested in the way discourse is structured. He assumes that discourse is organized according to the beliefs of the speaker about the beliefs of the hearer, rather than according to the semantic content of linguistic expressions. Chafe (1976, 28) illustrates this with the famous metaphor of "information packaging":

I have been using the term *packaging* to refer to the kind of phenomena at issue here, with the idea that they have to do primarily with how the message is sent and only secondarily with the message itself, just as the packaging of toothpaste can affect sales in partial independence of the quality of the toothpaste inside.

Our starting point, then, is that the packaging phenomena relevant to nouns include the following: (a) the noun may be either *given* or *new*; (b) it may be a *focus of contrast*; (c) it may be *definite* or *indefinite*; (d) it may be the *subject* of its sentence; (e) it may be the *topic* of its sentence; and (f) it may represent the individual whose *point of view* the speaker is taking, or with whom the speaker empathizes.

¹⁶ Thus, Schwarzschild (1997, 2) suggests a uniform approach in the vein of Halliday with a new definition, in which only the notion of *given* is defined, while the notion of *new* is understood as being the complement: "I submit therefore that the grammar makes reference to givenness and includes the statement in (4a) but no mention is made of novelty, hence there is nothing like (4b):

- (4a) Lack of focus indicates givenness
 (4b) Focus indicates novelty

Chafe extends Halliday's givenness into psychological models of the consciousness of speaker and hearer:

Givenness. What is it? The key to this distinction is the notion of consciousness (...). Given (or old) information is that knowledge which the speaker assumes to be in the consciousness of the addressee at the time of the utterance. So-called new information is what the speaker assumes he is introducing into the addressee's consciousness by what he says. (Chafe 1976, 30)

This definition of information structure is very similar to the definition of *psychological structuring* of von der Gabelentz (see above section 2.3.1 (i)). Chafe (1976, 30) himself notes that although this use of *given* and *new* is often misleading and a different use such as "activated" would be more appropriate, he will continue to use the old pair: Terms like "already activated" and "newly activated" would convey this distinction more accurately, but are awkward; we will probably have to live with the terms "given" (or "old") and "new."

The important move Chafe takes is that information structure is to be taken into the realm of psychology or psychological sentence and discourse planning. That is, the additional organization of the sentence is explained with respect to the conditions of the participants' minds. This throws us back to the positions of the early models of information structure, with all the relevant criticisms.

Chafe's view of givenness, as a kind of activation in the consciousness of the speaker and hearer, opens the discussion for a scale of givenness. Since the activation can be higher or lower and it can die away, a continuum of activation or givenness seems more appropriate. And in fact, research in this direction has proposed several such givenness hierarchies, like the *Scale of Familiarity* (Prince 1981), the *Givenness Hierarchy* (Gundel & Hedberg & Zacharski 1993) or the *Accessibility Marking Scale* (Ariel 1990).

Prince (1981; 1986, 208) picks up Chafe's packaging idea and states that speakers tailor sentences in various ways to (their assumptions about) their interlocutors or, in more detail:

Information in a discourse does not correspond simply to an unstructured set of proposition; rather, speakers seem to form their utterances so as to structure the information they are attempting to convey, usually or perhaps always in accordance with their beliefs about the hearer: what s/he is thought to know, what s/he is expected to be thinking about.

The idea of information packaging was further developed by Vallduví (1990), who assumes an information structure that consists of three parts merging the most prominent aspects of information structure into one: focus-background and topic-comment. The question (18) introduces *John* as a topic and focuses on the object that

John drinks. The predicate *drink* is both part of the comment as well as part of background in (19). Vallduví (1990, 55) proposes the structure (20) corresponding to his information structure in (21). He proposes a main partition into *focus* and *ground* (corresponding to the notion of focus-background), and a second partition of the ground (background) into *link* and *tail* (topic and the rest of the background), yielding his three informational units: *focus*, *link* and *tail*.

(18) What does John drink?

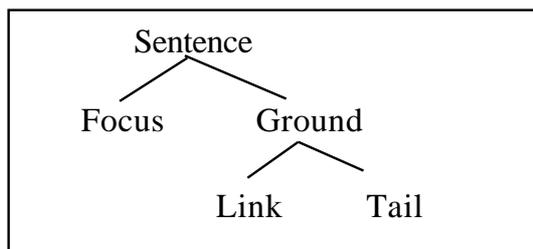
(19) Topic-comment and focus-background structure

topic	comment	
<i>John</i>	<i>drinks</i>	<i>beer</i>
background		focus

(20) Information packaging (Vallduví)

link	tail	focus
<i>John</i>	<i>drinks</i>	<i>beer</i>

(21) Information structure as focus-link-tail



Like Chafe and Prince, Vallduví describes the situation very informally using, for example, Heim's metaphor of file cards, but he does not attempt to give a semantic analysis of the phenomena presented.¹⁷ Vallduví (1990, 2) claims that information packaging does not effect truth conditions: "While their propositional contents are the same, they do not provide the same INFORMATION (...)." However, he does not give a clear account of what he means by information.

¹⁷ Asher (1997, 29) comments on this: "Vallduví's ideas are very suggestive and I think propitious for a general analysis of these notions. But many questions arise when one considers his analysis. What is this file cabinet information structure? Is it to be a model of discourse content (and the truth conditions of a discourse) or is it distinct? Vallduví suggests that it is distinct. But then, what is its role?"

In discussing contrastiveness, Chafe makes some interesting remarks on the semantics of contrastive focus, which he distinguishes from information focus expressed by the contrast of given-new. The contrastive focus on *Ronald* in sentence (22) conveys "the speaker's knowledge that Ronald, as opposed to other possible candidates the addressee might have had in mind, is the right selection for this role" (Chafe 1976, 33). Chafe lists three factors that are involved in the interpretation of this sentence: (i) the shared assumption or background knowledge that someone made the hamburgers; (ii) a set of possible candidates, and (iii) the assertion of which candidate is the correct one.

- (22) RÓNALD made the hamburgers.
- (i) background: someone made the hamburgers
 - (ii) set of possible candidates: {Bill, John, Max, Ronald, Tom,...}
 - (iii) assertion: Ronald is the one who made the hamburgers

Chafe's conception of contrastive focus is similar to Chomsky's description of information structure in terms of presupposition and focus.

3.2.4 Chomsky on focus and presupposition

Chomsky (1971, 199ff) discusses information structure in the context of his distinction between deep structure and surface structure. It is the deep structure that determines the meaning of a sentence. However, if it can be shown that intonational contrasts, which only effect the surface, exhibit systematic meaning contrasts, then the model is threatened. Even though Chomsky does not give a final answer, he discusses several examples and some approaches to describe them. What should be of interest here is his treatment of the contrast given-new, or in his terms: presupposition-focus. Focus is defined "as the phrase containing the intonation center" (Chomsky 1971, 200).

In a first approach Chomsky explains the focus-presupposition dichotomy in the following way. (24) is a reasonable answer to (23a)-(23d), all of which have the presupposition that John writes poetry somewhere. The presupposition is informally described as that part of the sentence that is conveyed independently of the speech act or the negation made in the sentence. The presupposition corresponds to the sentence minus the focus element. Chomsky proposes the deep structure (25) for (24), in which the presupposition is the embedded sentence and the focus is part of the matrix predicate *is in the garden*.

- (23a) Does John write poetry in his STUDY?
- (23b) Is it in his STUDY that John writes poetry?
- (23c) John doesn't write poetry in his STUDY.
- (23d) It isn't in his STUDY that John writes poetry

- (24) No, John writes poetry in the GARDEN.
- (25) [the place where John writes poetry] [is in the garden]
 presupposition: John writes poetry at a place
 focus: garden

Chomsky (1971, 205) informally describes the construction of such a deep structure: "The focus is the phrase containing the intonation center, the presupposition, and the expression derived by replacing the focus by a variable." Then in a quasi formalization, he proposes to associate each sentence with a class of pairs (F, P) where F is a focus and P a presupposition indicating the range of possible interpretations. Since the function of focus is to "determines the relation of the utterance to responses, to utterances to which it is a possible response, and to other sentences in the discourse", the range of possible interpretation can do so. For example, (24) is a proper answer to (23a) since they share the same presupposition that John write poetry at some place.

Even though Chomsky is not very explicit in his description of focus – he is more interested in the relation between surface structure and deep structure – he assumes like Halliday that focus is intonationally marked. In contrast to Halliday Chomsky (1971, 205) makes the claim that the interpretation of focus is to be integrated into semantics proper:

The notions 'focus', 'presupposition', and 'shared presupposition' (...) must be determinable from the semantic interpretation of sentences, if we are to be able to explain how discourse is constructed and, in general, how language is used.

Chomsky's very general view of focus in generative grammar was developed into a semantic theory by Jackendoff (1972), Höhle (1982) and others. Jackendoff's account will be the basis of the semantic theories of focus presented in chapter 4.

Chapter 4

Semantic theories of focus

The theories of information structure discussed in the last chapter assumed an independent level of organization of the sentence. They explicitly state that this is not a semantic level since a great number of effects attributed to *information structuring* does not effect the sentence meaning in terms of propositional content (e.g., Chafe 1976, Vallduví 1990). At first glance, this view seems reasonable for both aspects of information structure, for the "aboutness" distinction of the sentence as well as the discourse anchoring. Consequently, approaches to information structure employ other fields like psychology for an explanation of informational contrasts. However, the informational organization does not only interact with other linguistic levels, but also plays an essential role in several linguistic aspects of meaning. For example, it is essential for the construction and the coherence of a discourse, for the choice of anaphoric elements, for the interpretation of the adequate speech act and so on. More importantly, information structure is necessary for the interpretation of sentences with focus-sensitive particles like *only*, *also*, *too* or adverbs of quantification like *always*, *sometimes* etc. Here, we find truthconditional effects of different informational organizations of the text, which is the primary sign that the latter is of semantic import.

Therefore, semantic theories of information structure are built on the analysis of focus-sensitive particles. Their contribution to sentence meaning depends on the informational structuring of the sentence, which is considered to consist of a focus part and a complement to this focus. This complement is known under different terms such as *presupposition*, *frame*, *open proposition*, *shared knowledge* or *background*. I will use *background* as a neutral term, defined as complement of the focus unit. The focus-background effects are informally illustrated by the following three examples. In the simple assertion (1), the focus on *Fred* is said to induce a presupposition that Sam talked to someone and that there are reasonable alternatives that would have been good choices for this someone, as well.

- (1) Sam talked to FRED_F.
- (1a) It is part of the background or of the shared knowledge that Sam talked to someone. There are alternatives to Sam under discussion.

In (2), the focus particle *only* is translated into an operator that quantifies over alternatives to Fred and asserts that if such an alternative fits the background, then it is identical with the focus *Fred*. This corresponds to the paraphrase that nobody but Fred is such that Sam talked to him.

- (2) Sam only talked to $FRED_F$.
- (2a) Nobody but Fred is such that Sam talked to him or her.
- (2b) for every element x that is a reasonable alternative to Sam, if x fits the background "Sam talked to x " then x is identical with Fred

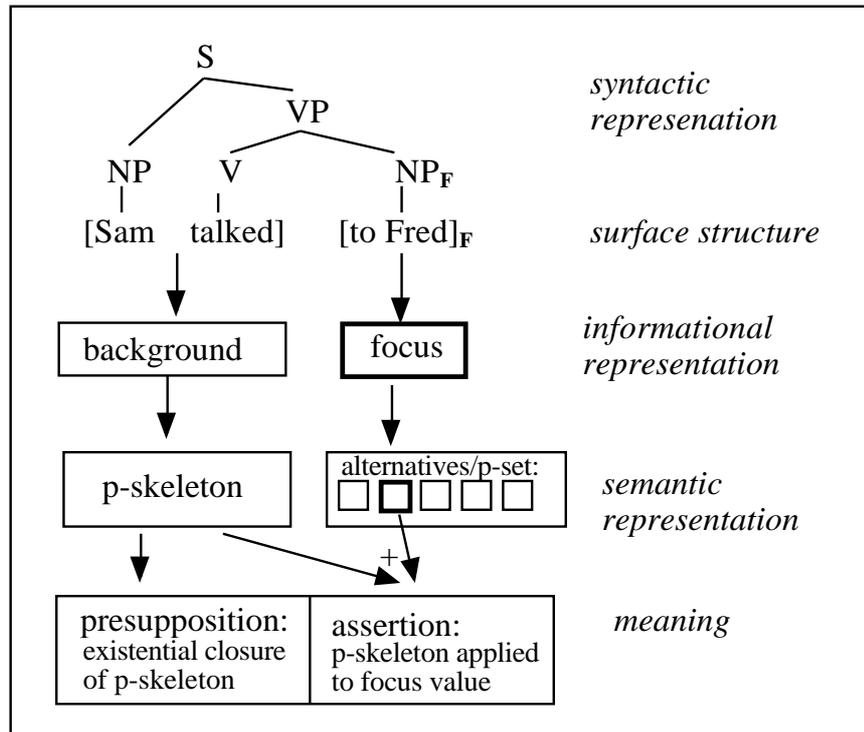
The adverb of quantification in (3) asserts that for most occasions in which Sam invites someone to the movies, it is Fred who is invited. Here, the adverb of quantification is translated into an operator which takes two arguments and compares the two: the set of times when Sam invites someone to the movies and the set of time when he invites Fred. The operator states that most time points of the first set are also in the second set. Here, the operator does not quantify over the focus, but the focus indicates how to form the proper domains for the quantifier.

- (3) Sam usually invites $FRED_F$ to the movies.
- (3a) For most times in which Sam invites someone to the movies, he invites Fred to the movies
- (3b) Most $\{t \mid \text{Sam invites someone to the movies at } t\}$
 $\{t \mid \text{Sam invites Fred to the movies at } t\}$

The following general picture can be drawn: The surface structure receives a syntactic representation in terms of constituents and an informational representation, which is a partition into background and focus. The background corresponds to a semantic structure that I will call here the *p-skeleton*, following Jackendoff's (1972) *presuppositional skeleton*, other expressions are *open proposition*, *frame* etc. The *p-skeleton* is formed by substituting the focused expressions by appropriate variables.

The focus induces or evokes alternatives in one way or other. The value of the focus, i.e., the semantic denotation of the focused expression, is part of the set of alternatives, which are sometimes called *p-set*. The *p-skeleton*, the set of alternatives, and the value of the focus combine to form the assertion and the presupposition of the sentence. The presupposition is formed by existential closure, i.e., by existential quantification over the free variables that had been substituted for the focused expression. Applying the value of *p-skeleton* to the focus value yields the assertion, as illustrated in the diagram (4), which refers to sentence (1), where no overt focus operator is present. Focus particles can be translated into quantifiers that operate on the three semantic objects defined so far: the *p-skeleton* the *p-set* and the value of the focus. The particular rules for this operator are the subject of the focus theories presented in this chapter.

(4) Information structure and focus-semantics



This simplified picture of semantic theories of focus will be realized by different theories in different ways. However, the following six assumptions are shared by most semantic approaches to focus (and information structure, in general):

- (5) General assumptions of semantic theories of information structure
- (i) The sentence is divided into two parts: the focus and the background. The focus is a semantic concept and marked by a pitch accent. The relation between pitch accent and focus is mediated by the syntactic feature *F*.
 - (ii) The focus constitutes the new material.
 - (iii) The background is roughly identified with given material.
 - (iv) The background is translated into the presuppositional-skeleton by substituting variables for the focused phrases.
 - (v) The presupposition of the sentence is derived by the existential closure of these variables.
 - (vi) The focus induces a set of alternatives to its value (restricted by considerations of context and appropriateness).
 - (vii) P-skeleton, p-set and focus-value are combined in various ways yielding the presupposition and the assertion of the sentence. Focus operators can express relation between these objects.

This concept of the informational structure of a sentence corresponds more to the discourse anchoring aspect of information structure than to the aboutness aspect. In other words, focus-background structure is defined analogously to the given-new distinction. This view combines aspects of what other theories describe as *informative focus* and *contrastive focus*. Chafe characterizes Halliday's information focus in terms of givenness, and contrastive focus in terms of background, alternatives and an operation on both (see section 3.3.3 above). The view advocated by semantic theories does not distinguish between these two kinds of focus, they rather intend to overcome this distinction and understand both as one basic phenomenon. In fact, it is not clear whether there are any semantic criteria for a classification into two independent classes of focus.

The chapter is structured as follows: Section 4.1 presents a basic semantic description of focus-sensitive operators like *only* or *even*. Section 4.2 presents the main concepts of focus semantics introduced by Jackendoff (1972), such as *focus*, *p-skeleton*, *presuppositional set*, *scope of a particle* and *association with focus*. In section 4.3, I introduce two focus theories, the LF-movement theory and Alternative Semantics. I will show that LF-movement theories cannot account for the association with focus in embedded structures like (8) below. Section 4.4 finally presents the different semantic levels of analysis and discusses which of these levels are affected by the semantics of focus. It will be argued that examples like (9) show that Alternative Semantics produces too many alternatives. It is concluded that focus affects a representational structure, rather than a denotational one.

In the course of the presentation, I will illustrate the arguments by certain examples, which I list below for better orientation. Example (1) illustrates the informative (*Who did Sam talk to?*) or the contrastive (*Sam talked to Bill. No, ...*) use of focus. Examples (2) and (3) show the interaction of focus with focus-particles and adverbs of quantification:

- (1) Sam talked to FRED_F.
- (2) Sam only talked to FRED_F.
- (3) Sam usually invites FRED_F to the movies.

Examples (6) and (7) are the classical motivation for developing focus semantics because they show that the sentence meaning differs depending on the location of the pitch accent. The paraphrases should make the meaning distinctions transparent.

- (6) Mary only introduced SUE_F to John.
- (6a) Sue and nobody else is such that Mary introduced him/her to John.
- (7) Mary only introduced Sue to JOHN_F.
- (7a) John and nobody else is such that Mary introduced Sue to him/her.

Examples like (8), discussed by Krifka (1996), show that the focus-sensitive particle does not associate directly with the focused expression. The paraphrase (8a), which is formed analogously to (6a) and (7a), does not capture the intuitive meaning of (8). This becomes obvious in a situation in which Sue introduced Bob and Bill to John and Mary talked to Sue and no other women. In this situation, (8a) becomes false since Bob is not the only one who was introduced by Sue to John. The example illustrates that a simple movement-approach to focus is not sufficient (see section 4.3.3 for the full argument).

- (8) Mary only talked to [_{NP} the woman who introduced BOB_F to John].
 (8a) Bob and nobody else is such that Mary talked to the woman who introduced him to John.

Kratzer (1991) discusses a problem for Alternative Semantics, which is illustrated by (9). Alternative Semantics predicts that, if the VP-ellipsis is reconstructed as in (9a), the second occurrence of *Tanglewood* induces alternatives independent of the first occurrence. Intuitively, the alternatives of both occurrence should co-vary, which must be encoded at a representational level different from the denotational level, where the focus semantics of expressions are realized in Alternative Semantics.

- (9) I only went to TANGLEWOOD_F because you did.
 (9a) I only went to TANGLEWOOD_F because you went to Tanglewood_F.

A final problem is demonstrated by (10), where the alternatives interact with the uniqueness condition of the definite article. According to the expected paraphrase (10a), only alternatives "survive" that describe professors that are unique with respect to a nationality. However, the intended domain of quantification includes all professors, as described by the paraphrase (10b). This problem of association with focus in definite NPs is the subject of the next chapter.

- (10) Sam only talked to [the DUTCH_F professor]_{NP}.
 (10a) No nationality but Dutch is such that Sam talked to the unique professor of this nationality.
 (10b) Sam talked to no professor but the Dutch professor.

4.1 A propositional analysis of *only*

In his classical article "A presuppositional analysis of *only* and *even*", Horn (1969) gives the first semantic account of the focus-sensitive particle *only* and *even*, which is based on the concept of presupposition. Since the understanding of this approach is essential for the comprehension of all other semantic theories presented here, I will discuss Horn's view first. He defines the notion of presupposition and then argues that particles like *only* and *even* are translated into operators that make contributions to the assertion *and* to the presupposition of the sentence.

Horn (1969, 98) regards a presupposition as one of the many possible inferences that we can draw from a sentence. He defines it in contrast to an entailment as in (11). S presupposes S' if from S we can conclude S' , and from $\neg S$ we can conclude S' . S entails S' if from S we can conclude S' , and from $\neg S'$ we can conclude $\neg S$.

- (11) (i) If ($S \rightarrow S'$) and ($\neg S \rightarrow S'$) then S presupposes S' .
 (ii) If ($S \rightarrow S'$) and ($\neg S' \rightarrow \neg S$) then S entails S' .

An instance of this concept of presupposition is the notion *presupposition of a question*, which Horn (1969, 98) – following Katz & Postal (1964) – defines as "a condition that the asker of a question assumes will be accepted by anyone who tries to answer it":

- (12a) Who saw Harry? Someone saw Harry.
 (12b) Where did Harry go? Harry went somewhere.
 (12c) When did Harry go? Harry went sometime.
 (12d) Why did Harry go? Harry went for some reason.

Each question corresponds to a presupposition which must be accepted if one answers the question. Thus, the question-test, which was already used by Paul (see section 1.3 and 3.1.2 (iii)) and others to indicate information structure, is understood as a particular instantiation of presupposition in general. In other words, one important test for information structure can be reconstructed by referring to inference properties of the sentence.

The set of possible responses to each of the questions in (12) can be defined as "the set of permissible existential instantiations of the appropriate presupposition". For example, an answer like *John saw Harry* is a typical instantiation. Thus, presuppositions can not only be distinguished from assertion by their insensitivity towards

negation, but also by their relation to questions, as demonstrated. Another classical test are it-cleft sentences, as used in section 3.3.4 example (14).¹

In a second step, Horn investigates the semantic contribution of *only* and *even* to the assertion and presupposition of a sentence containing such particles. The first observation is that the paraphrase (14) of sentence (13) consists of the presupposition (14a) and the assertion (14b). To make this point clearer, sentence (13) is negated in (15a) and (15b), both being mutual paraphrases, and tested for possible conclusions. From the negated sentences (15a) and (15b) as well as the positive (13), one can conclude (14a) that Muriel voted for Hubert, but we cannot conclude (14b) from (15a) or (15b). Thus (14a) is the presupposition of the sentence (13), and (14b) is the assertion.

- (13) Only Muriel voted for Hubert.
- (14) Muriel voted for Hubert and no one other than Muriel voted for Hubert.
- (14a) presupposition: Muriel voted for Hubert
- (14b) assertion: no one other than Muriel voted for Hubert
- (15a) It is not the case that only Muriel voted for Hubert.
- (15b) Not only Muriel voted for Hubert.

Horn proposes that the particle *only* is translated into a predicate *Only* that takes two arguments, the first argument being the NP adjacent to *only* and the second argument being the whole proposition containing the term. The operator expresses (i) the presupposition that the term holds of the proposition and (ii) the assertion that there is no other term different from that term that makes the proposition true. Horn (1969, 99) describes the essential semantics of *only* in schema (16), which will be part of all definitions that are presented in the remainder of this chapter. The negated existential formula for the assertion is equivalent to the universal formula, which can be paraphrased as *For all y if y holds of F then y is equal to x*.

- (16) Only (x=a, Fx)
 P: Fx
 A: $\neg(\exists y)(y \neq a \ \& \ Fy)$ (or: $\forall y [F(y) \rightarrow y=x]$)

¹ This is quite an informal notion of presupposition, which is often criticized. Reis (1977), for example, rejects the notion of presupposition as helpful semantic tool since there is no clear definition. Even though there is no agreement on the exact definition and delimitation of presupposition from other inferential properties, there is agreement that the notion of presupposition can effectively be used in semantic analysis. Compare the early discussion in Oh & Dinneen (1979) and the overviews given in van der Sandt (1988), Horn (1996), Beaver (1997) and Krahmer (1998). Atlas (1991) and Blok (1991) criticize Horn's analysis of focus-particles in terms of presuppositions in particular.

If this schema is applied to the sentence (13), the presupposition and assertion is formalized as in (17):

- (17) P: $V(m,h)$
 A: $\neg(\exists y)(y = m \ \& \ V(y,h))$

Sentence (18) with the particle *even* receives the paraphrase (19), whose first conjunct is the presupposition (19a) and the second the assertion (19b).

- (18) Even Muriel voted for Hubert.
 (19) Someone other than Muriel voted for Hubert and Muriel voted for Hubert.
 (19a) presupposition: Someone other than Muriel voted for Hubert
 (19b) assertion: Muriel voted for Hubert.

In contrast to *only*, the semantics of *even* contributes to the presupposition of the sentence, rather than to its assertion, as formulated by Horn (1969, 105) in (20). Thus Horn (1969, 106) concludes "that *even* (like *also*) asserts what *only* presupposes and presupposes the negation of what *only* asserts."

- (20) Even ($x=a, Fx$)
 P: $(\exists y)(y \neq x \ \& \ Fy)$
 A: Fx

Both the presupposition and the assertion are often merged into one conjunct – corresponding to the paraphrase (14) or (19) – when the distinction is not essential for the semantics presented. Furthermore, the assertion (16A) is generally formulated in the equivalent form with a universal quantifier. Thus the essential semantics of *only* can be captured by (21), and that of *even* by (22). The particles are translated into operators that take two arguments: the focus and the proposition, in which the focus is embedded. The meaning of *only* says that the proposition holds of the focus value and that for every other value if the proposition holds of this value then it is identical with the focus value. The meaning of *even* includes that there is someone else besides the value of the focus of which the proposition holds and the proposition holds of the value of the focus:

- (21) $\|Only\| (a, Fx) = Fa \ \& \ \forall y [F(y) \supset y=x]$
 (22) $\|Even\| (a, Fx) = \exists y [(y \neq a \ \& \ Fy) \ \& \ Fa]$

Given this elementary meaning of *only* and *even*, semantic theories have to account for the compositional mechanism that integrates these function into the semantic

composition. Furthermore, a focus semantics has to assign focus effects their location in the general semantic architecture.

4.2 The construction of focus

Jackendoff (1972) elaborates on Chomsky's (1971) rather informal remarks on the information structure of a sentence and its representation in terms of a pair focus-presupposition in order to capture its impact on meaning (see section 3.2.4). Following Chafe (1970), Jackendoff (1972, 230) characterizes focus and presupposition in terms of a discourse model consisting of speaker and hearer:²

We will use 'focus of a sentence' to denote the information in the sentence that is assumed by the speaker not to be shared by him and the hearer, and 'presupposition of a sentence' to denote the information in the sentence that is assumed by the speaker to be shared by him and the hearer.

He illustrates his notion of presupposition with the following examples. (24a) is a felicitous or coherent answer to (23), while (24b) is not. Jackendoff, following Chomsky, explains this by showing that (23) and (24a) share the presupposition that someone writes poetry, but (24b) has the presupposition that someone writes short stories.

- (23) Is it JOHN who writes poetry?
 (24a) No, it is BILL who writes poetry.
 (24b) No, it is JOHN who writes short stories.

In order to build the focus-presupposition structure into his grammar, Jackendoff introduces three important new features: (i) the syntactic focus feature *F*, (ii) the presuppositional skeleton and the presuppositional set, and (iii) the term *association with focus*.

4.2.1 The syntactic focus feature *F*

Jackendoff conceives of focus as a semantic notion, which is marked intonationally by pitch accent. Since in the generative model, syntax mediates between phonological and semantic interpretation, Jackendoff (1972, 240) introduces the focus feature *F* in

² Jackendoff, like Chomsky, must have been aware of the formal definition of presupposition in terms of inference pattern given by Horn (1969) and others (see section 4.1). Jackendoff lists Horn (1969) in his references. The point is rather that Jackendoff, like Chomsky, uses the notion presupposition as a semantic concept and additionally links it to the discourse in the terms of Chafe and others since there was no semantic apparatus for describing discourse relations.

syntax: "One artificial construct is required: a syntactic marker *F* which can be associated with any node in the surface structure." This feature is interpreted on the phonological side according to the Stress Assignment Rule, and on the semantic side according to the Focus Assignment Rule:

(25) Stress Assignment Rule (Jackendoff 1972, 237)

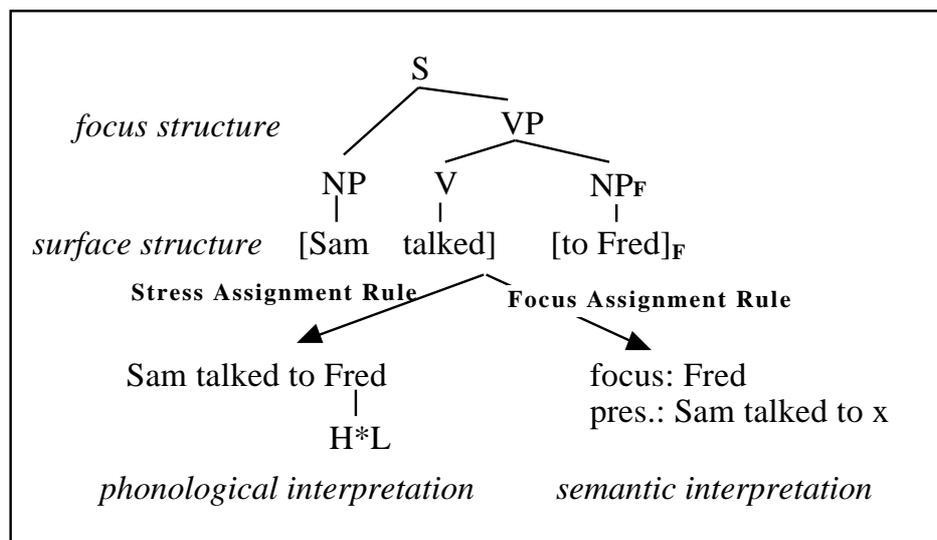
If a phrase *P* is chosen as the focus of a sentence *S*, the highest stress in *S* will be on the syllable of *P* that is assigned highest stress by the regular stress rule.

(26) Focus Assignment Rule first approximation (Jackendoff 1972, 240)

The semantic material associated with surface structure nodes dominated by *F* is the Focus of the sentence. To derive the Presupposition, substitute appropriate semantic variables for the focused material.

The focus feature *F* on the NP-node in (27) is phonologically interpreted as pitch accent on *Fred*, and its semantic interpretation says that *Fred* is the focus, whereas *Sam talked to someone* is the presupposition. The annotated surface structure is sometimes called *focus structure*:

(27) The focus feature *F* and its phonological and semantic interpretation



The Stress Assignment Rule interacts with other rule like the NSR, according to which the pitch accent on *Spanish* in (28) can be associated with the different syntactic forms in (29b)-(31b). The difference in focus is illustrated by different (intended) questions (29a)-(31a). This relation between the pitch accent and the annotated surface structure is called *focus projection* (see section 2.4.3). The theories discussed in the remainder of this section assume a syntactic structure annotated with the focus feature indicating the focus.

(32) John likes MARY_F.

(32a) Focus: Mary

(32b) p-skeleton (Jackendoff): the {object that is liked by John} is x

(32c) p-skeleton (accommodated): John likes x or: L(j,x)

The second step consists of constructing the presuppositional set, which is defined "as the set of values which, when substituted for x in $\text{Presupp}_S(x)$, yield a true proposition. We will symbolize the presuppositional set with the expression $x \text{ Presupp}_S(x)$." (Jackendoff 1972, 245):⁴

(32d) presuppositional set (Jackendoff): the {objects that are liked by John}

(32e) presuppositional set (accommodated): x [John likes x]

In the third step, Jackendoff constructs the presupposition and the assertion of the sentence from the Focus and the p-set. The presupposition states that the p-set is a coherent set in the discourse and it is under discussion. Jackendoff's (1972, 246) presupposition (32f) can be accommodated to a more familiar (32g). The assertion is simply that the Focus is part of the p-set, as expressed in (32h), an example being (32i):⁵

⁴ For the original example one could reconstruct the presupposition set as follows:

(32*d) p-set (Jackendoff):

relations between John and Bill
the xs that are
attitudes of John toward Bill

⁵ Jackendoff's example receives the following representation:

(32*f) Presupposition:

$x \text{ Presupp}_S(x)$ is a coherent set
is well defined in the present discourse
is amenable to discussion/is under discussion

(32*g) the set $\{X \mid \|\text{John X Bill}\| = 1\}$ is under discussion

(32*h) Focus $x \text{ Presupp}_S(x)$

(32*i) like $\{X \mid \|\text{John X Bill}\| = 1\}$

This construction illustrates the discourse background (presupposition) that the participants are speaking/discussion possible relations between John and Bill and the speaker is assuming that *like* is one of this relation.

- (32f) Presupposition:
- | | |
|----------------------------|---|
| | is a coherent set |
| x Presupp _S (x) | is well defined in the present discourse |
| | is amenable to discussion/is under discussion |
- (32g) the set {x | ||John likes x|| = 1} is under discussion
- (32h) Focus x Presupp_S(x)
- (32i) Bill {x | ||John likes x|| = 1}

The particular formulation of the presuppositional set seems to be odd, since it only includes those objects that yield a true proposition if they replace the variable in the p-skeleton. This, however, would in our example, only include Mary, such that the contrastive function of the focus is not reflected in this reconstruction. One would expect a slightly different formulation of the presuppositional set indicating that it contains elements that *could* form a true proposition. This problem, which was pointed out to me by Regine Eckardt (p.c.), certainly was the main reason why Rooth (1985, 12) constructed a different kind of semantic object, namely, his *p-set*⁶

The focus-influenced component of meaning which I will employ is a variation on Jackendoff's intermediate representation Presup. In the system of interpretation which I am employing, Jackendoff's proposal could be executed by letting a logical form phrase **a** have two denotations. **a'** is the normal denotation. In the other, the Presup **a''**, distinguished variables of appropriate type have been substituted for focused phrases. **a''** can be derived by a recursive definition:

- (33) Recursive definition of presupposition skeleton
- a''** is
- (a) a variable matching **a'** in semantic type if **a** bears the feature F.
 - (b) **a'**, if **a** is a non-focused non-complex phrase
 - (c) obtained by applying the semantic rule for **a** to **b₁'** ... **b_n'**, where **b₁** ... **b_n** are the component phrases of **a**.

Rooth then modifies this definition in order to produce alternative propositions. Alternative propositions of type *like'(j,x)* where x is some individual, are the denotation of a question like *Who does John like?* "The way I would like to think of the question-answer paradigm is that a question introduces a set of alternatives into a discourse; (...). The function of the focus in the answer (...), I suggest, is to signal that alternatives of this form are indeed under considerations. The revision (20) [= (34)] of (19) [= (33)] recursively generates these sets of alternatives, which I will call p-sets." Rooth (1985, 13f):

⁶ The idea of an alternative set as a secondary denotation goes back to Karttunen & Peters (1979).

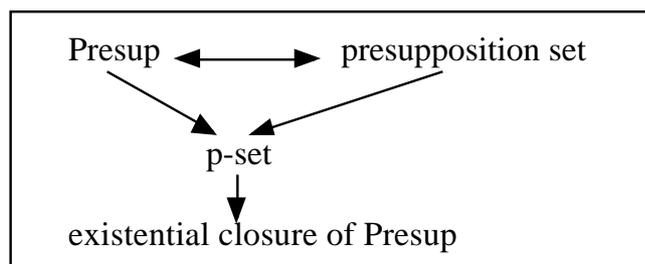
(34) Recursive definition of p-sets

a'' is

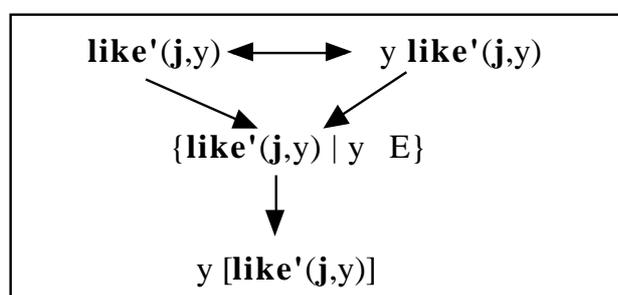
- (a) The set of objects in the model matching **a'** in type, if **a** bears the feature F.
- (b) the unit set **a'**, if **a** is a non-focused non-complex phrase
- (c) the set of objects which can be obtained by picking one element from each of the p-sets corresponding to the component phrases **a**, and applying the semantic rule for **a** to this sequence of elements, if **a** is a non-focused complex phrase.

This move from the representational presuppositional set to the denotational p-set was the starting point for Rooth's Alternative Semantics, which will be discussed in section 4.3.2 and chapter 5). Rooth (1985, 17) describes the relation between the Presup, the presuppositional set (or p-skeleton), and the p-set as follows (the example accommodates the example used here): Presups and presupposition sets encode the same information, modulo some problems having to do with the order of variables and arguments. Either can be mapped in a natural way to p-sets. The existential closure of the Presup can be recovered as the (possible infinite) disjunction of the elements [in] the p-set"

(35) Relation between Presup, presupposition set and p-set



(36) Example for Presup, presupposition set and p-set



To sum up, Jackendoff's rules construct the semantic objects from the surface structure. Rooth modifies one of the representational objects and defines it in terms of denotations (or alternatives). Thus we can distinguish between representational objects

(Focus, Presup (or p-skeleton), and presuppositional set) and denotational objects (p-set (or alternatives, focus value)).

These rules are developed for sentences without any overt focus-sensitive particles, which requires the described formation of presupposition and assertion. However, the semantic representation and objects developed so far provide the necessary means by which more complex interactions can be accounted for.

4.2.3 Association with focus and the scope of the particle

The described construction was developed on simple sentences with one focus. Jackendoff extends his analysis to examples with particles, like *only*, *even*, and *just*. He observes that these particles need a focus for their interpretation, and, therefore calls such constructions *association with focus*. Even though he has the necessary semantic structure for constructing the meaning of such particles, he discloses some additional problems for an analysis of association with focus:

We will propose a rule *association with focus*, which applies to *even* to associate its reading with the focus. Unfortunately, at the present stages of research the formal nature of this rule cannot be specified. The reason there must be a rule accomplishing this association, and not just a general semantic convention, is that there are particular structural conditions under which the association takes place. To specify these conditions, we need to define the notion of *range*. (Jackendoff 1972, 249)

Jackendoff's *range* is generally known under *the scope of the particle* or *the scope of the focus operator*. In (37) the particle *only* is associated with the focus *Spanish*. The scope of the particle *only* is the whole VP *advised to learn Spanish*. In general, the scope of the particle is its c-command domain:⁷

(37) They were only [_{VP} advised to learn [SPANISH]_F]_{VP}.

In most cases, the scope of a particle will coincide with the maximal category it is adjoined to. However, there are idiosyncratic restrictions to this general principle. For example, *only* cannot be associated with the subject, if it follows, whereas *even* can, as has been observed by Jackendoff (1972, 251-254). In (38a) the focus-sensitive particle *even* associates with the subject, but in (38b) *only* or *just* cannot do so. Association with focus is indicated by indexing the particle and its associated focus.

⁷ Jacobs (1983, 8ff) additionally distinguishes between the syntactic domain and the semantic domain of the operator ("syntaktischer Bereich" and "semantischer Bereich"). The syntactic domain is the co-constituent of the particle while the semantic domain corresponds to scopal behavior with respect to other operators. Jacobs (1983, 8ff) argues that both domains do not always coincide: "Semantischer und syntaktischer Bereich sind also nicht notwendigerweise (ja nicht einmal im Normalfall) identisch (...)." It was Jackendoff's intention to find a mapping from the syntactic to the semantic domain, when he discussed the range of the particle.

- (38a) JOHN₁ even₁ gave his daughter a new bicycle.
 (38b) *JOHN₁ only₁/just₁ gave his daughter a new bicycle.

The term *association with focus* is also applied to other interactions between an operator and a focus, as illustrated in section 1.7. Besides focus-sensitive particles like *only*, *even*, *also*, adverbs of quantification, nominal quantifiers, negation, modal operators, counterfactuals, superlatives etc. are also classified as associated with focus. However, not all these operators have the same properties as *only* or *even*. For example, adverbs of quantification take the whole sentence as their scope, rather than their c-command domain (see section 5.2.4). Furthermore, not all particles necessarily need a focus for their interpretation.⁸

For the construction of focus and focus phenomena in our semantics the following terms have been introduced:

<i>F-feature:</i>	Syntactic feature that marks focus-constituents at the surface structure (i.e., the focus structure). It is interpreted by phonology as pitch accent and by semantics as focus.
<i>focus projection:</i>	Projection of the feature F to higher syntactic nodes at surface structure.
<i>focus or focus domain:</i>	Semantic representation that corresponds to the focused constituent, i.e., the highest node with the focus feature (see (40a)). Complement to presupposition.
<i>scope of a particle:</i>	Its c-command domain (or its coconstituent)
<i>association with focus:</i>	The particle is associated with a focused element in its scope.

To illustrate the use of these terms, consider example (26) with the pitch accent on *Spanish*. This surface structure can be the phonological interpretation of three different

⁸ Bos (1999, 123) summarizes the different ingredients: "Apart from the particle itself and its focus, its scope is the third essential feature needed for interpretation. In (5) the scope of the inclusive focus particle *too* can either be the entire utterance of the embedded sentence only.

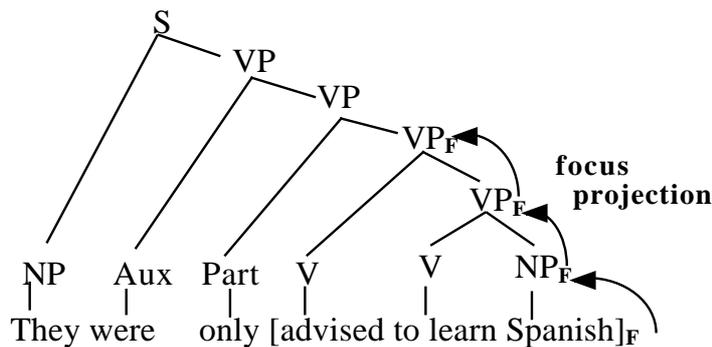
(5) I believe that BILL is coming too

In the reading where *too* takes scope over the entire sentence, the triggered presupposition is 'I believe that someone (not Bill) is coming'; however, when *too* takes scope only over the subordinated sentence, the involved presupposition is just 'Someone (but not Bill) is coming'. In summary, by interpreting focusing particles three ingredients are of importance: the particle itself, its focus, and its scope. Focusing particles refer to a set of alternatives for the focus. The members of this set are of the same type as the focus and sometimes given by context."

syntactic focus structures, two of which are presented in (26a) and (26b). (26a) represent the focus structure in which the focus is projected to the VP *advised to learn Spanish*, while in (26b) the focus feature is not projected, but stays on the NP *Spanish*. That means, in (26a) the particle associates with the whole VP being the focus (domain), but in (26b) only with the NP being the focus. However, in both structures the particle has the same scope, namely the VP *advised to learn Spanish*.

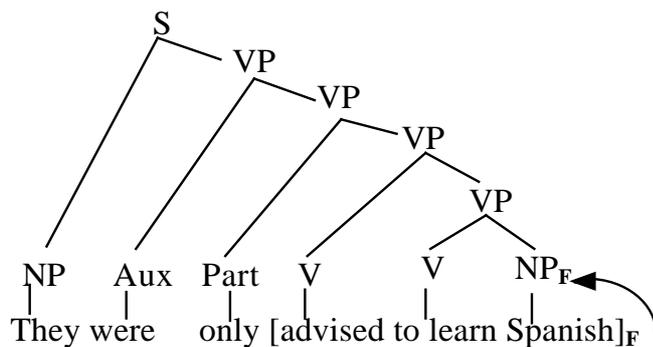
- (39) They were only advised to learn SPANISH
 |
 H*L

(40a)



- (40b) Nothing else happened to them than they were advised to learn Spanish
 (They were not asked to join the scouts, they were not meeting friend, they were not swimming,)

(41a)



- (41b) No subject than Spanish was such they were advised to learn it (They were not advised to learn German, they were not advised to learn Maths,...)

To summarize, Jackendoff has introduced several assumptions on the syntax and semantics of focus, which are still fundamental for most theories of focus (cf. Krifka 1991, 127).

- (42) Common assumption of focus theories
- (i) The sentence is divided into two parts: the focus and the background. The focus is a semantic concept and marked by a pitch accent. The relation between pitch accent and focus is mediated by the abstract syntactic feature *F*.
 - (ii) The focus constitutes the new material.
 - (iii) The background is roughly identified with given material.
 - (iv) The background is translated into the presuppositional-skeleton by substituting variables for the focused phrases.
 - (v) The presupposition of the sentence is derived by the existential closure of these variables.
 - (vi) The focused expression can associate with certain operators
 - (vii) The operators take different semantic objects as their arguments.

Compare also the list in (5) above, where the first five points are the same. What is controversial is the generating of alternatives (cf. (5vi)). Jackendoff yields alternatives from the presupposition set, while Rooth assumes that the focused expression invokes them. The particular formulation of the operations of focus particles on the semantic objects introduced here is subject of the next two section.

4.3 Semantics of association with focus

In section 4.1, Horn's (1969) basic assumptions with regard to the semantics of *only* and *even* were presented, and in section 4.2, Jackendoff's construction rules for focus-background structure were introduced. In this section, the two lines of investigations to focus are connected in semantic theories of association with focus. The semantics of the association with focus is of great importance for the general study of information structure, as well as for a compositional theory of semantics. Phenomena of association with focus provide a wide range of data that show that changing the information structure (here the focus) also changes the meaning in its truth-conditional aspect, which is the most reliable and robust aspect of meaning. On the other hand, association with focus has posed a new task for compositional semantics, which computes the ordinary meaning of a sentence from its surface structure. However, focus-sensitive particle like *only*, *also*, *too*, *even*, etc. need more information than the ordinary meaning representation makes available. Although sentences (43) and (44) differ only in the accent placement, i.e., in the focus, they express different truth conditions, as indicated in the paraphrases (43a) and (44a).

- (43) Mary *only* introduced SUE_F to John
- (43a) Sue and nobody else is such that Mary introduced him/her to John.

- (44) Mary only introduced Sue to JOHN_F
 (44a) John and nobody else is such that Mary introduced Sue to him/her.

The semantics of focus-sensitive operators requires two kinds of additional information: the value of the focused expression, i.e., the *focus*, and the value of the linguistic environment of the focus, which is neutrally called the *background*. In (43), *Sue* is the focus, whereas *introduced to John* is the background. The focus-sensitive particle is translated into an operator. The operator quantifies over variables from the domain of alternatives to the focused expression. The restriction of the operator consists of the background meaning and the nuclear scope is the focus value. In (43), the domain is formed by the alternatives to the focus *Sue*, and the background consists of the rest of the sentence.

Theories differ as to whether they directly access the meaning of focus and background, or whether they assume intermediate representations or constructions. In the next two subsections, I compare two frameworks:⁹ The *LF-movement* approach makes the semantic values of focus and background available for the focus operator. It extracts the focus from its background by movement it to a higher position. The *in situ* approach of Alternative Semantics posits an additional level of interpretation, the *alternative interpretation*, which is computed in parallel with the ordinary semantics.

4.3.1 Movement theories

Direct association with focus or *movement theories* assume that the focus is moved to a position adjoined to the focus operator at the level of Logical Form. The focus leaves a trace in its original position which is interpreted as a variable (cf. Chomsky 1977). The LF can be translated into the categorial language of the *structured meaning* or *structured proposition approach* (Jacobs 1983, von Stechow 1982; 1990, Krifka 1991). The VP in (43) receives the surfaces structure (43b), the logical form (43c) and the interpretation (43d):¹⁰

⁹ Krifka (1996) distinguishes four groups of semantics theories of focus, depending on the direct access to the focus value and the background value. *Double access theories* (LF-movement or structured propositions, see section 4.3.1) need both the denotation of the focus and that of the background. *Replacement theories* (higher unification theories, e.g., Pulman (1997) work with just the access to the focus. *In Situ-Binding Semantics* (e.g., Wold 1996) works with access to the background. And *Alternative Semantics* (see section 4.3.2) does not need any direct access to focus or background, it operates on the alternative interpretations triggered by the focus.

¹⁰ In general, theories distinguish between the surface structure, the Logical Form, the translation into a formal language and the interpretation of the formal language. In the remainder, we skip the translation into the formal language and interpret LF directly. See section 4.4 for a detailed discussion.

- (43b) only [_{VP} introduced SUE_F to John]
 (43c) only (Sue_{t1}, t₁ [_{VP} introduced t₁ to John])
 (43d) ||only|| (||Sue||, || t₁ [_{VP} introduced t₁ to John]||)
 Op. (focus, background)

The meaning of *only* combines with such a structured meaning consisting of the meaning of the focus (= **F**) and the meaning of the background (= **B**).¹¹ The semantic rule (45) of this operation first asserts the application of the meaning of the background to the meaning of the focus, and second states that the background, applied to any other object than the meaning of the focus, yields a false statement.¹²

$$(45) \quad ||\text{only}||(\mathbf{F}, \mathbf{B}) = \lambda x [\mathbf{B}(\mathbf{F})(x) \ \& \ \lambda y \text{ ALT}(\mathbf{F}) [\mathbf{B}(y)(x) \ \lambda y = \mathbf{F}]]$$

The domain of quantification of the operator is formed by a function *ALT* applied to the meaning of the focus **F**. The function *ALT* takes an object **d** and yields the set of elements that have the same type as **d**. We may also say that **d** generates the set of alternatives *ALT*(**d**). The function *type* assigns a type to an object, e.g., the denotation of a proper name like *Sue* is of type *e*. Hence, the alternatives generated from the denotation of *Sue* are all elements of type *e*, i.e., the domain of individuals.¹³

$$(46) \quad \text{ALT}(\mathbf{d}) = D_{\text{type}(\mathbf{d})}$$

$$(46a) \quad \text{ALT}(\|Sue\|) = D_{\text{type}(\|Sue\|)} = D_{\text{type}(s)} = D_e = \{\mathbf{b}, \mathbf{j}, \mathbf{m}, \mathbf{s}, \dots\}$$

These rules can now be applied to example (43), repeated as (47). In the LF (47a) the focused expression *Sue* is moved to a position adjoined to *only*, and leaves the trace *t₁*. This translation is compositionally interpreted: Proper names and predicates denote constants, as given in (47b). The application of a predicate to its argument is defined as a functional application, as in (47c). In (47d), the semantics (45) of *only* combines with

¹¹ Focus-sensitive operators like *only* can be placed in nearly any position in the sentence. Treating *only* as a VP adverbial is a generalization, from which most cases in English can be derived.

¹² This is a simplification since the first conjunct is a presupposition and the second is the assertion. In the remainder of this chapter, both aspects of the meaning are merged for convenience. Compare the discussion in section 4.1.

¹³ This (ontological) type restriction on alternatives is only a necessary condition. Sortal and contextual restrictions must also be applied. Compare Jackendoff's notion of "possible contrast" (section 4.2.2), Chafe's "possible candidates" (section 3.2.3) or "comparability" (Krifka 1991). This relation is sometimes represented by " ". Krifka (1991, 128) represents the meaning of *only* in the framework of structured propositions as follows:

(i) $||\text{only}||(\langle \cdot, \cdot \rangle) := \langle \cdot \rangle \ \& \ \lambda X [X \ \& \ (X) \rightarrow X = \cdot]$,
 where X is a variable of the type of \cdot .

Note that the alternative set (or p-set) always includes the object from which the set is generated.

the meaning of the focus and the meaning of the background. This yields the property of introducing nobody but Sue to John. Finally in (47e), this property combines with the subject, returning the interpretation of the sentence. It correctly expresses that Mary introduces Sue to John and that she does not introduce anyone else to John.¹⁴

- (47) Mary [_{VP} only [_{VP} introduced SUE_F to John]]
- (47a) Mary [_{VP} only [Sue₁]_{Focus} [t₁ [_{VP} introduced t₁ to John]]_{Background}]
- (47b) ||Mary|| = **m** ||Sue|| = **s** ||John|| = **j** ||introduced|| = **introd'**
- (47c) || t₁ [introduced t₁ to John]|| = z [**introd'**(z)(**j**)]
- (47d) ||only|| (||[Sue|, || t₁ [introduced t₁ to John]]||)
- = x [**introd'**(**s**)(**j**)(x) & y ALT(**s**) [**introd'**(y)(**j**)(x) y = **s**]
- (47e) ||Mary only [Sue t₁ [introduced t₁ to John]]||
- = **introd'**(**s**)(**j**)(**m**) & y ALT(**s**) [**introd'**(y)(**j**)(**m**) y = **s**

Focus movement is understood as an instantiation of a more general principle that also applies to quantifier movement and wh-movement. However, focus movement does not obey island-restrictions that hold for quantifier or wh-movement (cf. Jackendoff 1972, Rooth 1985, von Stechow 1991, Kratzer 1991).

This has led to Krifka's (1991; 1992; 1993) theory of focus interpretation in terms of structured propositions, where all "movement-like" transportations of the focus to the operator takes place on the semantic side. Therefore, they are not subject to syntactic restrictions to movement. Krifka (1996), however, applies a rather traditional LF-movement account, which he then blends with Alternative Semantics, as presented in section 4.3.3.

¹⁴ The formalism observes the following conventions: The lexical meaning of nouns, adjectives and verbs are represented in bold face with apostrophe. Proper names may be abbreviated by their first letter. A predicate takes first its subject argument, then its indirect object and then the direct object. The sentence *Mary introduces Sue to John* receives **introd'**(**s**)(**j**)(**m**) as its semantic translation.

4.3.2 Alternative Semantics

Alternative Semantics (Rooth 1985; 1992) does not separate the meaning of the focus from the meaning of the background by extracting the focus out of the background. It rather leaves the focus *in situ* and compositionally computes the alternatives that are generated by the focused expression on a new semantic level. Alternative Semantics distinguishes between two dimensions of meaning, the *ordinary meaning* $\| _o$ and the *alternative meaning* $\| _A$. The alternatives are formed by the function *ALT* applied to the ordinary meaning of the focused expression. The alternative value of an expression is a set containing elements of the same type as its ordinary meaning. In this sense, the alternative meaning of a basic expression is derived from the correspondent ordinary value. The alternatives are projected in parallel to the composition of the ordinary meaning.¹⁵

Since there are two semantic dimensions, we have to define the interpretation rules for both dimensions. The ordinary interpretation (48a) does not see the focus feature *F* and, therefore, interprets a focused expression like the unfocused one. The alternative interpretation of a focused expression (48b) creates the set of alternatives. The alternative semantics of an unfocused expression (48c) is the singleton containing the ordinary semantic value, which maintains the same type for the alternative values of all expressions – focused or unfocused. For purpose of illustration, the general schema (48) is instantiated for proper names in (49) and for intransitive verbs in (50):

- (48a) $\| _o = \| _F \|_o$
 (48b) $\| _F \|_A = \text{ALT}(\| _o) = D_{\text{type}(\| _o)}$
 (48c) $\| _A = \{ \| _o \}$
- (49a) $\| c \|_o = \| c_F \|_o = \mathbf{c}' \quad D_e$
 (49b) $\| c_F \|_A = \text{ALT}(\mathbf{c}') = D_e$
 (49c) $\| c \|_A = \{ \mathbf{c}' \}$
- (50a) $\| V \|_o = \mathbf{V}' \quad D_{\langle e, t \rangle}$
 (50b) $\| V_F \|_A = \text{ALT}(\mathbf{V}') = D_{\langle e, t \rangle}$
 (50c) $\| V \|_A = \{ \mathbf{V}' \}$

The interpretation of composition rules must be formulated in both ordinary and alternative semantics. For the time being, there is only one composition rule: the application of a predicate to its arguments. The ordinary semantic function of this

¹⁵ As already noted, the function *ALT* overgenerates alternatives. Thus, Rooth modifies the alternative interpretation of focused expression by substituting inclusion for identity, as in (i). However, for the argument presented here, this does not make a difference.

(i) $\| _F \|_A = \text{ALT}(\| _o) \quad D_{\text{type}(\| _o)}$

composition is functional application as in (51). The alternative function of functional application (52) is more complex since it must warrant that the alternatives that are generated by a focused expression can be projected. It is a set formed by all possible expressions $X(Y)$ that are derived from the application of an element X of the first alternative set to an element Y of the second alternative set.

$$(51) \quad \|_O = \|_O(\|_O)$$

$$(52) \quad \|_A = \{X(Y) \mid X \|_A, Y \|_A\}$$

For instance, the application of a predicate to its focused argument is the functional application (53a) of its meaning to the meaning of the argument. The alternative semantics (53b) denotes a set that includes all expressions that result from the application of the predicate to one of the alternatives to the argument. The alternative set (53c) generated by the VP *talk to SAM_F* includes the interpretations of all VPs of the form *talk to y*, where y is an alternative value to Sam. This is the set of individuals that have the property of talking to someone.

$$(53a) \quad \|\mathbf{V}(c_F)\|_O = \mathbf{V}'(\mathbf{c}')$$

$$(53b) \quad \|\mathbf{V}(c_F)\|_A = \{X(y) \mid X \|_A, y \|_A, \|\mathbf{V}'\|_A, \|\mathbf{c}'\|_A\} \\ = \{X(y) \mid X \|_A, y \|_A, \{\mathbf{V}'\} y \|_A, \text{ALT}(\mathbf{c}')\}$$

$$(53c) \quad \|\text{talk to SAM}_F\|_A = \{X(y) \mid X \|_A, y \|_A, \|\text{talk}\|_A, \|\text{SAM}_F\|_A\} \\ = \{\mathbf{talk}'(y) \mid y \|_A, \text{ALT}(\mathbf{s})\} \\ = \{d \mid y \|_A, \mathbf{talk}'(y)(d)\}$$

The definition of the meaning (54) for the (adverbial) focus-sensitive operator *only* operates on both aspects of the meaning of an expression α . When applied to a VP, the ordinary meaning $\|\text{VP}\|_O$ expresses the presupposition, whereas the alternative meaning $\|\text{VP}\|_A$ determines the domain of quantification for the operator. There is no property in the set of alternatives that holds of x other than the property that is identical with the ordinary meaning. Here, the operator does not need two disjoint parts of the meaning of the expression as in the LF-movement account. It rather works with both dimensions of the meaning. Thus, the focused expression is not directly involved in the semantics of the operator. It merely generates alternatives, which then are projected to the alternative meaning of the whole phrase.

$$(54) \quad \|\text{only VP}\|_O = x \|_A [\|\text{VP}\|_O(x) \& \text{P} \|_A \|\text{VP}\|_A \text{P}(x) \text{P} = \|\text{VP}\|_O]$$

We can now analyze sentence (43), repeated as (55). In (55a), the focused expression *SUE_F* generates a set of alternatives, whereas the alternative interpretations of *Mary*, *John* and *introduce* form singletons containing the ordinary meaning. The ordinary

semantics of the application of the predicate *introduce* to its arguments *Sue* and *John* yields the property **introd'(s)(j)**, as in (55c). The alternative value of this application is the set of properties consisting of introducing someone (i.e., an alternative value to Sue) to John. The semantics of *only* asserts in (55d) that there is only the one property, which consists of introducing Sue to John (and there is no other property of introducing someone else to John). This combines in (55e) with the subject and yields the correct semantic representation for the sentence, namely that Mary introduces Sue to John. Furthermore, for all predicates that are formed by the description *introduce someone to John* if they hold of Mary, then they are identical with the property of introducing Sue to John.¹⁶

- (55) Mary_{VP}[only_{VP}[introduced Sue_F to John]]
- (55a) $\|Sue_F\|_O = s$ $\|Sue_F\|_A = ALT(s) = D_e$
- (55b) $\|Mary\|_O = m$ $\|Mary\|_A = \{m\}$
 $\|John\|_O = j$ $\|John\|_A = \{j\}$
 $\|introduce\|_O = \mathbf{introd}'$ $\|introduce\|_A = \{\mathbf{introd}'\}$
- (55c) $\|introduced Sue_F to John\|_O = \mathbf{introd}'(s)(j)$
 $\|introduced Sue_F to John\|_A = \{\mathbf{introd}'(x)(j) \mid x \in ALT(s)\}$
e.g. $\{\mathbf{introd}'(s)(j), \mathbf{introd}'(s)(j), \mathbf{introd}'(j)(j), \dots\}$
- (55d) $\|only introduced Sue_F to John\|_O = x [\mathbf{introd}'(s)(j)(x) \ \& \ P$
 $\{\mathbf{introd}'(y)(j) \mid y \in ALT(s)\} P(x) \quad P = \mathbf{introd}'(s)(j)]]$
- (55e) $\|Mary only introduced Sue_F to John\|_O = \mathbf{introd}'(s)(j)(m) \ \&$
 $P \{\mathbf{introd}'(y)(j) \mid y \in ALT(s)\} P(m) \quad P = \mathbf{introd}'(s)(j)]]$

There is ongoing debate on whether the movement approach or Alternative Semantics is more suitable to describe association with focus and focus-phenomena in general (cf. Rooth 1985, von Stechow 1990; 1991, Kratzer 1991, Krifka 1991 and others). In the next section, I present one argument in this discussion, which was first brought to my attention by Krifka.

¹⁶ Alternative semantics must be defined intensionally to distinguish between extensionally equivalent p-sets which express a different intension. For instance, in a situation where Mary introduces Sue to John and Ann to John, and no other introductions are undertaken, the meaning of both predicates $\|introduced Sue to John\|$ and $\|introduced Ann to John\|$ are extensionally equivalent. In such a situation, sentence (55) would become true because the meaning **introd'(a)(j)** that is generated from the alternatives of *Sue* is identical with **introd'(s)(j)**. However, the sentence (55) is intuitively false in the given situation. LF-movement theories do not need intensions since they have direct access to the meaning of the focus, which on the other hand makes them too powerful (cf. Rooth 1985). In the following, I give the extensional version, which could be easily transformed into an intensional one.

4.3.3 Focus Phrases

Krifka (1996, sect. 6) discusses one problem for LF-movement theories that arises if the focused expression is embedded in an island. For example, the definite NP *the woman who introduced BOB_F to John* in sentence (56) forms an island for movements.¹⁷

(56) Sam only talked to [_{NP} the woman who introduced BOB_F to John]

Krifka shows that even if movement were possible, it would not yield the intuitive meaning. Since his example needs some digestion, I first give some settings and discuss the intuitive meaning before I present Krifka's analysis. Imagine a situation at a party where Sam talked to three women Ann, Mary and Sue (and several men). The women are characterized by their attempts to introduce Bob and Jim, two very shy guys, to Bill and John, two very sociable guys. I describe four sub-situations in (57) which differ in terms of the introductions done by Ann, Mary and Sue, but they are all equal in that Sam talked to Ann, Mary and Sue, but to no other women. The evaluation of the sentence with respect to the situations is given in (58)

(57) Situations of introductions

	Intros in sit1	Intros in sit2	Intros in sit3	Intros in sit4
Ann	Bob to John, Jim to Bill	Bob to John	Bob to John, Jim to John	Bob to John
Mary	Jim to Bill	Bob to John	Jim to Bill	Jim to John
Sue	Bob to Bill	--	--	--
eval.	OK	*	OK	*

(58) Evaluation of the sentence (57) with respect to the situations 1-4:

- sit1 The sentence is intuitively correct since Ann is the only woman who introduces Bob to John. No other woman introduces someone to John.
- sit2 The sentence is false since there are two women who introduce Bob to John which is not compatible with the semantics of *only*. Furthermore, the two equal descriptions *woman who introduced Bob to John* cause a presupposition failure because of the uniqueness condition of the definite article.
- sit3 The sentence is correct: Ann can have different descriptions, she is still the only one who introduces Bob to John.
- sit4 The sentence is false since there are two women who introduce someone to John, and Sam talks to them. This is, however, excluded by the meaning of *only*.

¹⁷ Similar arguments can be found in Steedman (1992, 1994) and Drubig (1994).

It is crucial to understand that the given evaluations of sentence (56) with respect to the described situations are correct. The point is that *only* ranges over women who introduced someone to John, i.e., the domain of quantification can be described as in (59):

$$(59) \quad x [\mathbf{woman}'(x) \ \& \ y \ \mathbf{introd}'(y)(\mathbf{j})(x)]$$

It does not play a role whether Sam has talked to other men or even to other women, if they did not introduce someone to John,¹⁸ since they are not included in the alternatives. Once we have accepted this intuition, we can start with an analysis.

According to the movement account, the focused expression *Bob* in (56) must be moved to a position adjoined to the operator *only*, leaving a trace behind as in (56a) (and disregarding island constraints). Krifka notes that the interpretation (56b) is not what (56) intuitively expresses. (56b) asserts that Bob is the only *y* such that Sam talked to the woman who introduced *y* to John, as paraphrased in (56c).¹⁹ This interpretation predicts, contrary to fact, that (56) is false in a sit₃, in which Ann introduced Bob to John and she introduced Jim to John. Intuitively, sentence (56) can be felicitously uttered in this situation since there is only one woman who introduces someone to John and Sam talked to this woman.

(56) Sam only talked to [_{NP} the woman who introduced BOB_F to John]

(56a) Sam [only [Bob] t₁ [talked to [_{NP} the woman who introduced t₁ to John]

(56b) y ALT(**b**) talk'(x[**woman'**(x) & **intro'**(y)(**j**)(x)])(s) y = **b**

(56c) Bob and nobody else is *y* such that Sam talked to the woman who introduced *y* to John.

Besides this semantic evidence, there are also syntactic considerations against the movement out of an island. The focused expression *Bob* cannot be moved due to an island constraint that also holds for *wh*-questions and quantifiers, as illustrated in (60) and (61). The question (60) is not wellformed because the *wh*-word cannot be moved out of the nominal island. Analogously, the universal quantifier in (61) cannot be moved out of this island. This is illustrated by the unwellformedness of the wide scope reading in (62).

¹⁸ It is not so transparent that women who did not introduce someone to John are excluded. If one cannot accept this, one should evaluate the sentence in the context that Sam talked to no other women than Ann and Mary.

¹⁹ I drop the presupposition (i) that Sam talked to the woman who introduced Bob to John

(i) talk'(x[**woman'**(x) & **intro'**(**b**)(**j**)(x)])(s)

- (60) *Who₁ did Sam talk to the woman who introduced t₁ to John.
 (61) Sam talked to the woman who introduced every man to John.
 (62) *For every man y, Sam only talked to the woman who introduced y to John.

Nevertheless, movement theories do allow movement of the whole island containing the wh-questions, as in (63). Analogously, Krifka (1996) and Drubig (1994) propose such "pied piping" also for NPs containing focused expression, as in (64). They introduce the category of "Focus Phrase" *FP*, which is a syntactic constituent corresponding to a complex NP (or highest NP) including the focused constituent. A focus-sensitive operator takes a Focus Phrase as its argument, e.g., *the woman who introduced BOB_F to John*, while the Focus Phrase itself associates with the focused constituent, here *Bob*. The first link is realized by movement of the whole complex NP as in (64). Yet the interpretation (64a) is not the intended meaning of (56) because it asserts that Sam talked to nobody but the woman who introduced Bob to John. This is not correct in a situation in which Sam talked to some other people as well. Besides this, such a semantics is not sensitive to the location of the focus inside the FP. It does not distinguish (64) from (65), where the focus is on *John*.

- (63) [Which woman who introduced Bob to John]₁ did Sam talk to t₁?
 (64) Sam [only [_{FP} the woman who introduced BOB_F to John] t₁ [talked to t₁]]
 (64a) y ALT(|| x[**woman'**(x) & **intro'**(b)(j)(x)]||) **talk'**(y)(s)
 y = x[**woman'**(x) & **intro'**(b)(j)(x)]
 (65) Sam [only [_{FP} the woman who introduced Bob to JOHN_F] t₁ [talked to t₁]]

The problem is caused by definition (45), repeated as (66) below, in which the quantifier ranges over values that are alternative to the semantic value of the focus. This semantics does not allow for a more structured, i.e., restricted, domain. In (56), the quantifier must range over a domain that is further restricted to individuals that alternate only with respect to the focused expression. In our example, the domain of quantification for *only* consists of women who introduce someone (i.e., alternatives to Bob) to John: {**d** | [z[**woman'**(d) & **intro'**(z)(j)(d)]]}. There might be several men or women that Sam talked to. There might be several persons who are introduced to John by a woman such that Sam talks to her. However, there is no woman who introduced someone to John and Sam talks to her, but the woman who introduced Bob (and possibly other persons) to John.

In order to solve this problem, Krifka (1996, sec. 7) proposes that the alternatives to the value of the Focus Phrase are computed according to the principles of Alternative Semantics. Thus he assumes a blend of the LF-movement theory and Alternative Semantics: A focus-sensitive operator takes a Focus Phrase as its argument, here *the*

woman who introduced Bob to John. The Focus Phrase itself associates with the focus constituent, here *Bob*. The first link is syntactically realized by movement of the whole complex NP as in (64); the second association is NP-internal and consists of computing the alternative interpretation of the NP as Alternative Semantics does.

Krifka gives a new interpretation rule (67) of the operator *only*, which differs from the definition (66) of *only* in LF-movement theories, where the operator takes the focus value and the background value as arguments. According to the new definition (67), *only* operates on the ordinary meaning $\| \cdot \|_O$ of the Focus Phrase α , the alternative meaning $\| \cdot \|_A$ and the background meaning $\| \cdot \|$. This allows a fine-tuned interpretation of the Focus Phrase in terms of focus-background structure: "We may assume that a focus phrase is just like a focus, except that the non-accented elements do not contribute to any variation in the alternative set." Krifka (1997, 3). The meaning rule (67) for *only* applied to (64) yields the semantic representation (68) for the sentence (56). It expresses that Sam talked to the woman who introduced Bob to John and that the woman who introduced Bob to John is the only x such that x is a woman who introduced someone to John and Sam talked to x .

$$(66) \quad \| \text{only} \| (\mathbf{F}, \mathbf{B}) = \lambda x [\mathbf{B}(\mathbf{F})(x) \ \& \ \lambda y \text{ ALT}(\mathbf{F}) [\mathbf{B}(y)(x) \ \lambda y = \mathbf{F}]]$$

$$(67) \quad \| \text{only} \| [\alpha]_{\text{FP}} \ t_1 [\alpha] = \lambda x [\| \cdot \| (\| \cdot \|_O)(x) \ \& \ \lambda y \ \| \cdot \|_A [\| \cdot \| (y)(x) \ \lambda y = \alpha]]$$

$$(68) \quad \text{talk}(\lambda x [\text{woman}'(x) \ \& \ \text{introd}'(\mathbf{b})(\mathbf{j})(x)])(s) \ \& \ \lambda y [\lambda z [\text{woman}'(y) \ \& \ \text{introd}'(z)(\mathbf{j})(y)] \ \& \ \text{talk}'(y)(s) \ \lambda y = x [\text{woman}'(x) \ \& \ \text{introd}'(\mathbf{b})(\mathbf{j})(x)]]$$

This example shows that the focus-sensitive operator does not necessarily quantify over alternatives of the type of the focused expression. Thus, the process from generating alternatives to the constructing of a p-set as domain of quantification is complex and involves some computation of the material in the Focus Phrase. Still, we have succeeded in describing the computation of these alternatives. Krifka (1996, sec. 7) proposes a mixed approach: the association between operator and Focus Phrase is realized by movement, while the computation of the alternatives inside the Focus Phrase should be accomplished by alternative semantics. In other words, the *ALT*-function applied to a complex NP, as in (47a), must be defined in a different way from (46), namely in terms of Alternative Semantics. However, Krifka does not account for the Focus Phrase internal generation of alternatives in Alternative Semantics. And in fact, there has been no attempt to describe such cases in Alternative Semantics. In section 5.2, I develop an approach to this problem for the first time.

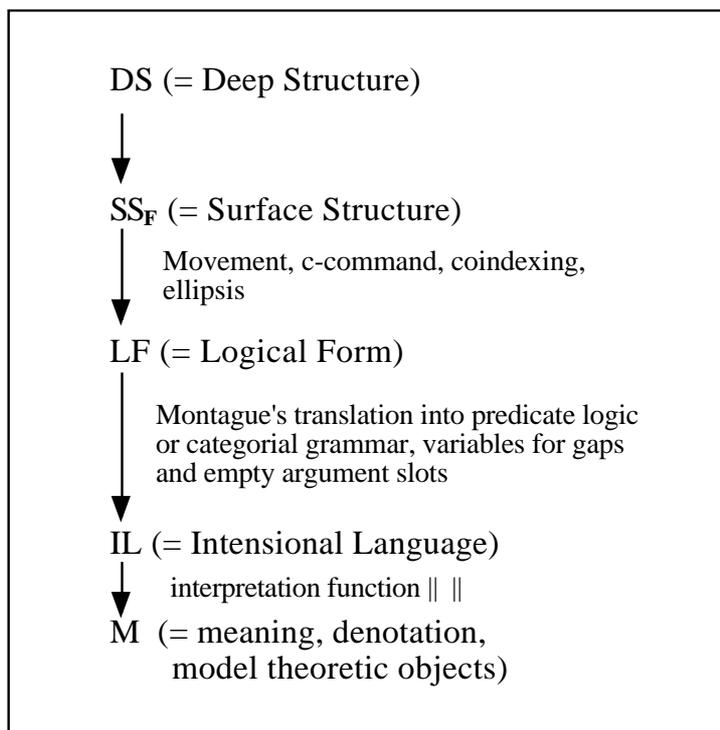
4.4 At what level does focus operate?

The focus semantics discussed so far assume an operation on alternatives to the focused expression. However, they do not agree on how to derive these alternatives and where to represent them. In this section, I account for the level at which focus operates with respect to different theories. In the following, I first present the different levels of representation and denotation and characterize the properties of the two focus theories discussed so far in this architecture. Then I present a problem noted by Kratzer and discuss her solution. I finally argue that focus primarily effects a representational level, rather than a denotational level semantics.

4.4.1 Levels of representation

In generative grammar, the following levels and mapping relations are assumed. Deep Structure, Surface Structure, and Logical Form are related by movement operations obeying the usual constraints. In the particular case of focus, the focus feature F is assumed to mark the focused constituent at surface structure (Jackendoff 1972; see section 4.2.1):

(69) Mapping relations from deep structure to denotation



At the level of Logical Form, noun phrases may have been raised from their base positions. For example, the quantifier phrase *every cat* at the Surface Structure (70a) is moved to a different position in Logical Form (70b). Representations of Logical Form

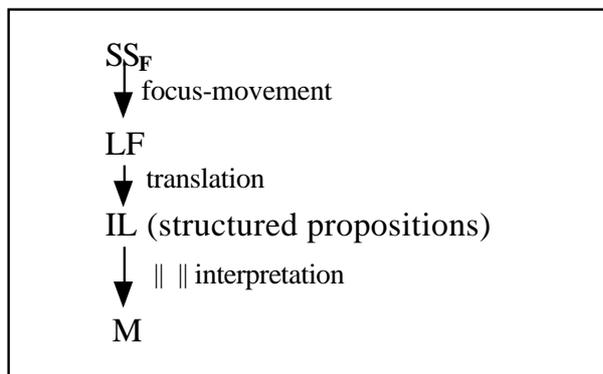
are translated into representations of Intensional Language. In this mapping process, gaps, for example, are replaced by variables, as illustrated in (70c) (cf. Kratzer 1991, 826):

- (70a) SS Jane₁ fed_{NP}[every cat]_{2m}
 (70b) LF _s[_{NP}[every cat]_{2s}[Jane fed_N[e]₂]]
 (70c) IL every'(cat') v_{e,2} [fed' (v_{e,2})(Jane')]

4.4.2 Focus represented in syntactic configurations

Movement theories assume that the focus feature at Surface Structure causes the focused constituent to move to a sister position of the focus operator in LF. The LF representation can be translated into IL without further modification.

(71) Mapping relations in LF-movement theories



The process can be illustrated by the contrast between (72a) and (72b). Both have the same constituent structure and differ only in the assignment of the focus feature in (72a) and (72b). The (highest) constituent with the focus feature is moved to the operator *only* in LF leaving behind an coindexed variable. Thus at the level of LF, the two structures differ in their configuration. This corresponds to different configurations for quantifiers. Once the different configurations are constructed, they are easily translated into IL:

(72a) SS John₁ VP[only VP[introduced F[Bill]₂ to Sue₃]]

(72b) SS John₁ VP[only VP[introduced Bill₂ to F[Sue]₃]]

the focused phrase moves to the operator

(72'a) LF: s[John₁ VP[only F[Bill]₂ VP[introduced e₂ to Sue₃]]

(72'b) LF s[John₁ VP[only F[Sue]₃ VP[introduced Bill₂ to e₃]]

translation into IL

(72"a) IL v_{e,1} [only'(Bill')(v_{e,2}[introduce'(v_{e,2})(Sue')(v_{e,1})])] (John')

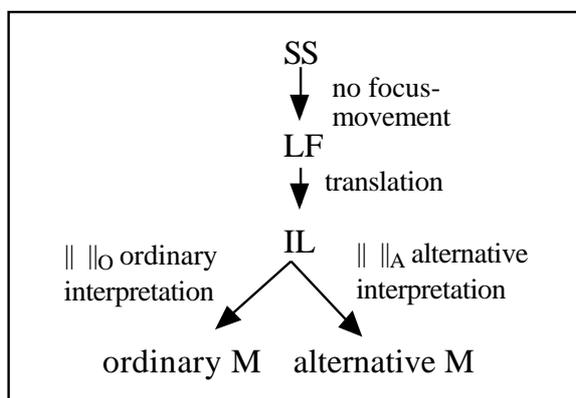
(72"b) IL v_{e,1} [only'(Sue')(v_{e,3}[introduce'(Bill')(v_{e,3})(v_{e,1})])] (John')

In this kind of approach, we need an additional movement rule from SS to LF. This movement rule is similar to those for quantifiers and *wh*-words. Thus, it must obey syntactic restrictions like islands. However, it was shown that focus can leave islands. That was one of the reasons for Rooth (1985) to develop an *in situ* theory of focus.

4.4.3 Focus as different denotational levels

Rooth's Alternative Semantics allows focused constituents to associate with a focus-sensitive operator while staying *in situ*. Under his proposal, F-features are assigned to constituents at Surface Structure and are passed on to the representation of Logical Form and further to the one of IL. Thus, Rooth introduces new kinds of expression at the level of IL, namely expression that are indexed by a focus feature: _F. The expressions of IL are then interpreted by two interpretation functions $\| \cdot \|_O$ and $\| \cdot \|_A$. The ordinary interpretation function $\| \cdot \|_O$ yields the ordinary denotation, which is computed without paying attention to the F-feature. The alternative interpretation function $\| \cdot \|_A$ produces the alternative denotation, which is computed by rules that are sensitive to the F-feature (see above (48)-(52)). This kind of meaning assigns alternatives to the corresponding ordinary one. The operator *only* then takes the ordinary and the alternative meaning as its arguments (see (54)).

(73) Mapping relations in Alternative Semantics



The mapping is illustrated in (74a) and (74b). The focus feature is mapped to IL via LF. Thus the difference in focus structure is not syntactically represented. It is only at the interpretation process that the two structures are distinguished. The alternative interpretation assigns a different denotation to these two structures, which is indicated in (74"a) and (74"b):

- (74a) SS=LF John₁ VP[only VP[introduced_F[Bill]₂ to Sue₃]]
 (74b) SS=LF John₁ VP[only VP[introduced Bill₂ to_F[Sue]₃]]
 (74'a) IL v_{e,1} [only'([introduce'(Bill'_F)(Sue')])] (John')
 (74'b) IL v_{e,1} [only'([introduce'(Bill')(Sue'_F)(v_{e,1}))] (John')
 (74"a) {introducing Bill to Sue, introducing Bill to Ann,
 introducing Bill to Mary,}
 (74"b): {introducing Bill to Sue, introducing Peter to Sue,
 introducing Tim to Sue,}

In Alternative Semantics, the focus feature is translated to the level of IL. An additional interpretation function assigns a different kind of denotation to the expression. Thus, focus induces alternatives, which are recursively projected, rather than inducing a syntactic partition of the sentence at some point.

4.4.4 Representational approach

Can we actually view focus as a feature which passes syntax untouched and only becomes operative at the level of semantic interpretation? Alternative Semantics suggests that this is the proper way to do. Yet, Kratzer (1991, 830-831) shows that the alternatives used in focus interpretation are sensitive to syntactic processes such as coindexing etc., and that focus interpretation is thus affected by syntactic structure. She describes the following situation: "Imagine now you are angry at me and start voicing the following accusations: "What a copy cat you are! You went to Block Island because I did. You went to Elk Lake because I did. And you went to Tanglewood because I did." I feel you exaggerate and reply:

- (75) I only VP[went to_F[Tanglewood]] because you did VP[e]

VP deletion, as in (75) is assumed to involve a reconstruction process copying the missing VP from an appropriate antecedent VP at the level of Logical Form (cf. Sag 1976 and Williams 1977). Since focus is not moved in Rooth's approach, (75a) is the representation at the level of Logical Form after reconstruction:

(75a) I_I[past_{VP}[only_{VP}[_{VP}[go to_F[Tanglewood]]] because you did [_{VP}[go to_F[Tanglewood]]]]]]

Kratzer notes that if we apply alternative interpretation to this form, (76) is the p-set for the VP that constitutes the scope of *only*, assuming that the domain D_e contains just Block Island, Elk Lake Lodge, and Tanglewood:

(76) p-set for go to_F[Tanglewood] because you did go to_F[Tanglewood]:
 go to Tanglewood because you went to Tanglewood,
 go to Tanglewood because you went to Block Island,
 go to Tanglewood because you went to Elk Lake Lodge,
 go to Block Island because you went to Tanglewood,
 go to Block Island because you went to Block Island,
 go to Block Island because you went to Elk Lake Lodge,
 go to Elk Lake Lodge because you went to Tanglewood,
 go to Elk Lake Lodge because you went to Block Island,
 go to Elk Lake Lodge because you went to Elk Lake Lodge

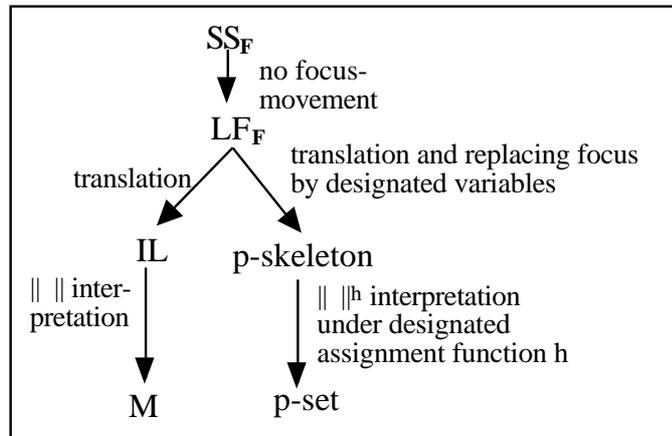
However, the p-set contains too many alternatives. The intended domain of comparisons is constituted by the following p-set containing just three elements:

(77) Desired p-set:
 go to Tanglewood because you went to Tanglewood
 go to Block Island because you went to Block Island
 go to Elk Lake Lodge because you went to Elk Lake Lodge

The point is that according to Rooth, each focused constituent at LF translates into a focus expression at IL, which is then assigned an alternative meaning independently of any other expression. However, the example showed that the production of alternatives are restricted if we have coreferential expression. In the generation of alternatives they must co-generate the alternatives, i.e., produce the same alternatives in parallel.

Kratzer (1991, 831) proposes a different architecture of the different levels. As before, focused constituents are F-marked at Surface Structure and F-marking is passed on to Logical Form. However, there are two translations from LF into two independent forms of IL, the ordinary IL and what Kratzer calls the presuppositional skeleton, originally due to Jackendoff (1972) and elaborated in Rooth (1985). The idea is that the p-skeleton consists of the ordinary IL-translation save for the focused expressions, which are replaced by designated variables. Coindexed focused expressions receive the same designated variable.

(78) Mapping relations in a representational approach



Designated variables (V_n) are interpreted according to a second assignment function h yielding the p-set, as in (79). Co-indexed expressions are co-varying in the p-set.

(79) Construction of p-sets:

Where α is any meaningful expression of some type τ , and g any ordinary variable assignment we define $\|\alpha\|^g$, the p-set of α with respect to g , as follows:

$$\|\alpha\|^g = \{a \in D : h[h \text{ is a designated assignment and } a = \|\alpha\|^g, h]\}$$

The semantics of *only* is defined as an operator which takes the IL-translation and the p-set (generated by (79)), and assumes that the IL-translation is the only one of the p-set that holds.

The point Kratzer makes concerns the level that is affected by focus. Her Tanglewood-example motivates that focus cannot only be computed at the level of alternative meanings, i.e., the denotational level, but that focus must operate on some structural or representational level. She further applies semantic tools like assignment function for variables, which also have a prominent function in discourse representation theories (Heim 1982, Kamp 1981) and dynamic logic (Groenendijk & Stokhof 1991). However, she does not give up the classical sentence perspective and uses the p-skeleton only to derive p-sets for more complex cases. In chapter 6, I propose to go one step further, and integrate the p-skeleton into a discourse representation theory.

4.5 Perspectives on the function of focus

In the course of this chapter, several theories of focus and association with focus were presented. Horn (1969) proposes a basic semantics for focus-sensitive particles like *only* or *even*, in which the particle is translated into an quantifier that takes the focus and the background as arguments. This approach is adopted from nominal quantifiers like *every* or *some*, for example, the particle *only* is translated as the quantifier *nobody*, *but*. Here, the focus provides one argument for the quantifier and determines the type of objects the operator ranges over.

Jackendoff (1972) introduces new semantic objects and structure for representing the information structure of a sentence, which he describes as focus-presupposition structure. Focus is linked to some notion of *new information*. From the basic unit Focus, he derives via the construction of the p-skeleton and the presuppositional set the presupposition of the sentence. The presuppositional set was introduced to capture the notion of alternatives, which was elaborated by Rooth (1985). Furthermore, Jackendoff introduces the notion of *association with focus* even though he does not give a semantic account for these constructions. In this view, the focus merely defines the p-skeleton and restricts the alternatives, but it does not generate alternatives by itself.

The two main competitors of a semantic theory of association with focus are the LF-movement, and the Alternative Semantics. In the former approach, focus is understood as a constituent that must move to a position adjacent to the focus operator. The focus operator is fed by the value of the focus and the value of the background (phrase minus focus). The focus operator is defined to range over alternatives of the focus value, which are generated by the function *ALT*, which is part of the semantic definition of the operator (see (45)). This matches the classical view that the operator ranges over objects of the same type as the focus value. Horn (1969) describes the meaning of *only* and *even* in this way, and Jackendoff (1972) describes the assertion of a sentence with focus in exactly this way: the focus is part of the p-set (or alternatives). However, in section 4.3.3, it was shown that this is not always the case. In (56), repeated as (80), the operator quantifies over women that introduce someone to John, while the focus is on *Bob*, who is not in the range of the operator. Any attempt to accommodate this to an operation which ranges over alternatives to Bob failed (see section 4.3.3.), so that Krifka proposed to calculate the alternatives by the mechanism of Alternative Semantics.

(80) Sam only talked to [_{NP} the woman who introduced BOB_F to John]

Alternative Semantics assumes that the focused expression itself invokes alternatives, which are recursively composed to form the alternative meaning of the sentence. The operator for *only* takes the ordinary and the alternative meaning as its arguments. Thus, the operator has no direct access to the value of the focused expression. This approach

is more flexible and not restricted by syntactic conditions, like the island constraints. However, the reconstruction of focus as inducing alternatives of the focused constituent seems to produce too many alternatives, as Kratzer (1991) has shown with the Tanglewood-example (see section 4.4).

Therefore, Kratzer (1991) proposes to use Jackendoff's p-skeleton, which was also considered by Rooth (1985), for generating alternatives. Since the p-skeleton is a representation, it is possible to coindex expressions such that they must co-vary even if producing alternatives. The function of the focus is neither to serve as argument for an operator nor to induce alternatives, it is rather reduced to marking designated variables in the p-skeleton. The p-skeleton provides the p-set which forms the argument of the operator *only* or *even* together with the ordinary meaning.

Summing up, two parallel tendencies in the semantic description of focus can be observed. First, the function of focus as dividing the sentence into two parts (focus and background) exhibited considerable semantic problems. Second, the function of focus as inducing alternatives is too powerful: there would be too many alternatives. Focus rather indicates the place for designated variables at certain levels or representation. Alternatives are then generated by other semantic operations. This function of focus as introducing variables at a particular representational level will be strengthened by the detailed account of association with focus in definite NPs as presented in the next chapter.

Chapter 5

Association with focus in definite NPs

In the last chapter it was argued that association with focus reveals the complex interaction between different levels of semantic representation and interpretation. Three theories of focus were discussed: LF-movement theories, Alternative Semantics, and Kratzer's representational version of Alternative Semantics. With respect to LF-movement theories, it was shown that it is problematic to assume that the operator representing the focus-sensitive particle takes as its arguments a partition of a sentence into focus-background. In particular, data from cases where the focus is of a different type than the objects the operator ranges over confirmed this criticism. On the other hand, Alternative Semantics assumes that the focus induces alternatives that compositionally build the alternative meaning. Focus operators take the ordinary and the alternative meaning as their arguments. However, the *Tanglewood*-example showed that it is not the focus or focused constituent that generates the alternatives, but rather the p-skeleton does so. The p-skeleton is formed from the surface structure by replacing the focus with appropriate variables.

The view of the function of focus as introducing variables at a certain representational level should be corroborated in this chapter by a detailed investigation into association with focus in definite NPs as in (1).

- (1) Sam only talked to [the DUTCH_F professor]_{NP}.

Given the following situation: At a meeting, where three American, five German, seven Italian and one Dutch professor take part, Sam talked to the Dutch professor and to one American professor but to nobody else. In this situation, sentence (1) is intuitively false. But in LF-moving theory as well as in Alternative Semantics the sentence is predicted to be true. In LF-moving theories the focused adjective is moved to the operator as in (2) with the paraphrase (2a).

- (2) Sam only (Dutch, X [talked to [the X professor]_{NP}])
(2a) No nationality but Dutch is such that Sam talked to the professor of this nationality.

The *only* is translated into an operation on the focus and background as defined in the last chapter. In (2) the focus **Dutch'** and the background $X[\text{talk}'(s, \text{iz } [X(z) \ \& \ \text{prof}'(z)])]$ combine to the presupposition $\text{talk}'(s, \text{iz } [\text{Dutch}'(z) \ \& \ \text{prof}'(z)])$, while the assertion is (2b). The definite article has received its classical semantics as iota-operator expressing the uniqueness condition (here: there is only one Dutch professor). This uniqueness condition can also be accounted for by the combination of universal and existential quantifiers as in (2c) (actually this is very similar to the definition of *only* which also expresses a uniqueness condition). A paraphrase for (2c) is: for all properties alternative to Dutch, if there exists a unique element x such that x has X and x is a professor and Sam talks to x , then X is Dutch.

(2b) $X \text{ ALT}(\text{Dutch}') [\text{talk}'(s, \text{iz } [X(z) \ \& \ \text{prof}'(z)]) \quad X = \text{Dutch}']$

(2c) $X \text{ ALT}(\text{Dutch}') [\ x \ y [(X(y) \ \& \ \text{prof}'(y)) \quad y = x] \ \& \ \text{talk}'(s, x)] \quad X = \text{Dutch}']$

The uniqueness condition of the definite article reduces the domain of quantification to exactly one element: the Dutch professor. All other expressions of the kind *the X professor* are not well-formed since they do not suffice the uniqueness condition of the definite article. Thus in a situation in which Sam talked to the Dutch professor and to one of the American professors, the sentence is counter-intuitively predicted to be true since there are not alternatives.

Similar considerations hold for the analysis in Alternative Semantics, as it will be shown in detail below. Here, the adjective *Dutch* induces alternatives such as *German*, *American*, and *Italian*. But again, when these alternatives combine with the definite article, as in *the X professor* for $X \in \{\text{Dutch, German, American, Italian}\}$, only *the Dutch professor* survives the uniqueness condition of the definite article.

Intuitively, the correct domain of quantification for the operator *only* consists of just the professors at that meeting. In other words, the focused expression does not contribute to the construction of the domain of quantification, it is rather "invisible" for that process.

In the remainder of the chapter, the argument, which was here informally presented, will be discussed in detail, in particular in the framework of Alternative Semantics. The different representations and mapping rules will be discussed with all formal scrutiny necessary. In section 5.1 the problem is described in more detail and embedded into the general research environment. Some of the tacit restrictions induced by simple examples are made explicit. Section 5.2 presents my analysis in Alternative Semantics. First the semantic rules are extended in order to describe common nouns and their modifiers, then the alternative function of the definite article is analyzed as the general union (" ") over a set of alternatives. This semantics allows to describe the example (1), and in section 5.3 it is successfully applied to the more complex example of Krifka from section 4.3.3. In section 5.3.4 it is shown that the operation of forming

the union of an alternative set has already been used for describing other phenomena of association with focus, such as adverbs of quantification. In section 5.3 I argue that such an operation being the alternative semantics of the definite article or some other kind of reconstruction does not fit into the overall architecture of Alternative Semantics. I discuss several alternatives and modification of the ordinary and alternative NP semantics in order to keep to the general principles of Alternative Semantics. However, it must be concluded that none of the presented modifications and alternatives are feasible. This means the alternative semantics of association of focus with definite NPs is a major problem of this kind of focus theory and its assumptions. The final conclusion leads towards a representational treatment of association with focus and focus-phenomena in general.

5.1 Definite NPs in focus

Focus semantics, like LF-movement theories or Alternative Semantics, are exemplified with proper names. However, proper names are quite exceptional because they do not contain linguistic material that could interact with grammatical structure. The only linguistic information they contribute is that they are of type *e*. For instance, the focused proper name *Sue* in (3) are associated with alternatives that are of the same type, namely type *e*. In LF-movement theories, these alternatives form the domain of quantification for the operator *only*. Thus, (3) is true if nobody but Sue is such that Sam talked to her or him. In Alternative Semantics, the alternatives are projected to the VP level and the operator *only* quantifies over VP-alternatives, yielding - in principle - the same truth conditions as in the LF-movement approach.

This chapter investigates association with focus in definite NPs in order to understand more about the interaction between the semantics of focus and the semantic contribution of complex NPs as in (4)-(9).¹ In particular, we will discuss three main issues: (i) the domain of quantification for the focus-sensitive operator, (ii) the whereabouts of the uniqueness condition in the set of alternatives, and (iii) the alternative function of the definite article. The first two issues can be illustrated by the informal analysis of the following examples:

- (3) Sam only talked to [SUE_F]_{NP}.
- (4) Sam only talked to [JOHN's spouse]_{NP}.
- (5) Sam only talked to [the first AMERICAN astronaut in space]_{NP}.
- (6) Sam only talked to [JOHN's mother]_{NP}.

¹ Possessive construction are subsumed in the class of definite NPs. Furthermore, we keep to the more familiar terminology of common noun (CN) and noun phrase (NP) instead of the recent terminology of noun phrase (NP) and determiner phrase (DP).

- (7) Sam only talked to [the woman who introduced BOB_F to John]_{NP}.
- (8) Sam only talked to [JOHN's sister]_{NP}.
- (9) Sam only talked to [the DUTCH_F professor]_{NP}.

(3) can be paraphrased as (3a) indicating that in a formal analysis the focus-sensitive operator quantifies over alternatives to the focused expression *Sue*. We could also use this strategy for (4) and (5): In (4), we quantify over persons who have a spouse and, in (5), we quantify over nationalities.

- (3a) Nobody but Sue is such that Sam talked to him/her.
- (4a) Nobody but John is such that Sam talked to his/her spouse.
- (5a) There is no nationality but being American such that Sam talked to the astronaut of that nationality.

While this strategy seems feasible for these two examples, the correspondent paraphrase (6a) for (6) predicts that John is the only child of his mother. In a situation in which Sam talked to Ann and to nobody else, and Ann is the mother of John and of Bob, the quantification over alternatives to the possessor, as in (6a), predicts contrary to fact that sentence (6) is false. For the operator *only* does not quantify over alternatives to John, but over alternatives to a larger constituent, e.g. *JOHN's mother* as illustrated by the paraphrase in (6b). Similarly, the paraphrase (7a) predicts contrary to fact that sentence (7) is false if Sam had talked to Diana and to nobody else, and Diana had introduced Bob to John and Bill to John. Again, the operator *only* quantifies over the set of women who introduce someone to John, rather than over alternatives to Bob.

- (6a) Nobody but John is such that Sam talked to his/her mother.
- (6b) No mother but John's mother is such that Sam talked to her.
- (7a) There is nobody but Bob such that Sam talked to the woman who introduced him/her to John.
- (7b) There is no women who introduces someone to John but the woman who introduces Bob to John such that Sam talks to her.

The second issue concerns the uniqueness condition expressed by the definite NP, which claims in (8) that John has only one sister and in (9) that there is only one Dutch professor at the contextual given situation. However, this uniqueness condition cannot be maintained in the set of alternatives, which is illustrated by (8a) and (9a): In a situation where Sam talked to John's sister and to one of the two sisters of Bob and to no one else, the paraphrase (8a) predicts contrary to fact that (8) is true, since Bob sisters are not in the alternative sets. The expression *Bob's sister* is not defined because it violates the uniqueness condition for definites. Similarly, in a situation where Sam

talked to the Dutch professor and to one of three German professors the analysis in (9a) predicts that the sentences is true because it does not contain any German professors. It is obvious that the domain of quantification in (8) is formed by sisters, rather than by unique sisters of a person, and the operator in (9) quantifies over professors, and not over unique professors with respect to their nationality. The paraphrases in (8b) and (9b) illustrate that the alternatives to a definite NP do not carry the uniqueness condition of the ordinary meaning of the definite NP.

- (8a) There is no one but John such that Sam talked to his/her sister.
- (8b) There is no sister but John's sister such that Sam talked to her.
- (9a) There is no nationality but being Dutch such that Sam talked to the professor of that nationality.
- (9b) There is no professor but the Dutch professor such that Sam talked to him.

Throughout this chapter we will illustrate the argument by examples with narrow focus, like in (5)-(9). Phrase final narrow focus cannot easily distinguished from broad focus since the focus feature can be projected. The pitch accent on *professor* in (10) can indicate narrow focus on the head noun *professor*, or broader focus on the constituent *Dutch professor*, the whole NP *the Dutch professor* etc.

- (10) Sam only talked to the Dutch PROFESSOR.

In order to avoid this ambiguity, we use examples with pitch accent on constituents that cannot project the focus feature, like in (7).

5.2 Alternative Semantics and definite NPs

In this section, I propose an extension of Alternative Semantics for analyzing association with focus in complex definite NPs. Three particular extensions are given: first the alternative interpretation rules of common nouns and their modifiers, second, the alternative composition rule for modification of common nouns, and third, the alternative semantic value of the definite article. This extended semantics is capable of analyzing focus in complex NPs. Before introducing the extensions, I summarize the main principles of Alternative Semantics introduced in section 4.3.2. Alternative semantics assumes that the focus feature F is mapped onto expressions in IL. These expression are interpreted by the ordinary interpretation function $\| \cdot \|_O$, which is not sensitive to the focus feature, and by the alternative function $\| \cdot \|_A$, which assigns a set of alternatives to a focused expression and to an non-focused expression the singleton set consisting of the ordinary meaning (see (11a), (11b) and (11c), respectively). Functional application receives an ordinary and an alternative function in (12) and

(13). Finally, the meaning of *only* is defined as operation over the ordinary meaning of the VP and its alternative meaning in (14):

$$(11) \quad \|_o = \|_F \|_o$$

$$(11b) \quad \|_F \|_A = \text{ALT}(\|_o) = D_{\text{type}(\|_o)}$$

$$(11c) \quad \|_A = \{\|_o\}$$

$$(12) \quad \|_o = \|_o(\|_o)$$

$$(13) \quad \|_A = \{X(Y) \mid X \|_A, Y \|_A\}.$$

$$(14) \quad \|_{\text{only VP}} \|_o = \lambda x [\|_{\text{VP}} \|_o(x) \ \& \ P \ \|_{\text{VP}} \mid P(x) \quad P = \|_{\text{VP}} \|_o]$$

5.2.1 Extension of Alternative Semantics

The fragment of Alternative Semantics discussed in section 4.3.2 and reviewed above is the starting point of the extension presented here. I confine the extension to common nouns (CN), and restrictive adjectives (A) as being noun modifiers (CN-modifiers). Semantically, common nouns and adjectives are properties and have the same type as intransitive verbs, namely $\langle e, t \rangle$. The ordinary semantic value (15a) and (16a) is a set of individuals (i.e. a property) regardless whether the expression is focused or not. The alternative semantic value (15b) and (16b) of a focused noun or adjective is the set consisting of alternative properties to the property expressed by the ordinary meaning. In absence of any further restrictions, the alternative set is equal to the set of all sets of individuals. The alternative semantic value of an unfocused noun or adjective is the singleton consisting of the ordinary semantic value, as in (15c) and (16c):

$$(15a) \quad \|_{\text{CN}} \|_o = \|_{\text{CN}_F} \|_o = \mathbf{CN}' \ D_{\langle e, t \rangle}$$

$$(15b) \quad \|_{\text{CN}_F} \|_A = \text{ALT}(\|_{\text{CN}} \|_o) = D_{\langle e, t \rangle}$$

$$(15c) \quad \|_{\text{CN}} \|_A = \{\|_{\text{CN}} \|_o\}$$

$$(16a) \quad \|_A \|_o = \|_{A_F} \|_o = \mathbf{A}' \ D_{\langle e, t \rangle}$$

$$(16b) \quad \|_{A_F} \|_A = \text{ALT}(\|_A \|_o) = D_{\langle e, t \rangle}$$

$$(16c) \quad \|_A \|_A = \{\|_A \|_o\}$$

The modification of a head noun α by an adjective β is interpreted in the ordinary semantics as the intersection of the ordinary semantic value of α with the ordinary semantic value of β . The alternative value of the modification is the set consisting of

sets that are formed by intersection of an element (i.e. set) of the alternative set of α with an element of the alternative set of β .²

- (17a) $\| \quad \|_O = \| \quad \|_O \quad \| \quad \|_O$
 (17b) $\| \quad \|_A = \{Q \quad R \mid Q \quad \| \quad \|_A \quad R \quad \| \quad \|_A\}$

These definitions allow representations of the following combinations of the focus feature in the modifier-head construction *Dutch professor* in a context with professors and students, some of them English and some of them Dutch. For example, assume the situation described in (18): there is the Dutch professor Johan, three English professors Ann, Sue and Peter, two Dutch students Luisa and Rob, and two English students Bill and Mary.

- (18) $\|Dutch\ professor\|_O = \{j\}$
 $\|English\ professor\|_O = \{a, s, p\}$
 $\|Dutch\ student\|_O = \{l, r\}$
 $\|English\ student\|_O = \{b, m\}$

The ordinary semantic value is the same for all the different focus feature combinations, namely the intersection of the set of Dutch with the set of professors as in (19), namely the set consisting of Johan. The alternative semantic value of the unfocused combination in (19a) is the singleton containing the ordinary semantic value, i.e. the set containing the set containing Johan. The alternatives generated by *DUTCH_F professor* are intersections of sets that are generated by the adjective *DUTCH_F* with the singleton set containing the set of professors, yielding the set containing all sets of professors of one nationality (given that the alternatives to Dutch include only nationalities). The composition of the modified noun *Dutch PROFESSOR_F* contains properties that are formed by combinations of the property of being a Dutch with the alternative properties to being a professor, namely the properties of being a professor, or being a student. Thus the alternative meaning is the set that contains the set of the Dutch professor and the set of the Dutch students, as in (19c):

² Alternatively, the CN-modifier can be raised to the higher type $\langle\langle e,t\rangle, \langle e,t\rangle\rangle$, which takes a property and yields a property, i.e. the adjective denotes a function from sets into sets. This semantics results in the same ordinary and alternative value for CN-modification:

- (28*) $\| \quad \|_O = \| \quad \|_O(\| \quad \|_O) = \{d \mid d_{\langle e,t\rangle} = f_{\langle\langle e,t\rangle, \langle e,t\rangle\rangle}(e_{\langle e,t\rangle}) f = \| \quad \|_O e = | \quad \|_O\}$
 (29*) $\| \quad \|_A = \{X(Y) \mid X \quad \| \quad \|_A, Y \quad \| \quad \|_A\}$

- (19) $\|[\text{Dutch}_{F/\emptyset} \text{ professor}_{F/\emptyset}]_{F/\emptyset}\|_O = \mathbf{Dutch' professor'} = \{\mathbf{j}\}$
- (19a) $\|\text{Dutch professor}\|_A = \{\mathbf{Dutch' professor'}\} = \{\{\mathbf{j}\}\}$
- (19b) $\|\text{DUTCH}_F \text{ professor}\|_A = \{Q \ R \mid Q \ \|\text{DUTCH}_F\|_A \ R \ \|\text{professor}\|_A\}$
 $= \{Q \ R \mid Q \ \{\mathbf{Dutch', English'}\} \ R \ \{\mathbf{professor'}\}\}$
 $= \{\mathbf{Dutch' professor'}, \mathbf{English' professor'}\}$
 $= \{\{\mathbf{j}\}, \{\mathbf{a, s, p}\}\}$
- (19c) $\|\text{Dutch PROFESSOR}_F\|_A = \{Q \ R \mid Q \ \|\text{Dutch}\|_A \ R \ \|\text{PROFESSOR}_F\|_A\}$
 $= \{Q \ R \mid Q \ \{\mathbf{Dutch'}\} \ R \ \{\mathbf{professor', student'}\}\}$
 $= \{\mathbf{Dutch' professor'}, \mathbf{Dutch' student'}\}$
 $= \{\{\mathbf{j}\}, \{\mathbf{l, r}\}\}$

5.2.2 The definite article

At the international faculty party, some students, several German, Italian and American professors, but only one Dutch professor appeared. In this context, sentence (20) can be felicitously uttered. In order to compute the alternatives of the definite NP from the alternatives of the CN we have to account for the function of the article at the level of alternative meaning. In a first approach we assume according to the general rule (11c) above that the alternative meaning of the article is the singleton of its ordinary meaning.³ If we take the iota operator as the ordinary meaning of the definite article, we then have the singleton containing the iota operator as the alternative meaning. However, this would result in the alternatives described in (20b). Here, the alternative set consists of unique professors with respect to a nationality. Since there are more than one professor for all countries but the Netherlands, all iota expressions are undefined except the one for the Dutch professor. Hence, the alternatives would include one single individual, namely the unique Dutch professor. However, the alternatives to *the DUTCH professor* intuitively include all other professors at the party. The semantics of (20b) predicts contrary to fact that sentence (20) is true in a situation in which Sam talked to the Dutch professor and one German professor.

³ Here, we exclude the possibility that the definite article can be focused. It is questionable whether sentence (i) is wellformed and what it could mean. It seems that the sentence becomes much better if the demonstrative *this* replaces the definite article, as in (ii). Example (iii) is from a letter to the editor (SF Chronicle from October 8, 1997), which discussed the location of a museum in San Francisco. However, this use of focus is clearly emphatic, and it is not clear whether the focused article would associate with a focus-sensitive operator.

- (i) ?Sam only saw THE_F man.
- (ii) Sam only saw THIS_F man.
- (iii) Getting there isn't half the problem. It is THE problem.

- (20) Sam only talked to [the DUTCH_F professor]_{NP}.
- (20a) $\| \text{the DUTCH}_F \text{ professor} \|_O = x [\mathbf{Dutch}'(x) \ \& \ \mathbf{prof}'(x)]$
- (20b) $\| \text{the DUTCH}_F \text{ professor} \|_A = \{ X(Y) \mid X \{ \}, Y \ \| \text{DUTCH}_F \text{ professor} \|_A \}$
 $= \{ d \mid d = x [\mathbf{R}x \ \& \ \mathbf{prof}'(x)] \text{ for some } R \ \| \text{DUTCH}_F \|_A \}$
 $= \{ x [\mathbf{Dutch}'(x) \ \& \ \mathbf{prof}'(x)] \}$

This example clearly demonstrates that the uniqueness condition of the ordinary meaning of the definite NP must not be preserved in the set of alternatives since this would exclude several proper alternatives. Intuitively, the set of alternatives rather consists of all professors at that party. In order to yield this set from the alternative set of the common noun *Dutch_F professor* (cf. 19b), we have to assume that the alternative function of the definite article is to collect all individuals from all alternative sets R to the property expressed in the modified noun as indicated in (21), and put them into a new set. In other words, the alternative function of the article removes one hierarchical level of the set-structure, i.e. it makes a set out of a set of sets. This function is the best described by the union " \cup ", and the definite article is assigned the union as its alternative semantics in (23). The consequences of this reconstruction are discussed in section 5.3.

- (21) $\| \text{the DUTCH}_F \text{ professor} \|_A = \{ d \mid d \ R \text{ for some } R \ \| \text{DUTCH}_F \text{ professor} \|_A \}$
 $= \{ d \mid d \ R \text{ for some } R \ \{ x [\mathbf{Dutch}'(x) \ \& \ \mathbf{prof}'(x)], \ x [\mathbf{Germ}'(x) \ \& \ \mathbf{prof}'(x)], \ x [\mathbf{Ital}'(x) \ \& \ \mathbf{prof}'(x)], \ x [\mathbf{Amer}'(x) \ \& \ \mathbf{prof}'(x)] \}$
- (22) $\| \text{the CN} \|_A = \{ d \mid d \ R \text{ for some } R \ \| \text{CN} \|_A \} = (\| \text{CN} \|_A)$
- (23) $\| \text{the} \|_A =$

With this extension, we can give the complete interpretation of (20) in Alternative Semantics. In (24a), the ordinary and the alternative value of the VP *introduced the DUTCH_F professor to John* is computed. The alternative meaning is the set of properties such that each properties consists in introducing a professor of a some nationality R to John. In (24b), *only* quantifies over such properties and asserts that there is only one such property and this property is equal to introducing the Dutch professor to John. Finally, this combines with the subject in (24c), yielding the intuitively correct meaning.

- (24a) $\| \text{introduced the DUTCH}_F \text{ professor to John} \|_O$
 $= \mathbf{intro}'(x [\mathbf{Dutch}'(x) \ \& \ \mathbf{prof}'(x)])(j)$
- $\| \text{introduced the DUTCH}_F \text{ professor to John} \|_A$
 $= \{ \mathbf{intro}'(x)(j) \mid x \ \| \text{the DUTCH}_F \text{ professor} \|_A \}$
 $= \{ \mathbf{intro}'(x)(j) \mid x \ \{ d \mid d \ R \text{ for some } R \ \| \text{DUTCH}_F \text{ professor} \|_A \} \}$

$$\begin{aligned}
 (24b) \quad & \|\text{only introduced the DUTCH}_F \text{ professor to John}\|_O \\
 & = x [\mathbf{intro}'(x [\mathbf{Dutch}'(x) \ \& \ \mathbf{prof}'(x)])(j) \ \& \\
 & \quad P \ \{\mathbf{intro}'(x)(j) \mid x \ \|\text{the DUTCH}_F \text{ professor}\|_A\} \ P(x) \\
 & \quad P = \mathbf{intro}'(x [\mathbf{Dutch}'(x) \ \& \ \mathbf{prof}'(x)])(j)]
 \end{aligned}$$

$$\begin{aligned}
 (24c) \quad & \|\text{Sam only introduced the DUTCH}_F \text{ professor to John}\|_O \\
 & = \mathbf{intro}'(x [\mathbf{Dutch}'(x) \ \& \ \mathbf{prof}'(x)])(j)(s) \ \& \\
 & \quad P \ \{\mathbf{intro}'(x)(j) \mid x \ \|\text{the DUTCH}_F \text{ professor}\|_A\} \ P(s) \\
 & \quad P = \mathbf{intro}'(x [\mathbf{Dutch}'(x) \ \& \ \mathbf{prof}'(x)])(j)]
 \end{aligned}$$

The essential point is that the alternative meaning of *the DUTCH professor* (or: $\|\text{the DUTCH}_F \text{ professor}\|_A$) is the set of all professors at the party. This is the set we intuitively expected.

5.2.3 Focus Phrases reconsidered

This semantics of the definite article can also be applied to more complex examples as discussed in section 4.3.3. Krifka (1996) introduced Focus Phrases in order to describe examples like (42), repeated here as (25). The focus operator does not associate directly with the focus, but indirectly via the Focus Phrase.

$$(25) \quad \text{Sam only talked to } [_{FP} \text{ the woman who introduced BOB}_F \text{ to John}]$$

Krifka describes the association between operator and Focus Phrase in terms of LF-moving theories, while the calculation of the necessary p-set of the Focus Phrase is done by Alternative Semantics. However, Krifka does not account for the appropriate rules. Having defined the alternative meaning of the definite article, we can do so. But first we have to give the interpretations for a relative clause *RC*, which are analogous to the one for adjectives (see (16a)-(16c) above):

$$(26a) \quad \|\mathbf{RC}\|_O = \|\mathbf{RC}_F\|_O = \mathbf{RC}' \ D_{\langle e,t \rangle}$$

$$(26b) \quad \|\mathbf{RC}_F\|_A = \text{ALT}(\|\mathbf{RC}\|_O) = D_{\langle e,t \rangle}$$

$$(26c) \quad \|\mathbf{RC}\|_A = \{\|\mathbf{RC}\|_O\}$$

An CN modified by a relative clause is interpreted according to the modification schemata given in (17a) and (17b). The relative clause *RC* is of type $\langle e,t \rangle$, expressing a property, and can be instantiated either as an adjective (A) or as an intransitive verb (V). The relative pronoun does not receive a semantic interpretation: it merely indicates which argument of the relative clause predicate is related to the head noun.

- (27) $\|CN \text{ who } RC\|_O = \|CN\|_O \quad \|RC\|_O$
 (28) $\|CN \text{ who } RC\|_A = \{Q \quad R \mid Q \quad \|CN\|_A \quad R \quad \|RC\|_A\}$

We can now analyze the complex CN *woman who introduced BOB_F to John*. The ordinary and alternative semantics of the VP *introduce BOB_F to John* are computed as in (29a) and (29b). The ordinary meaning of the whole CN is the property of being a woman and introducing Bob to John as in (29c). The alternatives generated by the whole phrase are combinations of the meaning of the head noun, **woman'**, with alternatives generated by the VP, **intro'(x)(j) | x ALT(b)**. The alternative meaning is a set of sets of individuals such that each set comprises women who introduce one particular person to John, e.g., **{intro'(b)(j), intro'(s)(j), intro'(j)(j), ...}**, as derived in (29d).

- (29) woman who introduced BOB_F to John
 (29a) $\|introduced \text{ BOB}_F \text{ to John}\|_O = \mathbf{intro'(b)(j)}$
 (29b) $\|introduced \text{ BOB}_F \text{ to John}\|_A = \{\mathbf{intro'(x)(j)} \mid x \text{ ALT}(\mathbf{b})\}$
 e.g. **{intro'(b)(j), intro'(s)(j), intro'(j)(j), ...}**
 (29c) $\|woman \text{ who introduced BOB}_F \text{ to John}\|_O$
 $= x [\mathbf{woman'(x)} \ \& \ \mathbf{intro'(b)(j)(x)}]$
 (29d) $\|woman \text{ who introduced BOB}_F \text{ to John}\|_A$
 $= \{Q \quad R \mid Q \quad \|woman\|_A \quad R \quad \|introduced \text{ BOB}_F \text{ to John}\|_A\}$
 $= \{Q \quad R \mid Q \quad \{\mathbf{woman'}\} \quad R \quad \{\mathbf{intro'(z)(j)} \mid z \text{ ALT}(\mathbf{b})\}\}$
 $= \{P \mid P = x [\mathbf{woman'(x)} \ \& \ \mathbf{intro'(z)(j)(x)}] \ z \text{ ALT}(\mathbf{b})\}$
 e.g. **{ x [woman'(x) & intro'(b)(j)(x)], x [woman'(x) & intro'(b)(j)(x)], x [woman'(x) & intro'(s)(j)(x)], ... }**

Given this alternative interpretation of definite NPs, we can now analyze the example (25), repeated as (30), in Alternative Semantics and without LF-moving. In (30a) the interpretations of the new constants are given. (30b) and (30c) repeat the interpretation of the complex phrase *woman who introduced BOB_F to John* from (29). This semantics combines with the article, the ordinary interpretation yielding a iota expression in (30d), and the alternative interpretation (30e) forming the set of elements that are women who introduce an alternative of Bob to John. We can simplify this set by replacing the restriction on y by an existential quantifier.

(30) Sam only talked to [_{NP} the woman who introduced BOB_F to John]

(30a) $\|\text{Sam}\|_O = \mathbf{s}$ $\|\text{talk}\|_O = \mathbf{talk}'$ $\|\text{talk}\|_A = \{\mathbf{talk}'\}$

(30b) $\|\text{woman who introduced BOB}_F \text{ to John}\|_O$
 $= x [\mathbf{woman}'(x) \ \& \ \mathbf{intro}'(\mathbf{b})(\mathbf{j})(x)]$

(30c) $\|\text{woman who introduced BOB}_F \text{ to John}\|_A$
 $= \{P \mid P = x [\mathbf{woman}'(x) \ \& \ \mathbf{intro}'(z)(\mathbf{j})(x)] \ z \ \text{ALT}(\mathbf{b})\}$

(30d) $\|\text{the woman who introduced BOB}_F \text{ to John}\|_O$
 $= x [\mathbf{woman}'(x) \ \& \ \mathbf{intro}'(\mathbf{b})(\mathbf{j})(x)]$

(30e) $\|\text{the woman who introduced BOB}_F \text{ to John}\|_A$
 $= \{P \mid P = x [\mathbf{woman}'(x) \ \& \ \mathbf{intro}'(z)(\mathbf{j})(x)] \ z \ \text{ALT}(\mathbf{b})\}$
 $= \{d \mid [\mathbf{woman}'(d) \ \& \ \mathbf{intro}'(z)(\mathbf{j})(d)] \ z \ \text{ALT}(\mathbf{b})\}$
 $= \{d \mid z [\mathbf{woman}'(d) \ \& \ \mathbf{intro}'(z)(\mathbf{j})(d)]\}$

Combining the NP with the verb *talk* we get the ordinary interpretation (30f) by functional application and the alternatives (30g) by the alternative semantics of functional application, as defined (11). (30g) describes the set of properties of talking to a woman who introduces someone to John. The interpretation (24) of *only* combines the ordinary meaning of the VP with its alternative interpretation. It quantifies over the alternatives and states that no value but the ordinary one holds of the subject. This semantics is applied to our example yielding (30h), which applied to the subject results in (30i). It correctly expresses that Sam talked to the woman who introduces Bob to John and for all properties of talking to a woman who introduces someone to John that hold of Sam, they are identical with the property of talking to the woman who introduced Bob to John.

(30f) $\|\text{talk to the woman who introduced BOB}_F \text{ to John}\|_O$
 $= \mathbf{talk}'(x [\mathbf{woman}(x) \ \& \ \mathbf{intro}'(\mathbf{b})(\mathbf{j})(x)])$

(30g) $\|\text{talk to the woman who introduced BOB}_F \text{ to John}\|_A =$
 $= \{\mathbf{talk}'(y) \mid y \ \{d \mid z [\mathbf{woman}'(d) \ \& \ \mathbf{intro}'(z)(\mathbf{j})(d)]\}\}$

(30h) $\|\text{only talked to the woman who introduced BOB}_F \text{ to John}\|_O$
 $= u [\mathbf{talk}'(x [\mathbf{woman}(x) \ \& \ \mathbf{intro}'(\mathbf{b})(\mathbf{j})(x)])(u) \ \&$
 $\quad P \ \{\mathbf{talk}'(y) \mid y \ \{d \mid z [\mathbf{woman}'(d) \ \& \ \mathbf{intro}'(z)(\mathbf{j})(d)]\}\}$
 $\quad P(u) \quad P = \mathbf{talk}'(x [\mathbf{woman}(x) \ \& \ \mathbf{intro}'(\mathbf{b})(\mathbf{j})(x)])]$

(30i) $\|\text{Sam only talked to the woman who introduced BOB}_F \text{ to John}\|_O$
 $= [\mathbf{talk}'(x [\mathbf{woman}(x) \ \& \ \mathbf{intro}'(\mathbf{b})(\mathbf{j})(x)])(\mathbf{s}) \ \&$
 $\quad P \ \{\mathbf{talk}'(y) \mid y \ \{d \mid z [\mathbf{woman}'(d) \ \& \ \mathbf{intro}'(z)(\mathbf{j})(d)]\}\}$
 $\quad P(\mathbf{s}) \quad P = \mathbf{talk}'(x [\mathbf{woman}(x) \ \& \ \mathbf{intro}'(\mathbf{b})(\mathbf{j})(x)])]$

It was shown that this extension of Alternative Semantics is capable of analyzing association with focus in complex definite NPs and describing Focus Phrases without LF-movement (cf. section 4.3.3). The question of whether the focus-operator

associates with the focused expression or a larger constituent that contains the focused expression does not arise in this framework. The focus-operator associates with the VP that contains a focus and operates on the ordinary and the alternative meaning of the VP. We have settled the question of the whereabouts of the uniqueness condition in the alternative set by an ad-hoc "solution", motivated by the data. However, the proposed alternative function for the definite article cannot be derived from its ordinary function. This calls for a discussion of the general architecture of Alternative Semantics, given in section 5.3.⁴

5.2.4 Adverbs of quantification

It is interesting to note that Rooth (1985, 172f) uses the union in the analysis of adverbs of quantification and focus, as in (31a)-(31b). An adverb of quantification is a relation between two sets of time intervals (or situations), as in (32): The second set consists of those time intervals at which the ordinary meaning of the sentence holds (= t [past(t) & AT(t , take-to-the-movies'(m, j))]). The first argument I_2 has to be derived from the alternative meaning of the sentence or its p-set. However, the p-set (33) of sentence (31a) is a set of sets of time intervals, which does not fit the type of the argument of the adverb.

(31a) MARY always takes John to the movies.

(31b) Mary always takes JOHN to the movies.

(32) always'(I₂) t [past(t) & AT(t , take-to-the-movies'(m, j))]

(33) $\{ t$ [past(t) & AT(t , take-to-the-movies'(y, j))] | $y \in E$

Therefore, Rooth (1985, 172f) argues: " I_2 can not be identified with this set, since I_2 denotes a set of time intervals, not a set of sets of time intervals. However, an object of the required type can be obtained as the union of (16) [= (34)]:"

(34) $\{ t$ [past(t) & AT(t , take-to-the-movies'(y, j))] | $y \in E$

⁴ The given analysis of the alternative semantics of the definite article calls for more investigations into the alternative function of other determiners and familiar expression, as illustrated in (i)-(v). In (i), the domain of quantification generated by the indefinite NP is similar to that one generated by the definite NP in (1). It is not clear how the domain of quantification is formed in (ii), where *five* is a weak quantifier. In the case of strong quantifiers, like in (iii), we have a clear preference to compare sets of five professors with respect to a nationality. Plural NPs as in (iv) and (v) generate alternatives similar to the singular cases:

- (i) Sam only introduced a DUTCH_F professor to John.
- (ii) Sam only introduced five DUTCH_F professors to John.
- (iii) Sam only introduced exactly five DUTCH_F professor to John.
- (iv) Sam only introduced the GERMAN_F professors to John.
- (v) Sam only introduced GERMAN_F professors to John.

The union (34) collects all time intervals t where someone took John to the movies. Supplying this as the value of I_2 in (32) produces the a meaning which can be described as follows: at every interval where someone took John to the movies, Mary took John to the movies.

Rooth (1985, 173f) compares his mechanism for operators like *only* and *even* on the one hand, and frequency adverbs on the other:

As I pointed out, there is a gross similarity between this idea about the interaction of focus with frequency adverbs and the chapter II proposals about association of focus with *only* and *even*: in both cases, focus determines a domain of quantification. But the two treatments differ at the technical level: in the frequency adverb case it is the union of the p-set, not the p-set, which is supplied as the value of the context variable.

This, however, is not correct as demonstrated in 5.2.2 with the definition of the definite article in association with focus-sensitive operators. It rather seems that the "accommodation" or "downgrading" of the p-set by the operation of union is necessary in certain cases when the operator ranges over a variable that is not of the same type as the focus expression. The use of this union operation for downgrading a p-set with too much structure, is also used for nominal quantifiers (cf. Eckardt 1999) and superlatives (Geilfuß-Wolfgang). This is not the case for VP-alternatives, as the analysis of Rooth has showed. It is still an open question for which p-sets this downgrading is necessary and which p-sets are happily fed into the operator. It seems that Krifka's notion of Focus Phrase may play an important role here: the NP-boundary in the case of the definite articles as well as the sentence boundary in the case of adverbials would delimit a Focus Phrase. However, the discussion has not even started on this issue.

5.3 The Architecture of Alternative Semantics

A detailed investigation of the interaction between focus and some other semantic operators should illuminate the general architecture of Alternative Semantics. If – as it is claimed in Alternative Semantics – focus generates alternatives, which then are compositionally computed parallel to the ordinary meaning, then the alternative meaning should interact with semantic operators analogously to the ordinary meaning. The behavior of alternative meaning towards to the uniqueness condition of the definite NP should be investigated as an example of such an interaction. However, it will be shown that the uniqueness condition of the definite article cannot be accommodated with the general principles of Alternative Semantics. Even though several modifications are proposed, none of them gives a satisfying account of the interaction between the principles of Alternative Semantics and the semantics of definite NPs.

The alternative level of meaning in Alternative Semantics, as introduced in section 4.3.2, are formed by two basic rules. The first rule ties the alternative semantic value of

an expression α to its ordinary value. If the ordinary semantic value is of type τ , then the alternative semantic value (or "p-set") is a set of elements of this type, i.e. of type $\langle \tau, t \rangle$. Moreover, the reflex of the particular formulation of the function ALT is that the ordinary value $\| \cdot \|_O$ of α is element of the alternative value $\| \cdot \|_{FA}$. The two interpretation rules (35)-(36) govern this dependency of the alternatives from the ordinary semantic values.

- (35) by creating singleton sets $\| \cdot \|_A = \{ \| \cdot \|_O \}$
 (36a) by creating alternatives (p-sets) $\| \cdot \|_{FA} = ALT(\| \cdot \|_O)$
 (36b) the ordinary value is element of the p-set: $\| \cdot \|_O \in \| \cdot \|_{FA}$

The second essential component of Alternative Semantics is the compositional construction of complex meanings. The construction rules must also warrant that the main relation between the ordinary meaning of a complex expression $\alpha\beta$ and its alternative meaning is preserved. Thus, the alternative interpretation of functional application and modification must project the alternatives such that they fit the type requirement given in the rules (35) and (36). In general, the alternative function of a construction rule \odot is derived from its ordinary interpretation (37i) in a schematic way: The construction rule is applied to the elements of the alternative sets of the expression involved, rather than to the sets themselves. The alternative value of the whole composition (37ii) consists of elements created in the described way. The alternative meaning of functional application (38ii) is a set of elements that are formed by functional application of one element in the alternatives set of the functor to one element of the alternative set of the argument. The alternative function of modification (39ii) is the set that is formed from the intersection of one element of the alternative set of the modifier with one element out of the alternative set of the modified.

- (37) Construction rule \odot
 (i) ordinary function $\| \cdot \|_O = \| \cdot \|_O \odot \| \cdot \|_O$
 (ii) alternative semantic function $\| \cdot \|_A = \{ X \odot Y \mid X \in \| \cdot \|_A, Y \in \| \cdot \|_A \}$
 (38) Functional Application
 (i) ordinary function $\| \cdot \|_O = \| \cdot \|_O (\| \cdot \|_O)$
 (ii) alternative semantic function $\| \cdot \|_A = \{ X(Y) \mid X \in \| \cdot \|_A, Y \in \| \cdot \|_A \}$
 (39) Modification
 (i) ordinary function $\| \cdot \|_O = \| \cdot \|_O \quad \| \cdot \|_O$
 (ii) alternative semantic function $\| \cdot \|_A = \{ R \quad Q \mid R \in \| \cdot \|_A, Q \in \| \cdot \|_A \}$

These rules warrant that the alternatives generated by the focused expression are projected at the level of alternative meaning up to the VP, where the focus operator takes them as its argument. In the last section we have encountered the problem of the

transition from the alternative meaning of a complex common noun, like *DUTCH_F professor* to the alternative meaning of the definite NP *the DUTCH_F professor*. While the former is a set of sets of individuals, the latter is represented by a set of individuals. Comparing the ordinary and the alternative meaning of definite NPs, we derived the union as representation for alternative meaning of the definite article. This, however, violates the two just given principles of Alternative Semantics with respect to the meaning of the article.

Let us assume that the ordinary meaning (40) of the definite article is a function of type $\langle\langle e,t\rangle, e\rangle$, i.e. a function that assigns one element to a set.⁵ According to rule (40), Alternative Semantics predicts that the alternative function is the singleton containing the ordinary meaning as in (41). This meaning correctly predicts the alternative sets for definite NPs without focus, as in (42) and for definite NPs of the type illustrated in (43)-(44), where the lexical material already expresses some unique condition:⁶

- (40) $\|\text{the}\|_O = f_{\langle\langle e,t\rangle, e\rangle}$
- (41) $\|\text{the}\|_A = \{f_{\langle\langle e,t\rangle, e\rangle}\}_{\langle\langle e,t\rangle, e\rangle, t\rangle}$
- (42) $\|\text{the Dutch professor}\|_A = \{X(Y) \mid X \{f_{\langle\langle e,t\rangle, e\rangle}\} Y \{\mathbf{Dutch'prof}'_{\langle e,t\rangle}\}\}$
 $= \{f_{\langle\langle e,t\rangle, e\rangle}(\mathbf{Dutch'prof}'_{\langle e,t\rangle})\}_{\langle e,t\rangle} = \{\mathbf{the\ unique\ Dutch'prof}'_e\}_{\langle e,t\rangle}$
- (43) $\|\text{the first AMERICAN}_F \text{ astronaut in space}\|_A = \{\mathbf{the\ unique\ first\ American\ Astronaut\ in\ space'}$, $\mathbf{the\ unique\ first\ Russian\ Astronaut\ in\ space'}$, $\mathbf{the\ unique\ first\ French\ Astronaut\ in\ space'}$, ...}
- (44) $\|\text{JOHN's spouse}\|_A = \{\mathbf{Bill's\ spouse'}$, $\mathbf{John's\ spouse'}$, $\mathbf{Ann's\ spouse'}$, ...}

Yet, this semantics is too restrictive for the formation of the alternative set of other classes of definite NPs, such as *JOHN'S_F sister* or *the DUTCH_F professor*. As shown in the last section, the uniqueness condition would exclude most of the relevant alternatives. Therefore, we assumed that the alternative function is the union over a set of sets of individuals, i.e. it is of type $\langle\langle e,t\rangle, t\rangle$, $\langle e, t\rangle\rangle$, as in (45). But this type cannot be derived from the type $\langle\langle e,t\rangle, e\rangle$ of the ordinary meaning as in (40):

⁵ In this view, the article is a term-creating operator of type $\langle\langle e,t\rangle, e\rangle$. We could also keep to the more traditional view that it is a determiner of type $\langle\langle e,t\rangle, \langle\langle e,t\rangle, t\rangle\rangle$. The argument can be expressed with this type, too. We assume the simpler type for the sake of conceptual simplicity. See also the discussion in footnote 19 below.

⁶ Here a classical analysis of definite NPs is assumed. Following Russell (1905), the uniqueness condition is understood as part of the semantics of the definite article. Strawson's (1950) position that the uniqueness condition is part of the presupposition is applied in the modification discussed in sections 5.3.3-5.3.4, where the lexical meaning of the article is just a term-creating operation.

$$(45) \quad \|\text{the CN}\|_A = \{d \mid d \text{ R for some R } \|\text{CN}\|_A\} = (\|\text{CN}\|_A)$$

$$(46) \quad \|\text{the}\|_A = f_{\langle\langle e,t\rangle,t\rangle,\langle e,t\rangle}$$

With this semantics of the definite article, two problems arise for the general architecture of Alternative Semantics: (i) the alternative meaning of type $\langle\langle e,t\rangle,t\rangle,\langle e,t\rangle$ cannot be derived by (40) from the ordinary meaning of type $\langle\langle e,t\rangle,e\rangle$, and (ii) the application of the article to the complex common noun is reconstructed by ordinary functional application (38i), rather than by its alternative function (38ii). Thus, this alternative function of the definite article does not fit into the general architecture of Alternative Semantics.

In the remainder of this section I give five suggestions to treat this problem, continuously stripping off the semantic contribution of the article to the construction of the alternative set of definite NPs. The first three suggestions keep to the two mentioned principles (35)-(36) of Alternative Semantics, while the last two deviate from them. In the first and most conservative suggestion, I modify the *ALT*-function that generates the alternatives. In a second suggestion, the uniqueness condition of the definite article is replaced by a maximality condition and the number information is not taken as being essential to the semantics. In a third approach, the idea is defended that the definite article is represented by a choice function. The fourth suggestion assumes that both the ordinary and alternative meaning of the definite article is reconstructed as a polymorph choice function. And finally, in the fifth suggestion we present the idea that the definite article does not contribute to the semantics proper. It only happens to be located at a place where we have to assume a type shift from the common noun to the NP. It is the alternative function of the type shift rule that yields the construction principles for the alternative sets of definite NPs.

5.3.1 Fine-grained descriptions

Assuming the classic semantics of the definite article and the main principles of Alternative Semantics, we can suggest the following treatment: Suppose that the function *ALT* produces so many alternatives that there is at least one alternative description for each individual in the intended domain of quantification that holds exclusively of this individual. In (47), *ALT* produces so many fine-grained alternative properties of *Dutch* that we find for each professor at the party (at least) one unique description. In (47b), the alternative meaning of the definite NP is computed according to the interpretation of functional application. The iota operator is applied to all alternatives to being Dutch, but only those alternatives "survive" that are singleton sets.

- (47) $\|DUTCH_F\|_A = ALT(\|DUTCH\|_O) = ALT(\mathbf{Dutch}') = \{\mathbf{Dutch}', \mathbf{German}', \dots, \mathbf{German}' \text{ from_Berlin}', \mathbf{German}' \text{ from_Tübingen}', \dots\}$
- (47a) $\|DUTCH_F \text{ professor}\|_A = \{\mathbf{Dutch}' \text{ prof}', \mathbf{German}' \text{ prof}', \dots, \mathbf{German}' \text{ from_Berlin}' \text{ prof}', \mathbf{German}' \text{ from_Tübingen}' \text{ prof}', \dots\}$
- (47b) $\|the DUTCH_F \text{ professor}\|_A = \{X(Y) \mid X \{ \}, Y \|DUTCH_F \text{ professor}\|_A\}$
 $= \{x [\mathbf{Dutch}'(x) \ \& \ \mathbf{prof}'(x)], x [\mathbf{Germ}'(x) \ \& \ \mathbf{prof}'(x) \ \& \ \mathbf{from \ Berlin}(x)],$
 $x [\mathbf{Germ}'(x) \ \& \ \mathbf{prof}'(x) \ \& \ \mathbf{from \ Tübingen}], \dots\}$

This solution preserves the general architecture of Alternative Semantics as described in the last section. The definite article is a functor that is applied to the common noun semantics, both in the ordinary as in the alternative meaning. However, the repair is highly artificial and not very convincing. In particular, it is not clear how the ALT-function "knows" the appropriate descriptions that fit single individuals given in the discourse. Moreover, it seems that it cannot produce the correct descriptions if part of the common noun restricts the choice of predicates, like *the professor of DUTCH_F nationality* or *the GREEN_F-colored apple*. It is not clear how we may distinguish between different German professors since there is no *professor of German-from-Tübingen nationality*.

5.3.2 No number information

It has been suggested that the definite article does not contribute the uniqueness condition directly, but rather in a derived way.⁷ It contributes a maximality condition which is realized in the singular as uniqueness and in the plural as the maximal set. If the number information of the common noun is not to be preserved in the alternatives, we could design the following picture: The focused adjective *DUTCH_F* generates alternative sets of individuals, which combine with the meaning of *professor* by intersection in (48a). The application of the maximality condition to each of the subsets of the alternative meaning of the common noun yields the set (48b) consisting of maximal elements, being the unique element of a set or its maximal extension, for example as a sum individual.⁸ All subsets of the alternative set of the common noun are preserved as elements of the alternative set of the NP. The alternative set of the definite NP *the DUTCH_F professor* consists of the Dutch professor, the German professors (comprised in some maximal element) etc.

⁷ Manfred Krifka, Daniel Büring and Roger Schwarzschild among others suggested this line of argument to me.

⁸ We do not want to go into the ontological questions on such maximal objects since it does not make a difference for the argument given here.

- (48) $\|DUTCH_F\|_A = ALT(\|DUTCH\|_O) = ALT(\mathbf{Dutch}') = \{\mathbf{Dutch}', \mathbf{German}', \dots, \mathbf{German}' \text{ from_Berlin}', \mathbf{German}' \text{ from_Tübingen}', \dots\}$
- (48a) $\|DUTCH_F \text{ professor}\|_A = \{\mathbf{Dutch}' \text{ prof}', \mathbf{German}' \text{ prof}', \dots\}$
- (48b) $\|the DUTCH_F \text{ professor}\|_A$
 $= \{X(Y) \mid X \in \{\max\}, Y \in \|DUTCH_F \text{ professor}\|_A\} = \{\max[\mathbf{Dutch}'(x) \ \& \ \mathbf{prof}'(x)], \max[\mathbf{Germ}'(x) \ \& \ \mathbf{prof}'(x)], \dots\}$
 $= \{\mathbf{the Dutch professor}', \mathbf{the German professors}', \dots\}$

This solution also preserves the general architecture of Alternative Semantics. Furthermore, we do not have to assume strange *ALT*-functions; we do not lose alternatives in the transition from the set of subsets to the p-set of the NP, since elements of non-singleton sets are comprised into sum individuals. This also resembles the treatment of plural semantics. Nevertheless, we get a new problem with predication of a part of a sum-individual. In a situation, where Sam talked to the Dutch professor and to one of the German professors, sentence (49) is intuitively false.

- (49) Sam only talked to the $DUTCH_F$ professor.

We have to assume that the predication applies to the Dutch professor and the sum individual representing the German professors. This, however, is far from being intuitive. It is not clear, whether Sam talked to the German professors when he talked to one of them. One would expect some kind of uncertainty in the judgement of such cases. Nevertheless, sentences like (49) are judged in the given situation without difficulty.

5.3.3 Choice functions

Let us "impoverish" the semantic contribution of the definite article further and assume that the semantics of the definite article is purely a function that selects one element out of the set denoted by the common noun. Thus, we replace the uniqueness and maximality condition by the principle of choice and we interpret the article by a choice function f . A Choice function is a function that assigns to a non-empty set one of its elements, or: $f(CN) \in CN'$.⁹ We can now compose the alternative set (48c), which is

⁹ Recently, choice functions have received much attention in formal semantics. The syntactic counterpart of choice functions, the epsilon operator, were first introduced into meta-mathematics by Hilbert & Bernays (1939, 12). They used the epsilon operator as a generalized iota operator in order to replace the existential and universal quantifier and characterize it syntactically by the two epsilon rules (i) and (ii). Semantically, a choice function Φ is a function that assigns to a non-empty set s one of its elements, as defined in (iii) or alternatively in (iv).

- (i) $\exists x Fx \quad F(\epsilon x Fx)$
(ii) $\exists x Fx \quad F(\epsilon x \neg Fx)$

based on the alternative set of the common noun in (48a). We paraphrase the element selected by the choice function as the *chosen* element.

$$(48c) \quad \begin{aligned} \llbracket \text{the DUTCH}_F \text{ professor} \rrbracket_A &= \{X(Y) \mid X \in \{f\}, Y \in \llbracket \text{DUTCH}_F \text{ professor} \rrbracket_A\} \\ &= \{f(\mathbf{Dutch' prof'}), f(\mathbf{Germ' prof'}), \dots\} \\ &= \{\mathbf{\text{the chosen Dutch professor'}}, \mathbf{\text{the chosen German professor'}}, \dots\} \end{aligned}$$

Each subset of p-set of the common noun is represented by one element in the p-set of the definite NP. But this gives us not enough alternatives, e.g. the choice function gives us only one German professor. There are two ways of modifying this choice function approach further: (i) we argue that the choice is undetermined, or (ii) we assume that we quantify over different choice functions.

Hilbert & Bernays (1939), who were the first to work with choice functions define them in an undetermined way, i.e. the choice function selects one element out of a set, but we do not know which one. This is also used in semantics for describing E-type pronouns (e.g. Ballmer 1978, Egli 1991, Neale 1990, Chierchia 1992). Such definite NPs can be paraphrased by *whoever*-phrases. Informally, this would result in the following alternative set, in which we find one representative for each of the subsets in (48a). Again, we run into the same trouble as in (48b) in section 4.2 since we do not have a good definition of predication over *whoever*-phrases.

$$(48d) \quad \begin{aligned} \llbracket \text{the DUTCH}_F \text{ professor} \rrbracket_A &= \{X(Y) \mid X \in \{f\}, Y \in \llbracket \text{DUTCH}_F \text{ professor} \rrbracket_A\} \\ &= \{f(\mathbf{Dutch' prof'}), f(\mathbf{Germ' prof'}), \dots\} \\ &= \{\mathbf{\text{whoever is a Dutch professor'}}, \mathbf{\text{whoever is a German professor'}}, \dots\} \end{aligned}$$

Another way to attack the problem is to take a family of choice functions $f_1, f_2, f_3 \dots f_n$ instead of one choice function. This modification of the choice function approach was first proposed by Egli (1991) and elaborated in Egli (1995) and Egli & von Heusinger (1995). Each choice function can assign a different element to a certain set. Therefore, the expressions $f_1(\mathbf{Germ' \cap prof'})$, $f_2(\mathbf{Germ' \cap prof'})$, ... denote different German professors such that we collect all elements of the subsets into the set of alternatives to the definite NP. The set in (48e) comprises the number of alternatives we need for the

(iii) (s) s if s \emptyset

(iv) f is a choice function (i.e. $CH(f)$ holds) iff $P(f(P))$, where P is non empty.

This very general characterization makes choice functions an attractive and flexible semantic tool. The range of application of choice functions in formal semantics has not yet been fully determined. They have been used for representing questions (Engdahl 1986), specific indefinites (cf. Reinhart 1992; 1997; Kratzer 1996, Winter 1997), E-type pronouns (Ballmer 1978; Chierchia 1992) and definite NPs (von Heusinger 1997). An unified approach of choice functions to pronouns and NPs was first given by Egli (1991; 1995) and Egli & von Heusinger (1995).

domain of quantification. Still, we have not explained how the idea of a family of choice function can be matched with the ordinary semantics of the article.¹⁰

$$(48e) \quad \|\text{the DUTCH}_F \text{ professor}\|_A = \{f_i(Y) \mid f_i \in \{f_1, f_2, f_3 \dots\}, Y \in \|\text{DUTCH}_F \text{ professor}\|_A\} \\ = \{f_1(\mathbf{Dutch}' \text{ prof}'), f_2[\mathbf{Germ}' \text{ prof}'], f_3[\mathbf{Germ}' \text{ prof}'], \dots\}$$

5.3.4 Polymorph choice function

The last three subsections tried to defend the two principles of alternative semantics, namely (i) the alternative meaning is the set consisting of the ordinary meaning and (ii) the alternative function of functional application is the process of building a set of elements such that the elements are derived from functional application of elements of the alternative sets involved. Since none of the three suggestion was totally convincing, we decide to abandon this requirement and investigate other possibilities. In particular, we abandon the correspondence between the ordinary and the alternative function of the article and propose to merge both functions of the definite article into a more abstract function: The meaning of the article is a function f that takes a set of type $\langle \tau, t \rangle$, and yields one of its elements of type τ . In this view, the article stands for a polymorph choice function or a general "type shifter", as in (49). In the ordinary interpretation (50), the definite article assigns to a set one of its elements. In its alternative use (51), the function assigns to the set of subsets one of its subsets. For instance, it assigns to the alternative meaning of *DUTCH_F professors* in (52) the subset of professors at the party in (52a) yielding the appropriate domain of quantification for the operator.

$$(49) \quad \|\text{the}\| = f_{\langle \langle \tau, t \rangle, \tau \rangle}$$

$$(50) \quad \|\text{the}\|(\|\text{man}\|_O)_{\langle e, t \rangle} = (f_{\langle \langle e, t \rangle, e \rangle}(\mathbf{man}'_{\langle e, t \rangle}))_e \quad \mathbf{man}'$$

$$(51) \quad \|\text{the}\|(\|\text{man}\|_A)_{\langle \langle e, t \rangle, t \rangle} = f_{\langle \langle \langle e, t \rangle, t \rangle, \langle e, t \rangle \rangle}(\{\mathbf{man}', \mathbf{woman}', \mathbf{child}', \text{etc.}\}) \quad D_{\langle e, t \rangle}$$

$$(52) \quad \|\text{DUTCH}_F \text{ professor}\|_A = \{\mathbf{Dutch}' \text{ prof}', \mathbf{German}' \text{ prof}', \dots, \\ \mathbf{prof}' \text{ at_the_party}, \dots\}$$

$$(52a) \quad \|\text{the DUTCH}_F \text{ professor}\|_A = f_{\langle \langle \langle e, t \rangle, t \rangle, \langle e, t \rangle \rangle}(\|\text{DUTCH}_F \text{ professor}\|_A) \\ = \mathbf{prof}' \text{ at_the_party}$$

The advantage of this approach is that we can keep to one general interpretation of the definite article. Intuitively, the function of the article is to pick out one element from a

¹⁰ It rather seems as if we use in (48e) an alternative set of choice functions. This might be more appropriate for demonstrative expressions. On the other hand, this picture would meet a theory that explains definiteness by the indexical principle of salience. The context provides the choice function that selects a element. The alternative set to this element is formed without this indexical anchoring, and thus using all available choice functions.

set. In the alternative function it selects one subset. This choice may either be governed by some maximality condition (chose the largest set) or by pragmatic information (take the appropriate set). The latter option supplies a parameter to encode contextual information restricting the alternatives. This additional contextual information is needed in any other account, as well. In the original approach of Rooth (1985), the actual domain of quantification of the focus operator is part of the p-set. Here, we argue that the context determines which of the many subsets generated by the common noun is the appropriate for the alternative meaning of the NP. Of course, we abandon the idea that the article has an ordinary and an alternative meaning. It has just one function. One can speculate that content words easily generate alternatives, while function words like the article do not so. Still, one might feel uneasy about the idea that we are happily produce all this alternatives for the common noun, and then throw them away except for one subset.

5.3.5 Type shifting operation

In a final approach to the problem we do not make any claims about the semantic contribution of the definite article to the ordinary or alternative meaning at all. The article merely indicates where a type shift operation from a common noun to an NP has taken place. This type shift operation is independent of presence of determiners as it also must be assumed for languages without articles. This is not to say that the article does not have a meaning, it is rather that the meaning does not contribute to the production of the alternative set of definite NPs. The type shift rule is a construction rule, whose alternative function can be derived from its ordinary function in a schematic way described in (37ii). The construction rule is applied to the elements of the alternative sets of the expression involved, rather than to the sets themselves.

(37) Construction rule ©

(i) ordinary function $\parallel \parallel_o = \parallel \parallel_{o©} \parallel \parallel_o$

(ii) alternative semantic function $\parallel \parallel_A = \{X©Y \mid X \parallel \parallel_A, Y \parallel \parallel_A\}$

Since type shifting rules involve only one expression α that is transformed from type γ to a different semantic type τ , we have to modify this schema slightly. We assume in (53) that the ordinary meaning $\parallel \parallel_o$ of the type shifted expression stands in a the semantic relation © to the ordinary meaning $\parallel \parallel_o$ of the expression. In other words, the value of the type shifted expression depends on the value of the original expression plus some semantic operation. For the alternative function of the type shift we assume according to the schema in (37) that an element X of the alternative set $\parallel \parallel_A$ of the type shifted expression stands in that relation © to an element Y of the alternative set $\parallel \parallel_A$ of the original expression. We can now form the construction rule (54), which transforms a common noun (CN) of type $\langle e, t \rangle$ into an NP of type e . We state the following minimal requirement: The denotation of the NP must be element of the

denotation of the CN. The alternative interpretation of this type shifting rule requires that an element X of the alternative set $\|_{NP\|_A}$ of the NP must be element of an element Y of the alternative set $\|_{CN\|_A}$ of the common noun. The definition (55) of the alternative set $\|_{NP\|_A}$ of an NP follows directly from this requirement: It consists of objects d that are elements of some Y such that Y is element of the alternative set $\|_{CN\|_A}$ of the common noun. This is the union over the alternative set $\|_{CN\|_A}$ of the common noun and what we had inferred from the data in section 5.2.2 in (22). However, the union is not the alternative meaning of the article since there is no such meaning. It is the alternative semantic function of the particular type shift operation from a common noun to an NP.¹¹

(53) Type shifting rules

- (i) ordinary function $\|_{\|_O} \Rightarrow \|_{\|_O}$ with $\|_{\|_O} \odot \|_{\|_O}$
(ii) alternative semantic function $\|_{\|_A} \Rightarrow \|_{\|_A}$ with $X \odot Y \ X \ \|_{\|_A} \ Y \ \|_{\|_A}$

(54) Type shifting rules for $CN \Rightarrow NP$

- (i) $(\|_{CN\|_O})_{\langle e,t \rangle} \Rightarrow (\|_{NP\|_O})_e$ with $\|_{NP\|_O} \ \|_{CN\|_O}$
(ii) $(\|_{CN\|_A})_{\langle \langle e,t \rangle, t \rangle} \Rightarrow (\|_{NP\|_A})_{\langle e,t \rangle}$ with $X \ Y \ X \ \|_{NP\|_A} \ Y \ \|_{CN\|_A}$

(55) $\|_{NP\|_A} = \{d \mid d \ Y \text{ for some } Y \ \|_{CN\|_A}\} = (\|_{CN\|_A})$

¹¹ The same argument can be given for a type shift from a common noun to a NP of type $\langle \langle e,t \rangle, t \rangle$. Here, the relation between the meanings are reversed. In (54*i), the common noun meaning must be element of the NP meaning. Therefore, an element X of the alternative meaning $\|_{CN\|_A}$ of the common noun must be element of an element Y that is in the alternative set $\|_{NP\|_A}$ of the NP. Thus, the alternative set of an NP of type $\langle \langle e,t \rangle, t \rangle$ consists of generalized quantifiers Q that include one of the elements Y of the alternative set $\|_{CN\|_A}$ of the common noun. This set is certainly to large and must be restricted in one way or other:

(54*) Type shifting rules for $CN \Rightarrow NP$

- (i) $(\|_{CN\|_O})_{\langle e,t \rangle} \Rightarrow (\|_{NP\|_O})_{\langle \langle e,t \rangle, t \rangle}$ with $\|_{CN\|_O} \ \|_{NP\|_O}$
(ii) $(\|_{CN\|_A})_{\langle \langle e,t \rangle, t \rangle} \Rightarrow (\|_{NP\|_A})_{\langle \langle \langle e,t \rangle, t \rangle, t \rangle}$ with $X \ Y \ X \ \|_{CN\|_A} \ Y \ \|_{NP\|_A}$

(55*) $\|_{NP\|_A} = \{Q \mid Y \ Q \text{ for some } Y \ \|_{CN\|_A}\}$

5.3.6 Summary

The discussed modifications of the semantics of the definite article are not capable of solving the general mismatch between compositional properties of ordinary meaning and alternative meaning. There are different conclusions that one can draw from this picture. The first conclusion is already suggested by the last modification: the definite article does not have any lexical semantics, and the union operation at the level of alternative semantics is a reflex of a semantic shifting rule. This calls also for a different ordinary meaning of the article, which, for example, is assumed in Discourse Representation Theories, where definiteness is not understood as contribution to the propositional content of the sentence, but to the construction of a discourse representation of the sentence and the discourse (see section 6.3). However, this conclusion cannot account for the observation that the union operation is not only used in the case of the definite article but also with adverbs of quantification, superlative construction etc., where no such general shifting rule is to be assumed. On what ground can one argue that the union operation is justified in these cases? It rather seems that the construction of such examples do not need all the alternative mechanism available, but can do with less structure.

This leads us to a second conclusion: the compositional rules of Alternative Semantics are too powerful, they create too much structure. In simple cases, like association of focus with proper names, this does not show up, but in more complex cases it does. In particular, there are too powerful compositional rules, which warrant that the alternatives generated by the focused phrase are "projected" to the level where they can be used as an argument of operators. This observation leads us in the same direction as the one at the end of the last chapter: In the light of these considerations, it seems not so plausible any more that the focus generates alternatives. To illustrate this point with our first example again:

- (1) Sam only talked to [the DUTCH_F professor]_{NP}.

In (1) the domain of quantification is just the set of professors - there is no mechanism necessary that determines the generating and composing of alternatives. One has only to take the argument of the operator and construct the restriction by *not* adding the focused material. Any attempt to generate more alternatives has led to problems discussed in the last section. Thus we come to the same conclusion as in the last chapter: the contribution of focus is neither to divide the sentence in two semantic objects nor to induce alternatives. It is just the blocking of the mapping of the focused expression to certain representational levels (which then can be used as arguments of operators).

5.4 The problems of focus semantics

Summarizing the last two chapters, where semantic focus theories were reviewed. The following problems have been found in the course of the presentation:

(i) LF-moving theories and the focus-background structure

LF-movement theories assume that focus induces a semantic focus-background structure. The values or denotations of the two semantic objects serve as arguments for focus-sensitive particles. However, as it was shown, this does not hold for adverbs of quantification nor for focus-sensitive operators like *only* that associate with deeply embedded constituents.

(ii) Focus Phrases and the computing of alternatives

Krifka (1996) proposes the notion of *Focus Phrase* to solve the discrepancy between the focused expression and the constituent the operator ranges over. However, he has to admit that the composition of alternatives inside the Focus Phrase must be determined by Alternative Semantics.

(iii) Alternative Semantics and variable binding

Alternative Semantics assumes that the focus contrastively generates alternatives, which are compositionally projected to the VP. The focus operator takes the ordinary meaning and the alternative meaning of the VP as its arguments. Kratzer (1991) shows that this mechanism generates too many alternatives, since the alternatives do not obey co-indexing at a representational level.

(iv) Alternative Semantics and definite NPs

In this chapter, I showed that in certain cases of embedded focus, the compositional rules generate too much structure. Therefore, it seems that focus does not induce alternatives. Focus rather determines which material of the sentence is mapped onto a representational level or p-skeleton.

(v) Kratzer's representational approach

Kratzer (1991) shows on examples with VP-ellipsis and its reconstruction that alternatives must obey certain co-indexing rules. Therefore, she proposes that focus is represented as designated variables at the representational level of p-skeleton. The interpretation of the p-skeleton yields the p-set or the set of alternatives which are used as argument for the focus operator. However, it is not clear why we have to operate on the denotations and not on the representations. An approach in which the focus-sensitive particle operates on the representational level seems more appropriate.

(vi) Focus and adverbs of quantification

A representation of association of focus with adverbs of quantification as in (56) raises additional problems (besides the question of the "downgrading" of the alternative set). In the most natural way of representation (56a), the variables in the second argument are not bound. In previous examples this was solved by adding the descriptive material from the first argument, as in (56b):

(56) Most of the time, a frog that sees a fly tries to CATCH it.

(56a) MOST({s | x,y [**frog'**(x) & **fly'**(y) & **see'**(x,y,s)]})
 ({s | **try-to-catch'**(x,y,s)})

(56a) MOST({s | x,y [**frog'**(x) & **fly'**(y) & **see'**(x,y,s)]})
 ({s | x,y [**frog'**(x) & **fly'**(y) & **see'**(x,y,s) & **try-to-catch'**(x,y,s)]})

In any case, the interaction of the variables introduced by the indefinite and the focus must be accounted for. Krifka (1992) concludes that "examples like (15) [= (56)] are donkey sentence, and we should expect that a combination of focus representation with a framework like Discourse Representation, File Change Semantics or another dynamic semantic representation is called for." And this seems the most promising way to attack the problem of focus semantics in particular and the representation of information structure in general.

Chapter 6

Focus and discourse semantics

Focus as one aspect of information structure is associated with different functions as discussed in the last chapters and illustrated by examples (1)-(4). In (1) the focus on *Fred* relates the sentence to the already established discourse as indicated by the paraphrase (1a). This is the prototypical case for theories of discourse organization, discussed in chapter 3.

- (1) Sam talked to FRED_F.
- (1a) It is part of the background or of the shared knowledge that Sam talked to someone. There are alternatives to Fred under discussion.

The discussion showed that there is no satisfactory semantic theory that can describe the information structure at an appropriate linguistic level. Discourse structure and information structure are rather conceived as additional levels that organize the processing or the make-up of the psychological models of discourse. The problem, of course, is to find clear linguistic contrasts in order to develop a linguistic descriptive system.

Such clear linguistic contrasts are generated by the interaction of focus particles and focus, or association with focus, as illustrated in (2) and the paraphrase (2b), where the particle is understood to be translated into a quantifier that operates on alternatives to the focus. In contrast to (2), sentence (3) expresses a clearly different content due to the placement of the pitch accent on *talked*.

- (2) Sam only talked to FRED_F.
- (2a) Nobody but Fred is such that Sam talked to him or her.
- (2b) for every element x that is a reasonable alternative to Fred, if x fits the background "Sam talked to x" then x is identical with Fred.
- (3) Sam only TALKED_F to Fred.
- (3a) Fred did nothing to Sam but talk.

Association with focus gave rise to a series of semantic frameworks, some of which were discussed in chapter 4. It was shown that one of the problems of such theories is that they identify the focus-background structure with the arguments of the operator

involved and that the operator quantifies over alternatives to the focus. This claim was refuted by examples like (4), where it is obvious that it is not the property of being of one nationality the quantifier operates on, but on the set of professors.

- (4) Sam only talked to [the DUTCH_F professor]_{NP}.
- (4a) Sam talked to nobody but the Dutch professor.
- (4b) Sam talked to no professor but the Dutch professor.

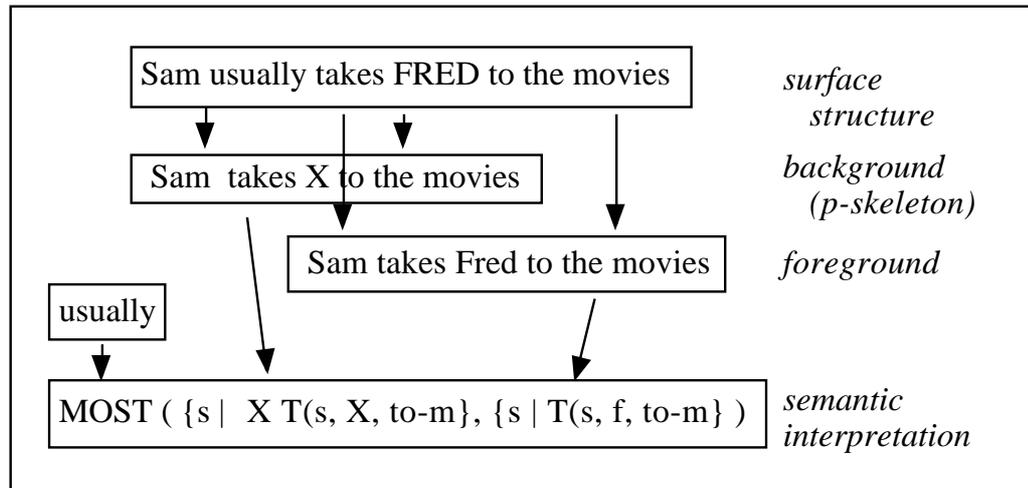
In an attempt to account for this problem, Krifka (1996) introduces the Focus Phrase, which associates with the particle, while containing the focus. Thus the focus does not interact directly with the operator.

Alternative Semantics had already abandoned the claim that a syntactic dichotomy of the sentence into focus and background corresponds to the arguments of focus operators. It rather assumes that the focus evokes alternatives that are compositionally built up at a different denotational level. However, problems with the overgeneration of alternatives and the compositional rules for the alternative meaning of definite NPs showed some major problems in the architecture of Alternative Semantics.

What is called for is a discourse semantics that (i) describes the embedding of sentences into the discourse and (ii) provides the adequate semantic objects that can be used as arguments of focus operators. In contrast to the dichotomy of the sentence in focus and background I propose two representational levels, the *foreground* and the *background*. The latter is what Jackendoff and others call the p-skeleton. The foreground representation contains all material supplied by the sentence. The background contains the foreground minus the focused expression which is substituted by designated variables. The interpretation of the foreground yields the ordinary meaning, while the existential closure over the designated variables of the background yields the alternatives. This is informally illustrated by the interaction of an adverb of quantification with a focused constituent, as in (5). The operator ranges over sets that are constructed from the foreground and the background representation as in (5b).

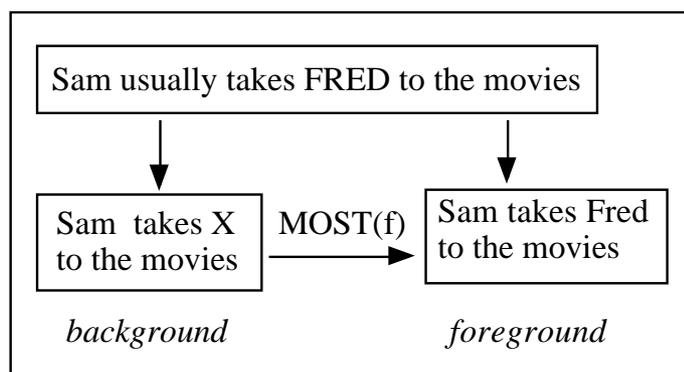
- (5) Sam usually takes FRED_F to the movies.
- (5a) For most times in which Sam takes someone to the movies, he invites Fred to the movies.
- (5b) Most {t | Sam takes someone to the movies at t}
 {t | Sam takes Fred to the movies at t}

(6) Schematic mapping relations for adverbs of quantification



However, I do not define focus operators as ranging over denotations of these two representations, but as ranging over the representations themselves. They express relations between the different representations of a sentence. Since the background contains the same material as the foreground, save the focused expressions which are replaced by designated variables, one can describe the relation between background and foreground in terms of underspecification: The background is underspecified with respect to the foreground. The adverb *usually* can be defined as ranging over functions that map the underspecified background onto the specified foreground, as in (7).

(7) Foreground-background representation for focus

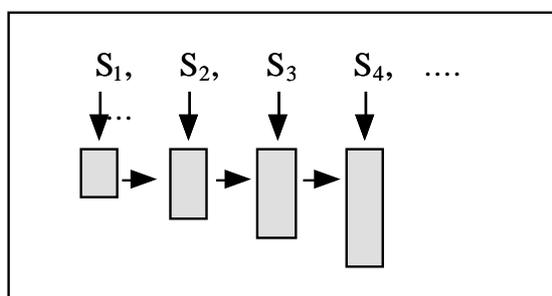


In order to derive this representation, I first present a semantic theory of discourse structure, namely Discourse Representation Theory.

6.1 Discourse Representation Theory

The initial problem that motivated discourse representation theories is the interpretation of nominal and temporal anaphora in discourse. The phenomenon of cross-sentential anaphora forces a semantics to extend its limits from the sentence to the discourse. The key idea in the way of thinking about the semantics of discourse in context exemplified in (Heim 1982) and (Kamp 1981) is that each new sentence or phrase is interpreted as an addition to or 'update' of the context in which it is used and that this update often involves connections between elements from the sentence or phrase with elements from the context. Informally described, a sequence of sentences S_1, S_2, S_3, S_4 , is interpreted by incrementally constructing a discourse representation as in (8). Anaphoric relations and definite expressions are captured by links between objects in this representation. In order to derive the truth condition of the sentence, the representation is embedded into a model.

(8) Discourse construction in classical DRT



The particular lay-out of File-Change Semantics of Heim (1982) and Discourse Representation Theory of Kamp (1981), DRT in short, was influenced by philosophical work on context change (Stalnaker 1978), by linguistic research on anaphoric relations (Karttunen 1976) and models of artificial intelligence to discourse (Webber 1979). Kamp (1981) formulates the two roots of DRT as follows:

Two conceptions of meaning have dominated formal semantics of natural language. The first of these sees meaning principally as that which determines conditions of truth. This notion, whose advocates are found mostly among philosophers and logicians, has inspired the disciplines of truth-theoretic and model-theoretic semantics. According to the second conception meaning is, first and foremost, that which a language user grasps when he understands the words he hears or reads. This second conception is implicit in many studies by computer scientists (especially those involved with artificial intelligence), psychologists and linguists - studies which have been concerned to articulate the structure of the representations which speakers construct in response to verbal inputs.

Corresponding to these different sources for the discourse representation, there is a debate still going on what kind of object the DRSs constitutes. Asher (1993, 64) enumerates three interpretation of the intermediate level of representation: (i) the DRS

is a level of "logical form"; (ii) the DRS is a "partial model" of what is said in the discourse; or (iii) the DRS is a "mental representation" of the content of a discourse formed by a recipient of it. I assume a position along the linguistic view (i) of DRS, i.e., I assume that DRSs, their objects, and their relations are linguistic entities that can be described by linguistic methodology.

The representation at this level is constructed from the surface structure of sentence and it serves as structure that can be embedded in a model in order to analyze the truth conditions. In this section, I concentrate on two basic structural properties of DRT: the realization of anaphoric relations and the quantification theory of nominal and adverbial quantifiers.

6.1.1 Anaphoric relations

Geach (1962) was among the first to note that cross-sentential anaphora cannot be described by means of classical binding since the scope of the existential quantifier cannot extend across a sentence boundary. In the classical representation (9a) of sentence (9), the last occurrence of the variable x is not bound, i.e. the anaphoric relation is not expressed. Geach proposes a different kind of existential quantifier, a text quantifier that takes the whole text into its scope, as illustrated in (9b). However, he did not account for its compositional properties or for the construction of such a formula.

- (9) A man walks. He whistles
 (9a) x [man(x) & walk(x)] & whistle(x)
 (9b) x [man(x) & walk(x) & whistle(x)]

A related problem was noted by Karttunen (1976), who observed that referents introduced by indefinites may have different "life spans", which is indicated by their potential to act as antecedents. The pronoun *it* in (10) can be anaphorically linked with the indefinite NP *a donkey*, while in (11) this is not possible. The life span of the referent introduced by *a donkey* cannot exceed the domain that is defined by the negation. Since a referent in the external world exists independently of any linguistic construction, Karttunen concludes that the notion of "life span" holds not of referents in the external world but of semantic objects that he named "discourse referents". Discourse referents are entities that are defined by expressing anaphoric relations and the interactions with domain creating operators like negation, modals or verbs of attitudes.

- (10) Pedro owns a donkey. He beats it.
 (11) John does not own a donkey. *He beats it.

A third puzzle concerns the quantificational force of indefinites, which depends on the construction in which they occur. The indefinite *a man* in (9) has existential force, while the indefinite *a donkey* in (12) or (13) expresses a universal force. Donkey sentences like (12) and (13) were introduced in the modern discussion by Geach (1962). Both sentences are interpreted by the formula (13a) expressing the universal force of the indefinite NP.

- (12) Every farmer who owns a donkey beats it.
 (13) If a farmer owns a donkey, he beats it.
 (13a) $x \ y \ [(\text{farmer}(x) \ \& \ \text{donkey}(y) \ \& \ \text{own}(x, y)) \ \rightarrow \ \text{beat}(x, y)]$
 (13b) $\text{Always}(\text{farmer}(x) \ \& \ \text{donkey}(y) \ \& \ \text{own}(x, y)) \ (\text{beat}(x, y))$

Kamp (1981) and Heim (1982) represent indefinite and definite noun phrases as variables (in the relevant argument position) and as open sentences, rather than as quantifier phrases. The indefinite noun phrase does not express any quantificational force by itself, but it receives the quantificational force from an operator in the construction. Sentence (9) is governed by an (invisible) existential text operator as proposed by Geach (1962), while the variable introduced by the indefinite *a donkey* in (12) is bound by the universal quantifier *every*. In (13), the conditional is analyzed as an (invisible) universal quantifier *Always*, which unselectively binds all occurrences of free variables. Other occurrence of such unselective binder are the adverbs of quantification (cf. Lewis 1975), as in (13b). Hence, the view that indefinites introduce variables that can be bound by other operators unifies the semantics of indefinites with the analysis of adverbs of quantification (see next section).

The best way to get acquainted with DRSs is to look at an example (cf. Asher 1993, 66f). The DRS for the first sentence in (9), repeated as (14) is (14a). The DRS in (14a) describes graphically an abstract, information structure, a DRS, with two parts. One part is called the *universe* of the DRS, the other its *condition set*. A DRS is an ordered pair consisting of its universe and condition set, written as $\langle U_K, \text{Con}_K \rangle$. The DRS in (14a) has as its universe one *discourse referent* x and as its condition a set of properties that are ascribed to the discourse referents in the universe. In (14a) the property of being a man and of walking is ascribed to the discourse referent x . Instead of the DRS in (14a), often the form (14b) is chosen, which consists of the set of discourse referents and the set of conditions separated by a "|":

(14) A man walks.

(14a)

x
man(x) walk(x)

(14b) $\{x \mid \text{walk}(x) \ \& \ \text{man}(x)\}$

To give the truth conditions for (14), we need to define a *proper embedding* for the DRS. Informally, a proper embedding for a DRS in an (extensional) model $M = \langle D, \|\ \|\rangle$, consisting of a domain D and an interpretation function $\|\ \|\$, is a function f that maps the discourse referents onto elements of the domain of M such that the elements are in the extension of the predicates that are ascribed to the discourse referents. For example, the DRS (14a) is true just in case that $f(x)$ is a man and $f(x)$ walks.

The sequence or conjunction of two sentences as in (9), repeated as (15), receives a DRS in steps. We start with the already established DRS for the first conjunct in (15a), then a new discourse referent for the pronoun *he* and a condition for the predicate *whistle* is added in (15b). The anaphoric link of the pronoun is graphically represented as $y=?$, indicating that the pronoun is still unresolved. The discourse referent that stands for an anaphoric expression must be identified with another *accessible* discourse referent in the universe, here the y is identified with the x , as in (15c). The whole sentence can also be represented as (15d) corresponding to (15c):

(15) A man walks. He whistles

a

x
man(x) walk(x)

b

x, y
man(x) walk(x) y=? whistle(y)

c

x, y
man(x) walk(x) y=x whistle(y)

(15d) $\{x,y \mid \text{walk}(x) \ \& \ \text{man}(x) \ \& \ y=x \ \& \ \text{whistle}(y)\}$

This mini-discourse is true if there is an embedding function f onto a model such that $f(x)$ is a man and walks and $f(y) = f(x)$ and $f(y)$ whistles. The truth conditions of this are the same as for Geach' logical form (9b) above.

Kamp & Reyle (1993, 70) give the construction rule for pronouns:

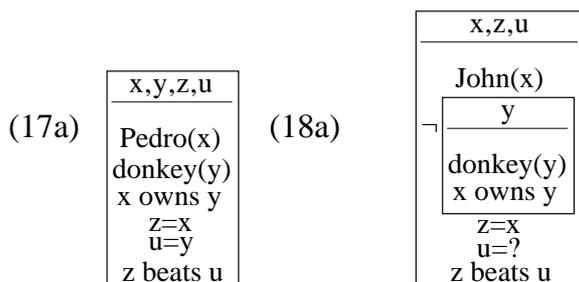
(16) Construction rule for pronouns in a DRS (Kamp & Reyle 1993)

1. Introduce a new discourse referent into the universe of the DRS
2. Introduce a condition obtained by substituting this referent for the NP-node of the local configuration that triggers the rule application in the syntactic structure containing this configuration and delete that syntactic structure.
3. Add a condition of the form $\text{ref} = \text{disc}$ where ref is a new discourse referent and disc is a *suitable* discourse referent chosen from the universe of the DRS.

The new discourse referent introduced by the pronoun must be linked or identified with an already established and accessible discourse referent. DRT defines accessibility in terms of structural relations, i.e., the discourse referent must be in the same (or a higher) universe. With this concept of accessibility, the contrast between (10) and (11), repeated as (17) and (18) can be described by the difference in the set of accessible discourse referents for the pronoun *it*. The construction rule for the negation in (18) creates an embedded discourse universe with the discourse referent y and the conditions $\text{donkey}(y)$ and $x \text{ owns } y$. The anaphoric pronoun *it* in the second sentence cannot find a suitable discourse referent since it has no access to the embedded discourse universe with the only fitting discourse referent y .

(17) Pedro owns a donkey. He beats it.

(18) John does not own a donkey. *He beats it.



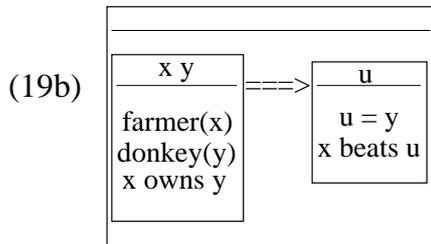
In DRT like in File-Change Semantics or other types of dynamic semantics, definiteness is captured as one instance of anaphora. Thus the linguistic relation of anaphora as well as the linguistic category of definiteness is reconstructed as the construction rule to link one entity at the discourse representation with another accessible. Accessibility is reconstructed as the structural embedding relations between discourse universes. Certain semantic operators, like negation, introduce their own universe, as illustrated in (18a). Other operators introduce even more complex structures.

6.1.2 Quantification

Quantifiers like *every*, *most*, *at least*, *no* etc. induce a more complex discourse representation structure. They are represented by two embedded DRSs and a quantificational relation between them. This structure is sometimes called a *box-splitting* -structure. For example, sentence (19) with the universal quantifier *every* and the logical form (19a) is represented as the DRS in (19b). The restriction *farmer who owns a donkey* is represented by the left DRS and the nuclear scope *beats it* by the right DRS. Note that the pronoun *it* can be linked to the discourse referents *y*, even though *y* is not in the same or a higher discourse universe. An additional rule of DRT licenses anaphoric links between the two DRSs of a quantifier structure.

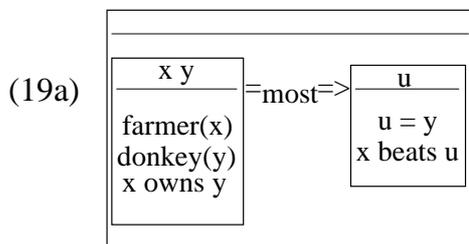
(19) Every farmer who owns a donkey beats it.

(19a) $x [(farmer(x) \ y [donkey(y) \ \& \ own(x,y)]) \rightarrow beat(x,y)]$



Based on observations of Lewis (1975), Heim (1982) develops a new semantics for *adverbs of quantification* like *always*, *usually*, *sometimes* etc. This semantics was translated into DRT: indefinites introduce discourse referents and the adverb of quantification induces a box-splitting in the same way as a nominal quantifier. For example, the adverb *usually* in (19) causes the box-splitting in (19a) with the descriptive material of the subject and its relative clause in the left universe and the matrix verb in right universe. The adverb is translated into an operator that quantifies over all free variables. It is said to quantify *unselectively* as in (19b), which is the translation of (19a) into a linear form.

(19) A farmer who owns a donkey usually beats it.



(19b) $MOST(\{x,y \mid farmer(x) \ \& \ donkey(y) \ \& \ owns(x,y)\}, \{u \mid u=y \ \& \ beats(x,u)\})$

6.2 Discourse structure and background

Information structure in terms of given vs. new was defined as the "packaging" of the propositional content of a sentence, which reflects the beliefs of the speaker about the beliefs of the hearer, but does not effect the truth conditions of the sentence. This view is still held by several approaches to information structure, even though it was as early as 1972 when Dretske stated that information structure makes a difference for truth conditions as well. Sentences with different information structure – what he calls contrastive foci – exhibit truth conditional contrasts when they are embedded in a larger context:

What I wish to show is that contrastive differences (...) are significantly involved in determining the meaning (hence, semantics) of a variety of larger expressions in which they can be embedded. If $C(U)$ is a linguistic expression in which U is embedded, and U can be given different contrastive foci (say U_1 and U_2), then it often makes a difference to the meaning of $C(U)$ whether we embed U_1 or U_2 . Linguistically this is important because it means that any adequate semantical theory, one that is capable of exhibiting the source of semantical differences between complex expressions, between $C(U_1)$ and $C(U_2)$, will have to be provided with the resources for distinguishing between U_1 and U_2 . (Dretske 1972, 412)

This classical quotation expresses the claim that whatever the nature of informational structure is, if it affects the meaning, i.e., the semantics, then it must be analyzed in terms of semantic theory. Dretske (1972, 412) further argues that a semantic understanding of these contrasts is necessary for the way we speak about the knowledge or the consciousness of speaker and hearer:

Philosophically speaking this is important because when philosophers are talking about explanation, about evidence, about reason (for doing and believing), and about knowledge, they are concerned, at least in part, with trying to understand what it means to say that S knows that U , S has a reason to believe that U , E is evidence that U , and E is the explanation of the fact that U . Until one understands how the contrastive differences in U can make a difference in what it *means* to say these things, one cannot hope to provide a correct analysis of these key ideas.

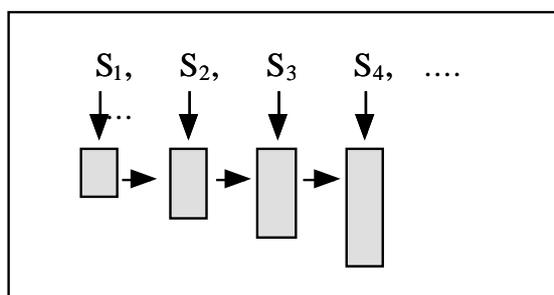
This program of investigating sentences and describing their informational properties with respect to the larger linguistic context has just started to be undertaken. In the remainder of this section I present Asher's theory of *segmented* DRT (= SDRT) as one of the rare examples of a semantic account of discourse. Even though Asher starts by defining discourse relations in terms of propositions, he eventually must make reference to the internal structure of sentences in order to capture basic discourse relations.

Asher (1993; 1997) develops a discourse structure in the DRT-approach that is not confined to the incremental composition of DRSs but also captures discourse relations between the sentences in the discourse:

SDRT is an extension of DRT that attempts to make clear in a precise and systematic way the interactions between semantic content and discourse structure. It provides a formal foundation for discourse structure in the tradition of Grosz and Sidner (1986) and Mann and Thompson's [= 1987, KvH] Rhetorical Structure Theory (RST), in which a text gives rise to a discourse structure that consists of propositions related by discourse relations. Further, SDRT shows how such a structure may be built up in an incremental and logically precise manner. Finally, SDRT offers a detailed integration of semantic and pragmatic phenomena relevant to the interpretation of discourse. (Asher 1999, 251)

In order to develop such a theory, Asher revises the classical DRT of Kamp (1981) and Kamp & Reyle (1993). The classical version describes the dynamic meaning of a discourse by processing sentence for sentence. Since the meaning of each sentence is construed as a function from truth conditions to truth conditions, the truth conditional content of the whole discourse is reconstructed by the sequential application of these functions. Asher (1993, 256) notes that "the notion of semantic updating in the original DRT fragment of Kamp (1981) (...) is extremely simple, except for the procedures for resolving pronouns and temporal elements, which the original theory did not spell out. To build a DRS for the discourse as a whole and thus to determine its truth conditions, one simply adds the DRS constructed for each constituent sentence to what one already had. (...) This procedure is hopelessly inadequate, if one wants to build a theory of discourse structure and discourse segmentation." In classical DRT, a sequence of sentences $S_1, S_2, S_3, S_4, \dots$ is analyzed by the incremental construction of one discourse representation for the whole discourse, as illustrated in (20).

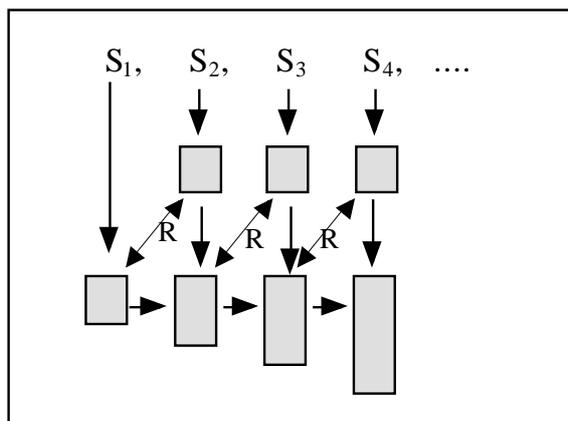
(20) Discourse construction in classical DRT



In SDRT, each sentence of a sequence S_1, S_2, S_3, S_4 , is first represented as a particular SDRS for that sentence, before the representation is merged with the already established representation, as in (21). The discourse representation of each single

sentence is necessary in order to define the discourse relation R between the sentence and the discourse.¹

(21) Discourse construction in *segmented* DRT



Asher (1993, ch. 7) defines several discourse relations, which are essentially borrowed from Rhetorical Structure Theory (RST), such as *causation*, *explanation*, *coherence*, *elaboration*, *continuation*, etc. These relations hold between the propositions expressed by the sentence under consideration and the set of propositions that are expressed by already established sentences in the discourse. There are two discourse relations that make reference to the internal structure of the sentences involved: *parallelism* and *contrast*, which are defined by Asher (1993, 285) as follows: "Parallelism involves a pairing of constituents in an SDRS and their parts such that each pair contains two semantically and structurally similar objects. Contrast also involves a pairing between constituents and their parts, in which at least some pairs contain structurally similar but semantically dissimilar objects." In order to describe these two discourse relations Asher (1993, 285) defines the notion of *theme*:

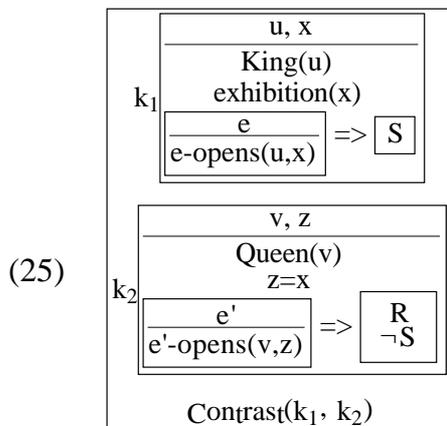
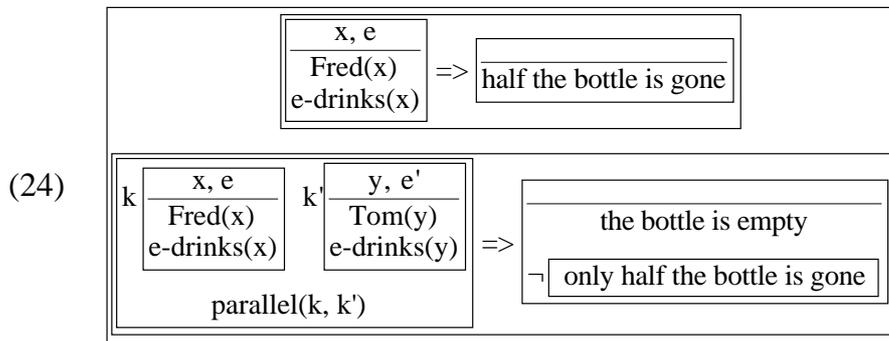
Echoing the distinction between topic and focus or given information and new, I shall isolate for each constituent a *theme*. Parallelism between two constituents is maximized when there is a common theme and it is as maximal as is compatible with informativeness. Contrast is maximally plausible when themes are complementary or even contraries.

The function of Asher's *theme* (roughly corresponding to the notion *background*) is illustrated by the following two examples, which Asher (1993, 284) ascribes to van der Sandt:

¹ The construction mechanism is more complex if the anaphoric relations are represented as well. In that case, the construction of the DRS for the particular sentence must be connected (or embedded) into the discourse DRS in order to license the linking of discourse referents. This aspect, however, will not be considered here.

- (22) If Fred drinks, half the bottle is gone. If Tom drinks too, the bottle is empty.
 (23) If the King opens the exhibition, the newspaper will comment on his speech.
 But if the Queen opens it, they will comment on her robe.

In both examples the second sentence is dependent on the first. In (22), the second sentence says that if Tom *and* Fred drink, then the bottle is empty. In the second sentence in (23) it is said if the Queen opens the exhibition *and the King does not*, then the newspapers will comment on her robe. Asher (1993, 295f) assigns the SDRSs (24) and (25) to (22) and (23), respectively:



In both analyses, part of the representation of the first sentence is related to a part of the representation of the second sentence. In (24), the SDRS $\{x,e \mid \text{Fred}(x), \text{e-drinks}(x)\}$ from the first sentence is said to be parallel to the condition $\{y,e \mid \text{Tom}(y), \text{e-drinks}(y)\}$ of the second sentence. What is structurally the same in both SDRSs is the representation $x \{x,e \mid \text{e-drinks}(x)\}$ for *someone drinks*. Analogously, in (25) the SDRS k_1 stands in the relation of contrast to k_2 . Again, what is compared is something like $x \{x,z,e \mid \text{exhibition}(z) \ \& \ \text{e-open}(x,z)\}$ for *someone opened the exhibition*.

This short presentation of Asher's SDRT should have motivated the use of DRs in the description of discourse and discourse relations. Asher explicitly makes reference to representational structures in his model that serve as objects for the operations defined. He formally defines some of the discourse relations as embedding relations or

isomorphy between *modified extended embedding trees* (MEE trees) of DRSs. Even though we cannot go into the details of his formalism,² the examples should have motivated the idea that discourse relations are defined as operations on the representation of the background (Asher's *themes*).³

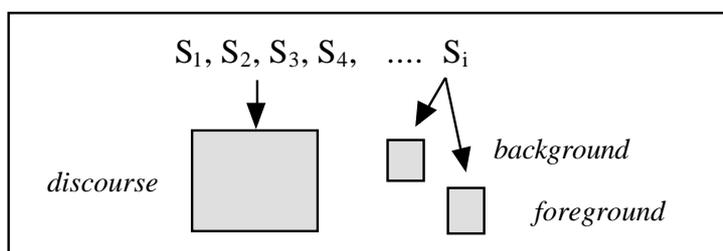
6.3 The Foreground-background semantics

My approach is based on the assumption that a sentence makes (at least) two kinds of contribution to the context: the ordinary meaning and the background meaning. These two contributions are not provided by a dichotomy of the sentence surface in focus-background, but by two construction mechanisms that translate the sentence into two representations at the level of discourse representation. I assume a DRT-like model (see section 6.1) with an extra set of construction rules for the background representations. The foreground is constructed from the material of the sentence in the common way a DRS is constructed. The background, however, is a DRS in which the focused expressions are not present; they are merely represented by designated variables. Background and foreground are both DRSs or representational objects at the intermediate level of discourse representation. Thus there are (at least) three objects when analyzing a sentence: the DRS for the discourse, the DRS for the background and the DRS for the foreground:

² Asher (1999, 255) for example gives the following definition of his discourse relation "Parallel": "**Definition:** For α, β constituents of an SDRS \mathbb{K}_0 , $\text{Parallel}(\alpha, \beta)$ is satisfied in \mathbb{K}_0 iff there are MEE trees α' and β' for α and β , respectively, and a tree isomorphism $\alpha' \rightarrow \beta'$ such that for all nodes α_i of α' and there are themes P and P' of α_i and β_i such that $\text{polarity}(\alpha_i, P) = \text{polarity}(\beta_i, P')$."

³ In a different semantic approach to the "Information Structure in Discourse", Roberts (1996, 3) takes up the idea that the discourse is organized in moves: "There are two types of moves which players may make (...): What Carlson calls *set-up moves*, which are questions, and what he calls *payoff moves*, which are assertions. Note that moves, on the interpretation I will give them, are not speech acts, but the semantic objects which are used in speech acts: A speech act is the act of proffering [sic] a move. (...) I assume that there are two aspects to the interpretation of any given move: its *presupposed content* and its *proffered content*. I use the term *proffered* as a cover for what is asserted in an assertion and for the non-presupposed content of questions and commands." Even though discourse relations are reduced to the question-answer pairs, Roberts also assumes that a single sentence makes two distinct contributions to the discourse: material that is assumed to be accepted and material that is offered for acceptance. Roberts' *presupposed content* corresponds to Asher's *theme*, which is what here is called *background*, while her *proffered content* corresponds to the *foreground* use here.

(26) DRSs for the discourse, foreground, and background



There are relations between each pair of DRSs: the relation between the discourse and the foreground concerns the rhetoric relationship mentioned in section 6.2. The relation between the background and discourse is generally described in terms of givenness, and the relation between the background and the foreground serves as the domain over which discourse operators range. In the following subsections, first the construction rules for the background-DRS are formulated, then the relation between the background and the discourse is described, and finally the sentence internal phenomena of association with focus is captured by the relation between the background and foreground.

6.3.1 The construction of foreground and background

The foreground DRS is constructed according to the rules of DRT (Kamp & Reyle 1993), which were informally presented in section 6.1. The background structure is constructed in the same way except for focused expressions, which are represented by a designated variable of the appropriate type. Due to the particular construction rules, the designated variable substitutes conditions, rather than discourse referents.⁴ This is even the case for proper names, which are introduced into the DRS by a discourse referent and a condition in which the name serves as predicate, as illustrated in (27). The foreground representation (27a) contains the two discourse referents x and y , and the conditions which link the discourse referents to Sam and to Fred, and the conditions that expresses the relation of talking between the two. The background representation (27b) contains the same structure except for the condition $Fred(y)$, which is replaced by $X(y)$. (27c) also refers to the background structure, but in a less space consuming way.

⁴ This is a structural difference between givenness and definiteness. However, one can also claim that definiteness is a subcategory of givenness. Allerton (1978), for example, distinguishes between givenness of linguistic items and givenness of the referent, which is linguistically reflected in pro-form and definiteness, respectively: Allerton (1978, 145) notes that "The difference between pro-form givenness and definite-givenness corresponds in large measures to Halliday and Hasan's (1976) distinction between 'substitution' and 'reference'."

(27) Sam talked to FRED_F

(a)	(b)	(c)				
<table style="width: 100%; border-collapse: collapse;"> <tr><td style="border-bottom: 1px solid black; padding: 2px;">x, y</td></tr> <tr><td style="padding: 2px;">Sam(x) Fred(y) x talks to y</td></tr> </table>	x, y	Sam(x) Fred(y) x talks to y	<table style="width: 100%; border-collapse: collapse;"> <tr><td style="border-bottom: 1px solid black; padding: 2px;">x, y</td></tr> <tr><td style="padding: 2px;">Sam(x) X(y) x talks to y</td></tr> </table>	x, y	Sam(x) X(y) x talks to y	{x,y Sam(x) & X(y) & x talks to y}
x, y						
Sam(x) Fred(y) x talks to y						
x, y						
Sam(x) X(y) x talks to y						

The focused verb *talked* in (28) is represented in the background (28b) as the variable *R* over relations, while the focused VP in (29) is represented as the one-place predicate variable *P*. In the latter case the internal structure of the focused constituent is not preserved in the background representation.

(28) Sam TALKED_F to Fred.

(a)	(b)	(c)				
<table style="width: 100%; border-collapse: collapse;"> <tr><td style="border-bottom: 1px solid black; padding: 2px;">x, y</td></tr> <tr><td style="padding: 2px;">Sam(x) Fred(y) x talks to y</td></tr> </table>	x, y	Sam(x) Fred(y) x talks to y	<table style="width: 100%; border-collapse: collapse;"> <tr><td style="border-bottom: 1px solid black; padding: 2px;">x, y</td></tr> <tr><td style="padding: 2px;">Sam(x) Fred(y) x R y</td></tr> </table>	x, y	Sam(x) Fred(y) x R y	{x,y Sam(x) & Fred(y) & x R to y}
x, y						
Sam(x) Fred(y) x talks to y						
x, y						
Sam(x) Fred(y) x R y						

(29) Sam [talked to FRED]_F

(a)	(b)	(c)				
<table style="width: 100%; border-collapse: collapse;"> <tr><td style="border-bottom: 1px solid black; padding: 2px;">x, y</td></tr> <tr><td style="padding: 2px;">Sam(x) Fred(y) x talks to y</td></tr> </table>	x, y	Sam(x) Fred(y) x talks to y	<table style="width: 100%; border-collapse: collapse;"> <tr><td style="border-bottom: 1px solid black; padding: 2px;">x</td></tr> <tr><td style="padding: 2px;">Sam(x) x P</td></tr> </table>	x	Sam(x) x P	{x,y Sam(x) & x P}
x, y						
Sam(x) Fred(y) x talks to y						
x						
Sam(x) x P						

The focused adjective *Dutch* in (30) is replaced by a predicate variable *X* in the background. Note that the definite article does not appear in the representation. This was one of the consequences of the discussion in chapter 5, where it was shown that association with focus in definite NPs raises more problems for focus theories that they can manage. In particular the interaction of the focus semantics with the semantics of the definite article was shown to lead to serious problems. Therefore, it was concluded that focus semantics does not interact with the uniqueness condition of the definite article. One way to implement this is to assume with other discourse semantics (Heim 1982, Kamp 1981, Kamp & Reyle 1993) that the definiteness is a discourse pragmatic concept which is not expressed in the lexical meaning. It is operative while constructing the DRSs, for example, as an additional condition that there is only one Dutch professor. Such a condition could be understood as a locally accommodated representation (cf. Kamp & Reyle 1993, 297-299), which will be suppressed here:

(30) Sam talked to [the DUTCH_F professor]_{NP}.

(a)

x, y
Sam(x) Dutch(y) prof(y) x talked to y

(b)

x, y
Sam(x) X(y) prof(y) x talked to y

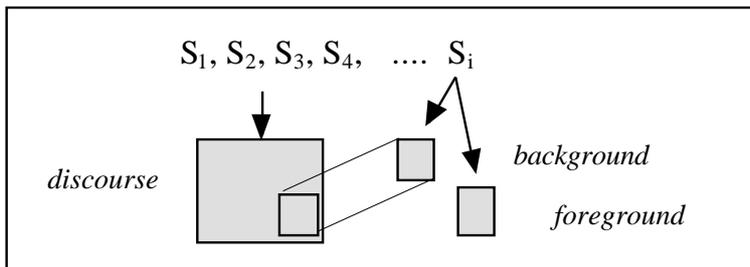
(c)

{x,y | Sam(x) & X(y) & prof(y) x talks to y}

6.3.2 Discourse structure, background, and givenness

The view of information structure enforced here allows for a new approach to the notion *givenness* introduced by Halliday (1967b). He defines given as "anaphorically recoverable", while new is "textually and situationally non-derivable information", or "contrary to some predicted or stated alternative", or "replacing the WH-element in a presupposed question". With the discourse model developed so far, the description "anaphorically recoverable" can be captured: the background comprises the given material of the sentence. The representation of the background must be mapped onto a part of the already established discourse DRS, as illustrated in (31):⁵

(31) Relation between discourse-DRS and background-DRS



This approach to givenness is representational and non-propositional: it is representational in that it follows one of the basic tenets of DRT, namely that anaphoric relations are relations between discourse objects rather than between denotations (or objects in the world). The same holds for givenness: it is a relation between discourse objects; it differs from anaphora in that it is defined as a relation between the conditions and not between discourse referents as in the case of anaphoric relations. The second point concerns the non-propositional definition of background. In section 3.2.4, givenness was substituted by the semantic concept of presupposition. However, Allerton (1978, 151) already notes the difference between these two concepts:

We may now perhaps appreciate how givenness differs from the notion of 'presupposed'. Givenness applies to sentence constituents including their component lexical items and to

⁵ For the direction of a formal account for this approach compare Asher (1993, 1999) and the definition of his discourse relation "Parallel" quoted above.

combinations of these; but it can also apply to whole sentences, when these are embedded. Presuppositions, on the other hand, apply to propositions. Propositions are always potential sentences, having the capacity for being true or false. (...).

In order to illustrate the difference between the representational approach to givenness and the presuppositional one, I briefly review Schwarzschild's (1997) attempt to accommodate Halliday's notion of givenness to a presuppositional treatment. Schwarzschild (1997) demonstrates the different steps one has to take to describe the representational view of *given* in terms of entailment. He starts with the following definition.

(32) An utterance is given iff it is entailed by prior discourse.

Schwarzschild (1997, 7) notes then: "The first problem that (13) [= (32)] runs into is that it is based on the notion of entailment, a notion that relates propositional utterances, but we want to apply the term 'given' to expressions of any type. (...) To remedy this let's assume a sort of type shifting operation that raises expressions of type t , by existentially binding unfilled arguments." If the phrase *green apple* has been mentioned, then he assumes that an utterance of *apple* is given, as in (33):

(33) $x(\text{green-apple}(x)) \text{ ENTAILS } x(\text{apple}(x))$

He calls the operation that allows us to generalize the notion of entailment "existential type shifting." He constructs the p-skeleton by substituting the F-marked constituents by designated variables, and then derives from that the existential closure over these designated variables. Schwarzschild (1997, 9) defines *given* in terms of entailment as follows:

(34) An utterance U counts as **given** iff it has an antecedent A , and modulo - type-shifting, A entails the result of replacing F-marked parts of U with existentially bound variables.

The non-focused material in (35B) is given because the utterance (35A) entails in (36) the background structure of (35B).

(35) A: John ate a green apple.
B: No, John ate a RED apple.

(36) John ate a green apple ENTAILS $\exists Y$ John ate a Y apple

This relation between the two utterances in (35) can be represented as in (37). (37a) is the DRS for the discourse so far, here only for the first utterance *John ate a green apple*, which is assumed to be established when the second utterance is interpreted.

(37b) constitutes the background representation and (37c) the foreground representation of (35B).

(37a)	(37b)	(37c)															
<table style="width: 100%; border-collapse: collapse;"> <tr><td style="border-bottom: 1px solid black; padding: 2px;">x, y</td></tr> <tr><td style="padding: 2px;">John(x)</td></tr> <tr><td style="padding: 2px;">green(y)</td></tr> <tr><td style="padding: 2px;">apple(y)</td></tr> <tr><td style="padding: 2px;">x ate y</td></tr> </table>	x, y	John(x)	green(y)	apple(y)	x ate y	<table style="width: 100%; border-collapse: collapse;"> <tr><td style="border-bottom: 1px solid black; padding: 2px;">x, y</td></tr> <tr><td style="padding: 2px;">John(x)</td></tr> <tr><td style="padding: 2px;">X(y)</td></tr> <tr><td style="padding: 2px;">apple(y)</td></tr> <tr><td style="padding: 2px;">x ate y</td></tr> </table>	x, y	John(x)	X(y)	apple(y)	x ate y	<table style="width: 100%; border-collapse: collapse;"> <tr><td style="border-bottom: 1px solid black; padding: 2px;">x, y</td></tr> <tr><td style="padding: 2px;">John(x)</td></tr> <tr><td style="padding: 2px;">red(y)</td></tr> <tr><td style="padding: 2px;">apple(y)</td></tr> <tr><td style="padding: 2px;">x ate y</td></tr> </table>	x, y	John(x)	red(y)	apple(y)	x ate y
x, y																	
John(x)																	
green(y)																	
apple(y)																	
x ate y																	
x, y																	
John(x)																	
X(y)																	
apple(y)																	
x ate y																	
x, y																	
John(x)																	
red(y)																	
apple(y)																	
x ate y																	

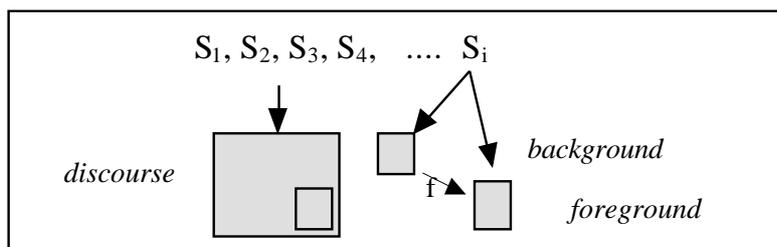
The background (37b) can be retrieved from the already established discourse (37a) without making reference to presuppositions. A purely structural relation between the two representations suffices.

However, if one prefers to link the sentence with the discourse by using presuppositions, the representational approach can be translated into the presuppositional one along the lines Schwarzschild proposes. In general, the existential closure of the background yields the presupposition.

6.3.3 Background-foreground interaction

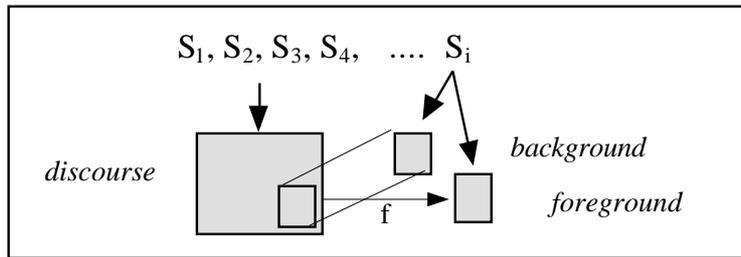
This section focuses on the relation between the background and the foreground, which can be understood in two ways: either as a relation between the background structure of the sentence under analysis, or as the whole content of that sentence, i.e. the foreground, as illustrated in (38).

(38) Relation between background DRS and foreground DRS



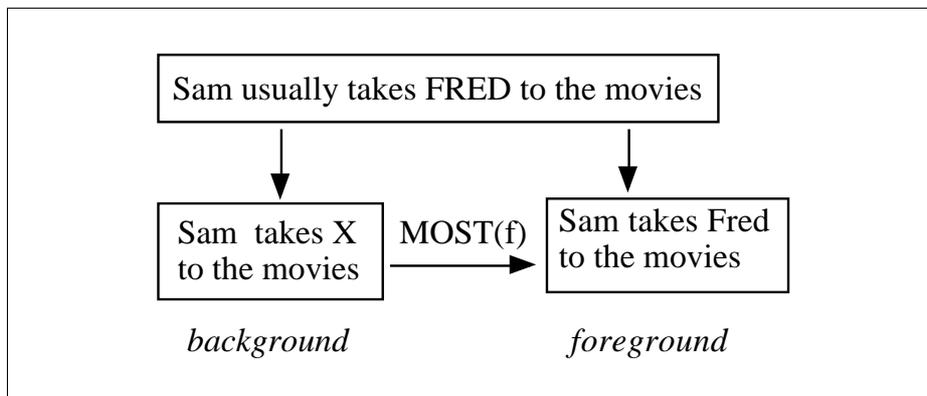
Since the background can also be understood as a structure that is provided by the already established DRS, the relation between background and foreground can also be understood as a relation between the discourse representation and the representation of the whole sentence, as illustrated in (39):

(39) Relation between discourse DRS and foreground DRS



In both cases a function f is assumed that relates the background to the foreground. Since the only difference between the background and the foreground representation is the use of designated variables in the background for focused expressions, the function f corresponds to a designated assignment function h that assigns conditions to the designated variables. I will assume that focus operators range over those functions rather than over denotational objects. According to this approach, the representation (7) from above, repeated as (40) is motivated:

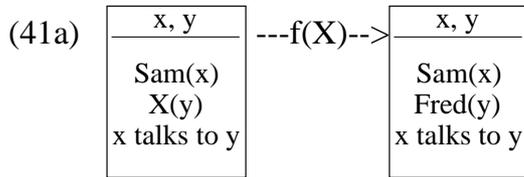
(40) Background-foreground representation of adverbs of quantification



6.3.4 Association with focus

With this basic mechanism, it is possible to analyze association with focus with different operators, which will be informally presented in this chapter. Focus-sensitive particles and adverbs of quantification are translated into operators that range over functions from the background onto the foreground. Sentence (2), repeated as (41), is represented as background and foreground in (41a). The particle is not represented at either representation, but rather translated into an operator ranging over functions f from the background onto the foreground. The operator is defined as asserting that there is no function but the function expressed in the sentence. Since in this example the only difference between the two representations in (41a) consists of assigning the name *Fred* to the discourse referent y , the function can be reduced to the designated assignment function h with respect to the variable X , asserting that for all designated assignment functions h , they assign the value *Fred* to the variable X , as in (41b):

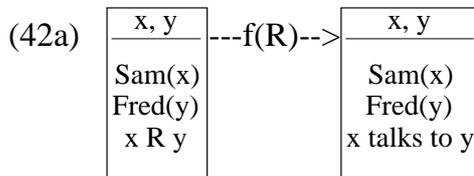
(41) Sam only talked to FRED_F.



(41b) $h(\|Sam(x) \& X(y) \& x \text{ talks to } y\|^{g,h} = 1) \rightarrow h(X) = \text{Fred}$

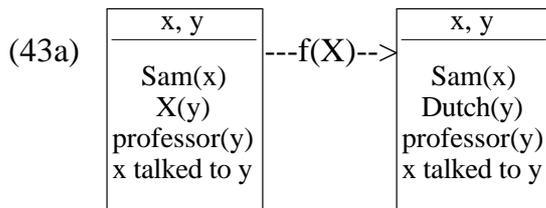
Analogously, sentence (3), repeated as (42), is analyzed as (42a), where the function that ranges over the variable R being the only difference between the two representations. Again, it is said that there is no other relation that hold of Sam and Fred other than the relation of talking:

(42) Sam only TALKED_F to Fred.



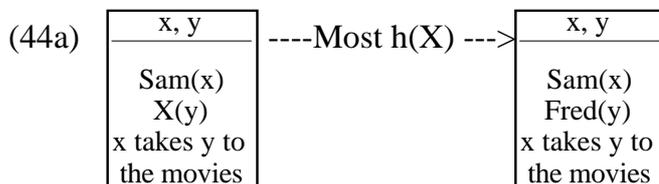
Example (4) repeated as (43), is represented as in (43a), where the function ranges over the variable X , standing for the property of having a certain nationality:

(43) Sam only talked to [the DUTCH_F professor]_{NP}.



Finally, the adverb of quantification in (5), repeated as (44), is translated into an operator *Most* that ranges over the function, which varies here only with respect to the value of X :

(44) Sam usually takes FRED_F to the movies.



6.4 Perspectives

The theory of information structure sketched in the last section radically differs from the approaches discussed in chapter 3, which present the information structure as a dichotomy of the sentence content into focus and background. As it was argued, the psychological gestalt-notion of figure-ground has haunted linguistics for some time. And if one likes to use this often misused metaphorical concept, then I suggest it should be used in the same way Caffi (1997, 437) applied it to illustrate pragmatic presuppositions:

In order to clarify the concept of presupposition, some authors have compared speech with a Gestalt picture, in which it is possible to distinguish a ground and a figure. Presuppositions are the ground; what is actually said is the figure. As in a Gestalt picture, ground and figure are simultaneous in speech; unlike the two possible representations in the Gestalt picture, speech ground and figure have a different status, for instance with respect to the possibilities of refutation. What is said, i.e., the figure, is open to objection; what is assumed, i.e., the ground, is 'shielded from challenge' (Givón 1982, 101). What restricts the analogy is the fact that discourse is a dynamic process; the picture is not. When communicating, one is constantly asked to choose what to put in the foreground and what in the background. Discourses and texts are therefore multilevel constructions. Presuppositions represent at least a part of the unsaid.

Like presuppositions, the background expresses another aspect of the sentence, but not as a distinct unit of the sentence, but as a distinct representation of the sentence. To summarize the main assumption of the foreground-background semantics for information structure:

- (i) The information structure of a sentence consists of the foreground and the background. Both terms refer to representations at a discourse representational level.
- (ii) The foreground corresponds to the representation of the whole sentence (modulo certain particles), while the background corresponds to the same representation save for the focused expressions, which are substituted by designated variables.
- (iii) This information structure is described in the framework of DRT, i.e. in an explicit linguistic theory of sentence and discourse semantics.
- (iv) The information structure into foreground and background provides important discourse objects (DRSs, construction trees, etc.) that are essential for the definition of discourse relations between sentences in a discourse.
- (v) The classical concept of givenness is understood as a structural condition of DRSs at the representational level. More precisely, givenness can be defined in terms of isomorphy between parts of DRSs. In other words, an expression is given if it is already present in the discourse representation.

- (vi) In this view, the classical informational concept *focus* does not constitute a basic unit. The focused expression merely indicates the difference between the background (i.e. the given material) and the foreground (i.e. the whole sentence). The focused expression is represented as a designated variable in the representation.
- (vii) Focus-sensitive particles and adverbs of quantification are translated into operators that range over functions from the (underspecified) background onto the fully specified foreground. In this way, association with focus is reconstructed as a discourse operation similar to contrast or information focus.

These main assumptions of the foreground-background semantics have led to a different view of information structure. Information structure is understood as part of discourse semantics, and therefore, as part of linguistic description. Information structure certainly effects sentence processing, psychological models and computational questions of language, but in the way described here, it is a linguistic level with linguistic objects. The particular view defended here might have raised more questions than it has solved. In particular, it is still an open issue over what kind of domains focus operators range: alternatives, p-sets, presuppositions, DRSs or functions between DRSs. Certainly more research is necessary to elaborate this question. Furthermore, the theory presented has to be tested against a wide range of data, some of which were presented in chapter 1. Another point concerns the different levels of the "unsaid" such as presupposition, background, implicatures etc. There are subtle differences between these notions and it seems that a sentence contributes much more to a discourse than its foreground and its background. And finally, the developed semantic representation of information structure should be related to the phonological representation of intonation. This was the initial motivation for this investigation. The next chapter presents some remarks about building a relation between the two representational levels.

Chapter 7

New vistas of the intonational lexicon

In the course of this study, two lines of presentation were followed: on the one hand, I described the development of intonational phonology from the "impressionistic" description of the contour to the autosegmental approach, which assumes an abstract tune consisting of abstract tones. On the other hand, I discussed theories of information structure and semantic approaches to focus. I showed that information structure is best understood as part of a semantic discourse representation theory. The natural point where the intonation and the information structure meet is the lexicon, in particular the intonational lexicon. The term *intonational lexicon* is ascribed to Liberman (1975): "Liberman 1975 proposes that intonation is organized into a 'lexicon' of 'intonational words'. He compares the mode of meaning of these words to 'ideophonic' effects in language, especially as seen in languages (like Korean and Bahnar, which he cites) which have recognizable ideophonic components to their segmental lexicon. He notes (142) that

the meanings of these [ideophonic] words are extremely abstract properties, which pick out classes of situations related in some intuitively reasonable, but highly metaphorical way: the general 'meaning' seems hopelessly vague and difficult to pin down, yet the application to a particular usage is vivid, effective, and often very exact.

He then suggests that English intonational meaning should also be viewed in just this way. That is, the elusive effects of intonation can be explained by assuming that each contrasting contour has an abstract context-free element of meaning, which produces specific nuances in specific contexts." (Ladd 1980, 201)

I do not comment on Liberman's view that contours are like ideophonic words, but stress the consequences of his proposal to assume an intonational lexicon.¹ First of all

¹ Liberman's original notion of an intonational lexicon, i.e. a place where intonational features like tunes and tones are listed, contains two important elements (cf. Ladd 1980, 202):

(i) Intonation is not assigned to utterances by rules of syntax, but represents an independent lexical choice from an intonational lexicon; in context, the general meaning of the intonation contour interacts with the other meanings in the sentence to produce specific nuances.

(ii) The mode of meaning of intonation is like that of 'ideophonic' segmental words.

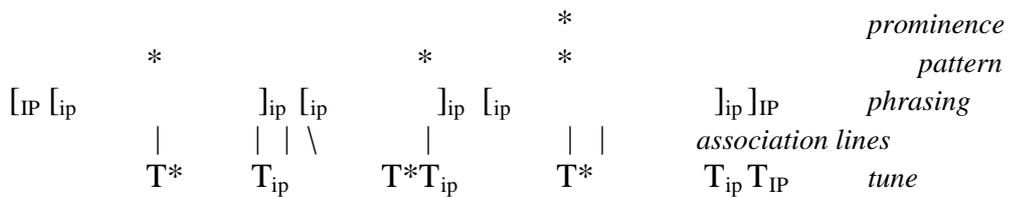
The particular formulation of Liberman assumes that the meanings assigned to the intonational features are "ideophonic" and iconic. Following Ladd (1980, 285ff), a morphemic nature of the intonational features is assumed.

it was revolutionary to propose an intonational *lexicon* in light of the definition of intonational features as *post-lexical*. The second astonishing point was the proposal that the intonational meaning is context-free and independent of the structure of the text. Liberman's concept of an intonational lexicon has proved very productive in intonational phonology, even though there has been no full-fledged account to describe such a lexicon. What makes Liberman's notion so productive are the necessary components of an intonational lexicon and their relations to each other. The lexicon not only lists the intonational units, it must also account for their combinatory possibilities. Furthermore the lexicon has to specify the kind of functions that are assigned to the intonational units, and finally the particular relation between the intonational morphemes and their functions must be accounted for, in particular with respect to the compositionality of the functions. I will discuss the following components of the lexicon:

- (i) the morphemes of the intonational lexicon
- (ii) rules of combination and composition
- (iii) semantic objects relating to the morphemes
- (iv) the particular relation between intonational morphemes and their function

Before these features are reviewed in the next section, I present two main results of the discussion in the preceding chapters. In chapter (2), I presented the development of the phonological approach to intonation which led to autosegmental intonational phonology, which describes three independent subsystems of intonational patterns, tune, prominence, and phrasing, at abstract levels of representation, which are linked by association lines, as illustrated in (1):

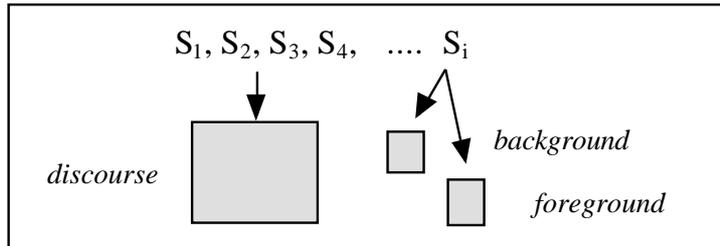
(1) Overall schema of the intonational subsystems



In chapters 3-5, I discussed semantic theories of information structure, and in chapter 6, I developed a new kind of semantics for information structure. The main assumption is that a sentence makes (at least) two contributions to the context: one contribution indicates the discourse anchoring of the sentence and the other indicates the propositional content. These contributions are represented as background and foreground, respectively. In constructing a discourse representation we deal with three representational objects while analyzing the sentence, as in (2): the representation of

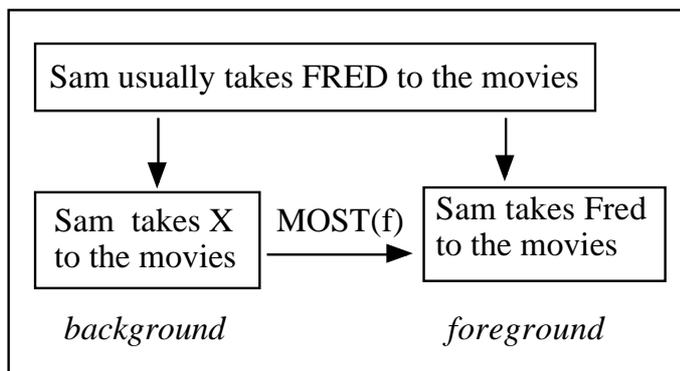
the established discourse, the representation of the background, and the representation of the foreground. These three objects are linked in various ways (see section 6.2).

(2) DRSs for the discourse, foreground, and background



These representations not only interact with objects in the discourse, they also serve directly or indirectly as arguments for operators in the sentence. For example, adverbs of quantification like *usually* take the background and foreground as their arguments, or alternatively they quantify over functions f from the background onto the foreground as informally illustrated in (3).

(3) Foreground-background representation for focus



In the remainder of this chapter I discuss these phonological and semantic structures and relate them to each other.

7.1 Intonational morphemes

The development of intonational phonology started with the definition of intonation as a linguistic research domain and the "phonemicizing" of the features involved. The assumption that intonation expresses a function or a meaning is one of the basic methodological fundamentals of this research tradition. The distinction between a linguistic and a paralinguistic or non-linguistic meaning was essential to establish the proper domain of intonational data. And the contrast in meaning between minimal pairs defined the smallest units of the intonational systems. For example, Pike (1945) ascribes an 'intonational meaning' to each contour, Trager & Smith (1951) view

contours as intonation morphemes, Bolinger (1958) describes accents as morphemes and accounts for the general meaning or function of each of the accents, etc. The approaches differ in whether they assume morphemic status for the whole contour or morphemic status for the parts of the contour. In the course of this study, different characterizations have been presented.

For example Gibbon (1998, 88) accounts for the "meaning" of the final boundary tone of the intonational phrase as follows (see section 2.5.2):

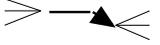
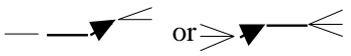
(4) Relations between sentence type, tone and speech act in German

Sentence Type (Mood)	Tone	Speech Act
Declarative	Fall Rise	Assertion Echo question Uncertain statement
Imperative	Fall Rise	Command Request, plea
Interrogative (auxiliary inversion)	Fall Rise	Peremptory question Neutral question
W-question <i>wer, wie,</i>	Fall Rise	Neutral question Interested or echo question

However, this meaning is highly dependent on the syntactic sentence type, and it is not clear whether it is possible to extract a more abstract meaning for the fall or rise.

Bolinger assigns particular meanings or functions to the pitch accents in the contour, while Gussenhoven defines the meaning of his pitch accents as indicating different ways of contribution to the background, as discussed in section 2.5.5:

(5) Meaning of configurational pitch accents (Bolinger 1958)

	configuration	description	function
A		down from	assertive
B		up to (or from)	'connectedness', 'incompleteness'
C		down to the accented syllable	anti-assertive

(6) Function of pitch accents (Gussenhoven 1984)

		description	function
1	fall	HL	addition
2	fall-rise	HLH	selection
3	rise	LH	testing

Pierrehumbert & Hirschberg (1990, 289-302) attempt to capture the meaning of pitch accents, following earlier studies of Bolinger and others. Here the pitch accent roughly indicates the referential or discourse status of the item associated with the linguistic expression with the pitch accent with respect to a psychological discourse model of the belief of the discourse participants (see section 2.5.5):

(7) Function of pitch accents (Pierrehumbert & Hirschberg 1990, 289-302)

pitch	<i>discourse function</i>	<i>typical environment, or e.g.</i>
H*	items are new	neutral declarative intonation
L*	items are not to be instantiated in the open expression	yes-no questions and others
L+H	convey the salience of some <i>scale</i> linking the accented item to other salient items	L*+H L H%: uncertainty L+H* L H%: correction
H+L	instantiations of the accented items should be inferrable	H*+L L L% "teaching" H+L* H L%: confirming a reaction previously recognized

The function of the pitch accents described in (7) must be embedded in and related to the function of the boundary tones and phrase tones. Pierrehumbert & Hirschberg (1990, 308) summarize the different functions:

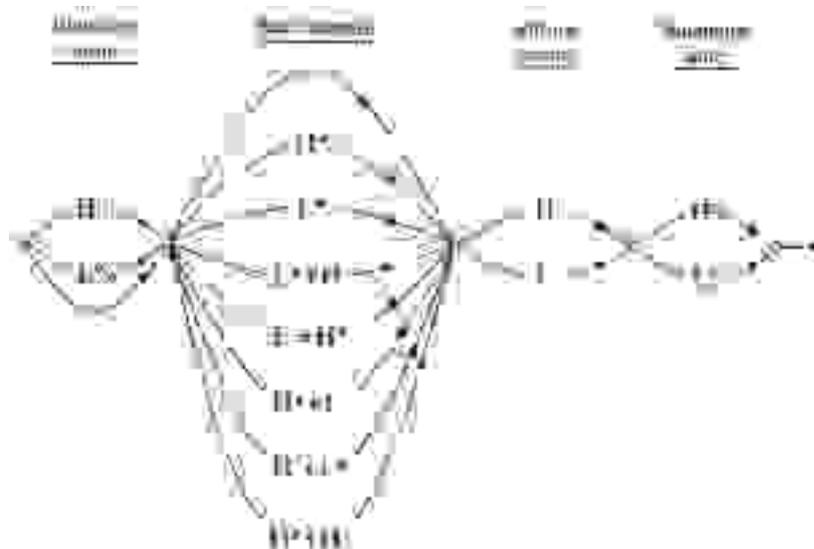
Pitch accents convey information about the status of discourse referents (...). Phrase accents convey information about the relatedness of intermediate phrases (...). Boundary tones convey information about the directionality of interpretation for the current intonational phrase (...). So, not only do different features of an intonational phrase convey different aspects of its meaning, but the meaning conveyed by each feature has scope over a different phonological domain.

However, it is not clear whether these different functions combine and if so how. While the intonational features all belong to one abstract tune, their functions seem to be related to different domains. This observation raises the next point: compositionality.

7.2 Compositionality

Pierrehumbert (1980) represents an intonational contour by a tune consisting of abstract tones (8), which are generated by a finite state grammar (9) that combines the tones listed into legal tunes:

- (8) *Phonological tones* (Pierrehumbert 1980)
- (i) Each phrase requires at least one *pitch accent* (for English: H^* , L^* , or bitonal as H^*+L , $H+L^*$, L^*+H , $L+H^*$, and H^*+H)
 - (ii) Each phrase receives a *phrase accent* (H^- , L^-) at the end of the word that is associated with the last pitch accent
 - (iii) Each phrase ends with a *boundary tone* ($H\%$, $L\%$)
- (9) The finite state grammar of Pierrehumbert (1980)



This grammar accounts for the legal tune and therefore describes the possible composition of tones to tunes. However, Pierrehumbert (1980) does not account for the relations between the elements in the tune. To show the relevance of this point, consider the syntactic expansion rule $S \rightarrow NP VP$ which licenses the well-formed syntactic configuration. The syntactic rule is interpreted on the semantic side as functional application of the VP to the NP (or for quantifier phrases: of the NP to the VP). The important point is that the syntactic configuration has a clear functional correlate. The question is whether there is such a functional correlate for the tune, and if there is how can we describe its nature.

There have been different suggestions how to interpret the relation between the elements of the tune: (i) The most classical description is in terms of phonological words, a tradition going back to Liberman's view of the contour as 'ideophonic word'. (ii) Steedman describes the pitch accent as functions that require an argument in order to yield a tune. His approach reflects the reconstruction of linguistic configurations in

categorial grammar. (iii) Pierrehumbert & Hirschberg (1990) propose that the different tones have independent functions ranging over different domains. They claim that the tune expresses some compositional meaning, however they do not show how to link the different functions to one composition.

(i) *The tune describing an ideophonic word*

Hayes & Lahiri (1991) execute the program of the intonational lexicon proposed by Liberman (1975) in the most comprehensive way. They account for the different tunes in Bengali and decompose the tunes into intonational *stems*, *suffixes* and *prefixes* (they use *I* for intonational phrase and *P* for phonological or intermediate phrase (ip)):

(10) The intonational lexicon of Bengali Hayes & Lahiri (1991)

a	Accents ("stems"):	L*	question	accent	
		H*	declarative	accent	
		L*H _P	focus	accent	
b	Boundary Tones ("suffixes"):	L _I	neutral		
		L _I H _I	continuation	rise	
		H _I	offering		
		H _I L _I	yes/no		
c	Prefix:	L+	finality marker		
			(forms L+H*	when	
			attached to H*)		

These tones combine to the following tunes, assuming that there are three pitch accents, and optional T_P and one obligatory T_I (Hayes & Lahiri 1991, 72):

(11) Possible tunes in Bengali

L*H _I	Offering
L*H _I L _I	Yes/ne question
L*H _P H _I	Focus
L*H _P L _I H _I	Focus with continuation rise
H*L _I	Declarative
H*L _I H _I	Declarative with continuation rise
L+H*L _I	Downstep
L+H*L _I H _I	Downstep with continuation rise

Hayes & Lahiri (1991, 77) do not account for the way these morphemes combine, they informally state: "These morphemes combine fairly freely, (...). We believe that further decomposition of the contours, especially the boundary tone sequences, may be possible, but to do this will require a better understanding of their meanings." From their remarks one can infer that they assume a kind of semantic operation of

conjunction: the declarative accent H^* plus the neutral boundary tone L_1 yields a declarative statement, etc.

This view is influenced by the phonological tradition of analyzing units like the syllable or the phonological word, which consist of one prominent part and other more or less important parts. Here, the pitch accent constitutes the central part and the boundary tones additional affixes. However, morphological composition is already difficult to describe and there is no general agreement on the description of the relation between affixes and stems in lexical semantics. I therefore doubt whether the comparison of the tune with a phonological word contributes to the understanding of the composition of the functions expressed by particular tone.

(ii) *Tune representing the functional contribution to the utterance*

Steedman executes Halliday's thematic structure in terms of combinatory categorial grammar (CCG). This can be illustrated with the following example which receives the thematic structure in *theme-rheme*. Both thematic units are further divided into given material and new material; the latter is associated with the pitch accent.

(12) Q: I know that Mary's FIRST degree is in PHYSICS.
But what is the subject of her DOCTORATE?

A: (Mary's DOCTORATE) (is in CHEMISTRY)
L+H*LH% H* LL%
Given New Given New
Theme Rheme

The basic units are the new expression, the theme and the utterance. All other parts are defined with respect to these basic elements. For example, the rheme is a function that takes the theme as argument yielding the utterance (this is of course, the instantiation of the subject-predicate structure in terms of functional application).

Steedman now defines the function of the pitch accent $L+H^*$ as theme that misses a boundary tone, i.e. as a function that needs a boundary tone to yield a theme. Analogously, the pitch accent H^* indicates a function that needs a boundary tone in order to yield a rheme. Thus in the description of tones, Steedman assumes the boundary tones and the whole tune as the primary units.

(13) Categorical functions of tones (Steedman 1991)

LH%	boundary tone	simple argument
LL%	boundary tone	simple argument
L+H*	pitch accent	function from boundary tone into theme
H*	pitch accent	function from boundary tones into rheme
L+H*LH%	contour	simple argument: theme
H* LL%	contour	function from themes into utterance.

Thus Steedman accounts for the composition of the tune in an elegant way. However, he essentially uses the terms *theme* and *rheme* as well as *given* and *new*. As long as

these concepts are not explicitly defined a full evaluation of this approach does not seem possible. In the course of this study it was shown that both pairs are not easily definable, in particular I argued that the dichotomy of the sentence in *theme* and *rheme* is linguistically not adequate. Moreover, I motivated the definition of *given* in terms of construction of discourse representations rather than as semantic markers, rather than in terms of their contribution to (the propositional content of) the utterance.

(iii) *Tones representing different discourse functions*

Pierrehumbert & Hirschberg (1990) give a list of functions of pitch accents (see (7) above) and boundary tones. The latter indicate whether the phrase to which the boundary tone is associated should be interpreted with respect to the preceding discourse or to the following discourse. Pierrehumbert & Hirschberg (1990, 304) illustrate this point on the following contrast between (14) and (15). The low boundary tone L% in (14) indicates that this sentence is related to the discourse by its own, while the high boundary tone H% in (15a) indicates that it is to be interpreted with respect to the following sentence. This difference influences the choice of the antecedent of the pronoun *it*: In (14) it refers to the following proposition *I spent two hours figuring out how to use the jack*, while in (15) it refers back to the *new car manual*

- (14) a My new car manual is almost unreadable
L L%
 b It's quite annoying
L H%
 c I spent two hours figuring out how to use the jack
L L%
- (15) a My new car manual is almost unreadable
L H%
 b It's quite annoying
L L%
 c I spent two hours figuring out how to use the jack
L L%

Pierrehumbert & Hirschberg (1990, 308) summarize their view of the composition of tones and their meanings:

In this paper we have presented the beginning of a compositional theory of the meaning of intonational contours. We propose that S chooses an intonational contour to convey relationships between (the propositional content of) the current utterance and previous and subsequent utterances—and between (the propositional content of) the current utterance and beliefs H believes to be mutually held. These relationships are conveyed compositionally via selection of pitch accent, phrase accent, and boundary tone.

Unfortunately, Pierrehumbert & Hirschberg construct their discourse model in terms of psychological modeling or in terms of structuring the content of beliefs. It is not clear what the structure of beliefs is and whether beliefs are linguistic objects or not. The principle approach to intonational function is appealing and it might give interesting insights for processing issues or for psychological models, however, it is not clear whether such a model is intended for linguistic theory. If it were then the basic linguistic elements of this model must be described before one can apply it.

To sum up, Hayes & Lahiri (1991) propose a compositional model that reflects the structure of morphemes in words. The meaning of the single morphemes are *added* to yield the meaning of the contour. Steedman (1991) describes the meaning of the tone in functional terms. Starting from the boundary tone and the utterance as primary units, all other elements are described as functions that ultimately contribute to the utterance. Pierrehumbert & Hirschberg account for quite different functions of tones but they fail to account for compositional principles combining these functions. It seems that the combinatory mechanism can only be described in a linguistic model of discourse.

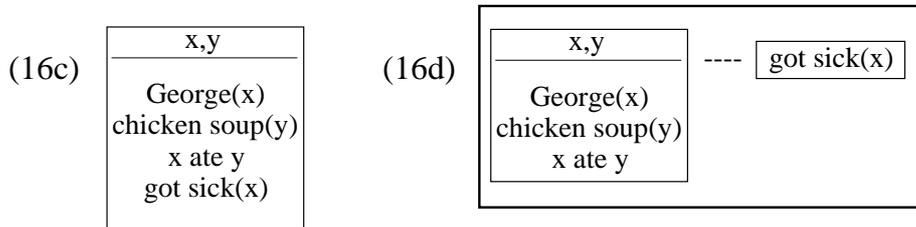
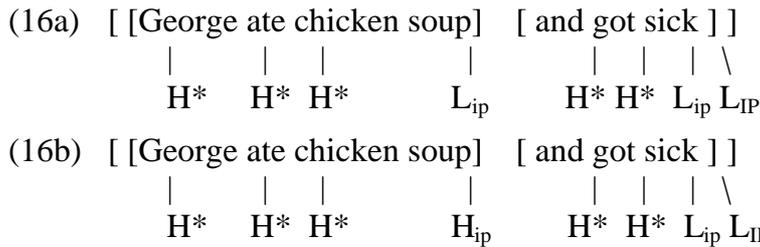
7.3 The semantic background

In contrast to the three approaches to intonational meaning presented in the last chapter, I claim that intonational features determine the construction of discourse representational structures, like the background.

In chapter 6, I gave a sketch of a discourse semantics which comprises different discourse relations and several phenomena that are traditionally ascribed to information structure. The foreground-background semantics accounts for notions like the focus-background structure as well as association with focus. The foreground-background semantics is an extended DRT: besides the ordinary representation there is an additional background representation which contains designated variables that replace focused material.

During the presentation of this foreground-background semantics the general picture was evolving: A sentence makes (at least) two contributions to the context: (i) the proposition expressed in the sentence, and (ii) its relation to the established discourse. The former is represented in the foreground and the latter in the background. In section 6.3 it was argued that the focused constituent is substituted by a designated variable in the background. Thus the function of pitch accent can be described as the construction rule to supply the background representation with a designated variable instead of the focused expression. The function of the boundary tones can informally be captured as follows: a boundary tone indicates a break in the construction of the DRS and thus provides particular representations, which can be used to express discourse relations or which can be used as arguments for semantic operators.

To illustrate this point, compare (16a) with (16b). Both sentences express the proposition that it was the case that George ate chicken soup and that it was the case that he got sick. The DRS corresponding to this is (16c). The DRS (16d) represents the two intermediate phrases as two separate temporary DRSs, which allow the establishment of additional discourse relations.



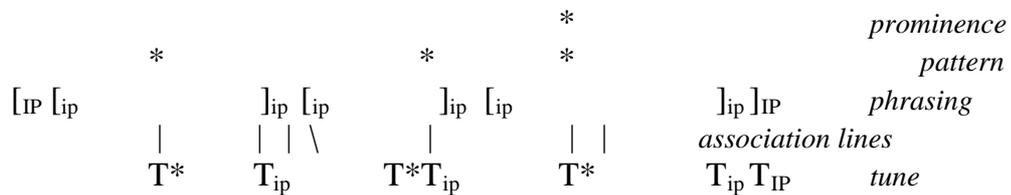
Besides this function of introducing additional temporary structure in the discourse representation, the boundary tones can also indicate the way in which these structures are related. In general, the high boundary tone allows the addition of the structure to the already established discourse, while the low tone seems to indicate that the DRS is not ready to be integrated into or evaluated with respect to the established discourse. First additional material is to come before the structure is (partly) completed and can interact with other parts of the discourse representations. The boundary tone of the intonational phrase functions in the same way: it indicates the termination of one DRS and that it can be related to other DRSs in terms of discourse relations.

Thus the semantic correlates for the intonational features are the construction rules of discourse representations (DRSs). The function of intonational features are reflected in the particular DRSs and their parts, such as designated variables or discourse anchoring.

7.4 The intonational link: an outlook

The different subsystems of intonational patterns contribute in different ways to the construction of the DRSs. Intermediate boundary tones indicate a potential stop of the construction of a DRS and the possibility to use this temporary object for interaction with other objects in the representation. Often these intermediate representations do not interact with the discourse structure, but in certain cases the DRSs of intermediate phrases serve as objects for semantic operators. The intonational phrase boundary indicates that the discourse representation can be related to other discourse objects at a higher level than the intermediate phrase. Finally, prominence patterns – reflected in pitch accents – introduce variables into the background representation. One of the main function of the background representation is to mark the sentence material that is already anchored, i.e., given, in the discourse, as illustrated in (18). The general relation between the intonational structure and the discourse structure in its "information aspect" is illustrated by (17) and (18).

(17) Overall schema of the intonational subsystems



(18) Overall schema of the discourse construction

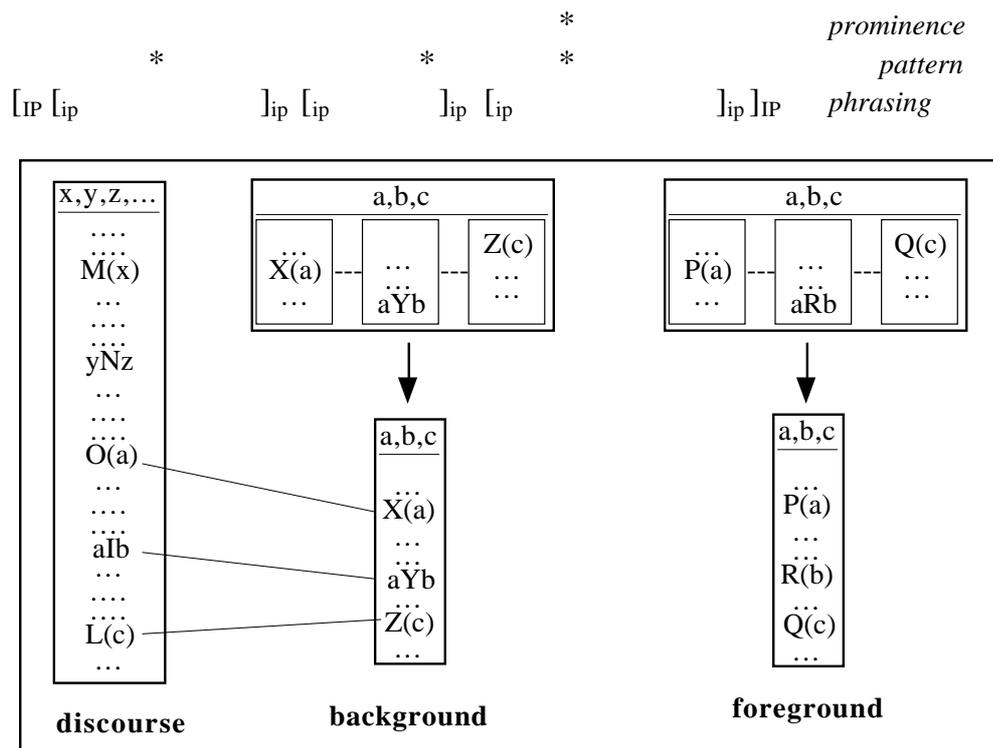


Diagram (18) schematically demonstrates the construction process of the background and foreground. This process has different steps: as illustrated on top of the diagram, intermediate phrases can mark temporary DRSs which are later merged to one large foreground and one large background DRS. At that early stage of smaller units, these small DRSs can serve as the domain for semantic and discourse operators. For example, they can establish discourse relations like *causation* or *continuation*. The second step yields one representation for the background and foreground each. At this construction step, relations between the foreground, the background and the discourse representation can be operative. For example, focus-particles like *only* translate into operators that take a background and a foreground as their arguments.

The consequences of a theory along these lines posit a challenge to lexical theory, intonational phonology, and semantics:

The lexical theory has to account for the entry of intonational features, such as tones and tunes, and the meaning that is associated with them. Like the meaning of anaphoric pronouns, the abstract meaning of tones makes reference to the construction algorithm. This means that the lexicon must be able to integrate a type of meaning that is related to discourse construction, rather than to word meaning or the propositional content of a sentence. The analysis of such a meaning will open a new view on the information stored in the lexicon and on the interaction of lexical meaning with other grammatical structure.

The challenge for intonational theory concerns the definition and categorization of tones and their functions. Given the discourse model discussed so far and the range of possible functions in this model, tones and tunes can be assigned functions that are related to the construction of the discourse representation. Being so, the widely held view that intonational features express to speech acts, propositional attitudes, or beliefs on belief states of the hearer must be re-evaluated.

The concept of a foreground-background semantics posits a challenge for semantic theory because the foreground-background semantics tries to integrate a wide range of phenomena. Discourse effects, such as information focus or discourse anchoring, could be accounted for by using the concept of background. On the other hand, the background played an essential role for the definition of discourse operators. Foreground-background semantics intends to span this wide field of semantics phenomena while assuming that there is only one semantic theory. This of course has further consequence for the general architecture of grammar.

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