

Information Structure and the Partition of Sentence Meaning*

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1. Introduction

The article argues for a different perspective on information structure. Traditionally, information structure is modeled by a partition of the ordinary meaning in two parts. In contrast to this, I argue for a semantics in which one representation corresponds to the meaning expressed in the sentence and the other representation to the background meaning. Besides the grammatical subject-predicate distinction, theories of information structure assume an additional partition of the sentence in (at least) two parts: an information unit, often called "focus", corresponding to the focused phrase, and a complementary unit which corresponds to the remainder of the sentence, often called "background". The informational partition of the sentence 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 (or syntactic) prominence of the focused phrase. In these theories, the ordinary meaning of the whole sentence must be composed of the two informational units in a subject-predicate manner. The additional background or presuppositional information is derived from the background unit, and focus-sensitive operators are translated into quantifiers that range over alternatives (or p-sets) that are generated by the focused phrase. I discuss three problems of this view: (i) The ordinary meaning of a sentence is only indirectly derived from the two informational units. (ii) The meaning of the focused expression receives a too important position with respect to the meanings of the other expressions. (iii) There is no satisfactory account for the analysis of more complex focus phrases, such as focused definite NPs.

I propose a different information structure, which consists of two parallel informational units: a foreground representation, and a background representation. The foreground represents the meanings of all expressions in the sentence, while the background represents all expressions but the focused ones, which are replaced by designated variables. The background comprises all those expressions that are discourse-anchored, i.e. which are previously mentioned in the discourse. Thus the two informational units foreground and background correspond to the sentence meaning and discourse meaning, respectively. The focus indicates the "difference" between these two units, rather than an independent unit. The high informativeness of the focus follows from this architecture, and the approach accounts for the discussed problems: (i) The ordinary meaning of a sentence corresponds directly to the foreground. (ii) The focused expression merely indicates the difference between both informational units. (iii) Focus-

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sensitive operators are translated into quantifiers that range over functions from the background into the foreground, accounting for more complex focused phrases such as definite NPs.

The paper is structured as follows: In section 2, I discuss the early models of information structure. In the course of the presentation of these theories, I try to make several implicit assumptions explicit. In particular, most approaches rely on the following two descriptively attractive, but poorly defined notions: (i) the "Aristotelian" subject-predicate structure, and (ii) the dichotomy of *figure-ground* from Gestalt theory, a theory of psychology. Section 3 presents classical models of information structure, which assume the communicative basis of this structure. The Prague School transformed the early models into linguistic theories, which then were adapted by the American structuralistic schools. Section 4 discusses semantic approaches to information structure by the example of Alternative Semantics, one of the most advanced theory of focus and background structure. However, it will be shown that even this theory has severe problems in analyzing complex expressions such as definite NPs. Section 5 gives a general perspective on the foreground-background semantics developed in this paper. The foreground represents the meaning expressed in a sentence, while the background comprises the discourse meaning expressed by that sentence. The section ends with a summary and potential directions for further research.

2. The background of information structure

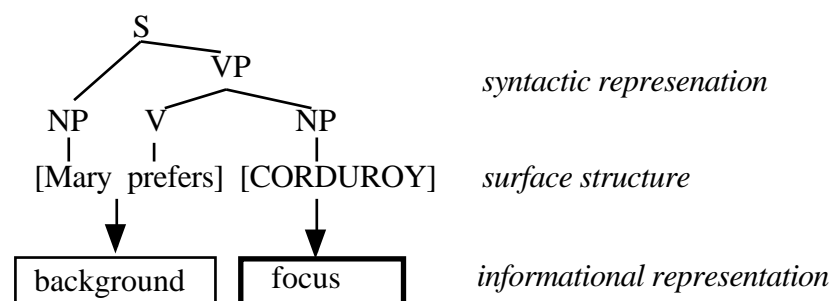
The informational dichotomy of the sentence has received different terms as listed in table (1):

(1) Terminology for the informational dichotomy

notion	used by
<i>psychological subject - psychological predicate theme - rheme</i>	von der Gabelentz (1869), Paul (1880) Ammann (1928): <i>Thema - Rhema</i> , Mathesius (1929), Prague School: Firbas (1964) Daneš (1970), American structuralistic Tradition: Halliday (1967)
<i>topic - comment topic - focus</i>	von der Gabelentz (1869), Reinhart (1982) modern Prague School: Sgall & Hajičová & Benešová (1973)
<i>presupposition - focus background - focus old/given - new already activated - newly activated</i>	Chomsky (1971), Jackendoff (1972) Chafe (1976) for contrastive focus, Jacobs (1982) Halliday (1967), Chafe (1976) Chafe (1976)
<i>open proposition - focus notional subject - notional predicate</i>	Prince (1981) É. Kiss (1995)

The primary function of this structure is understood as inducing a partition of the sentence into two informational units, which are independent of – and sometimes even orthogonal to – the grammatical subject-predicate organization, as illustrated in (2):¹

(2) Grammatical and information structure



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 terms *theme - rheme* and later *topic - comment*, which are both borrowed from traditional rhetoric and philology. Chomsky (1971) employs *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. This very idea of the dichotomy was transmitted unnoticed from the psychological tradition of linguistics to the anti-psychological one, which has based linguistic functions on informational concepts. All these approaches have in common that the information structure is defined with in terms of a subject-predicate structure of a sentence: The two informational units can be reunited to a complete sentence in an "extra-grammatical" subject-predicate manner. However, it were the problems of the grammatical subject-predicate structure of the sentence that had motivated the additional information structure.

2.1 The logic of the 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 not only arises in the attempt to define the concepts at one level, but more often it 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.²

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

¹ The example is discussed in Steedman (1991), who proposes a more flexible syntax (Combinatory Categorical Grammar) in order to align the syntactic structure to the informational one.

² The presentation of the subject-predicate structure in these four fields are motivated by the lexicon article of Garver (1967).

often associated with the noun and the verb in a simple sentence. Typological research has shown that subject and predicate are not universal categories; so some linguists have proposed to replace this contrast by the contrast between *topic* and *comment*. 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 of a sentence, 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.

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. In the sentence *Bill was hit by John* the context has to decide which is the epistemological subject.⁴ More complex sentences, in which a relation between two or more objects is described, cause other problems for the epistemological view of the sentence structure. In other words, the epistemological view is as context dependent in its determination as the use of topic in linguistic theory.

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 modern terminology) 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 form of the copula, e.g. *some...is*, *all ... are*, etc.

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

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 Depending on the intonation of the spoken sentence *Bill was hit by John* certain preferences can be indicated.

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):

- | | | |
|------|---------------------------------|---|
| (4a) | Socrates walks. | Walk(socrates) |
| (4b) | Every Athenian hates some king. | $x [A(x) \quad y [K(y) \ \& \ H(x,y)]]$ |

In this way, Frege solved (i) the problem of negation, (ii) the representation of sentences with singular terms, and (iii) with multiple quantification. The copula does not receive any semantic content but is understood as a surface form of flexion. In order to define the relations expressed in a sentence, he introduces new formal expressions. Frege (1879, vii) explicitly argues for the replacement of the terms *subject* and *predicate* by *argument* and *function*, respectively:⁵

Insbesondere glaube ich, daß die Ersetzung der Begriffe *Subject* und *Prädicat* durch *Argument* und *Function* sich auf die Dauer bewähren wird. Man erkennt leicht, wie die Auffassung eines Inhalts als *Function* eines *Argumentes* begriffsbildend wirkt. Es möchte ferner der Nachweis des Zusammenhanges zwischen den Bedeutungen der Wörter: *wenn, und, nicht, oder, es giebt, einige, alle* u.s.w. Beachtung verdienen.

The *metaphysical* (i.e. ontological) distinction between subject and predicate is closely correlated to the substance-attribute distinction, which has caused major disputes in philosophy. In particular, it is controversial whether subjects and predicates are related to ontologically different kinds of objects, or whether they can be assumed to be of a similar nature. For example, Plato gives ontological prominence to predicates, since they never change, while subjects easily change. Aristotle, however, gave ontological standing to both subjects and predicates.

Frege accepted the subject-predicate dualism as a basis for his metaphysics, which he built in parallel to his logic. As already mentioned, he replaces the traditional notion of subject and predicate by argument and function. The argument is defined as complete or saturated object, while the predicate is an unsaturated item, or what Frege called a *function*, representing a concept. Together they form a sentence, another kind of saturated item.

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

⁵ Van Heijenoort gives the following English translation of Frege ([1879] 1967, 7): "In particular, I believe that the replacement of the concepts *subject* and *predicate* by *argument* and *function*, respectively, will stand the test of time. It is easy to see how regarding a content as a function of an argument leads to the formation of concepts. Furthermore, the demonstration of the connection between the meanings of the words *if, and, not, or, there is, some, all*, and so forth, deserve attention."

It was only Frege's definition of the sentence structure as function-argument structure that provides the basic 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.

2.2 Hermann Paul and psychologism

During the course of the 19th century, psychology became the epistemological foundation 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] 1920, 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] 1920, ch. 15-16) introduces most of the relevant aspects of the relation between the psychological subject-predicate structure and the grammatical subject-predicate structure, of which I only will mention the following three (for a more detailed discussion see von Heusinger 1999, sect. 3.1.2):

- (6) 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 a criterion for thematicity

(i) The psychological fundaments of linguistics

The terms *psychological subject* and *psychological predicate* were introduced by von der Gabelentz (1869), who compared the sequence of thoughts or psychological concepts with the sequence of linguistic expressions in a sentence.⁶ He distinguished two levels: the grammatical level and the psychological level of composition, and defines the psychological subject as "that about which the hearer should think", and the psychological predicate as "that what he should think about it". This is one of the first formulation of the "aboutness-aspect" of information structure in a sentence. 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] 1920, 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 ([1880] 1920, 124) is that the sentence is divided into (at least) two parts. He 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 *predicate*. These grammatical categories are based on a psychological relation. We have to distinguish between psychological subject and predicate, and grammatical subject and predicate because they do not always coincide. However, 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 aufgebaut.

(iii) The question test as criterion for thematicity

The clearest test for the psychological predicate is the constituent question. Paul ([1880] 1920, 283) 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? | "Where does Karl go tomorrow?" |
| | Karl fährt morgen nach BERLIN. | |

⁶ 30: A similar distinction had previously been suggested by Weil ([1844] 1978, 30): "Syntax relates to the exterior, to things; the succession of the words relates to the speaking subject, to the mind of man."

- | | | |
|------|---|-----------------------------------|
| (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 or with the discourse anchoring.

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 the presentation in this section, 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 linguistically not well defined.

2.3 The communicative shift

At the beginning of the 20th century, the interest in the communicative (or social) function of language 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.⁷ 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.

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.

⁷ 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."

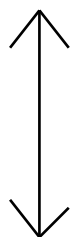
Ammann and others have recognized that the sentence is organized not only by syntactic structure, but also by other principles. However, they were unable to locate this organizational level in linguistic theory proper. Instead they referred to other fields like psychology and information theory. One 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.

2.4 Gestalt theory: The concept of figure and ground

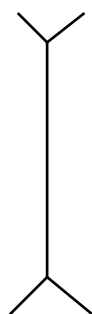
In the course of the 19th century, the syntactic definition of the sentence became more elaborate. At the same time it became obvious that the syntactic description does not cover all aspects of sentence meaning. Differences in the presentation of the sentence content were attributed to an underlying 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 (8) and (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.

(8)



(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. 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:⁸

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 Information structure in structuralism

3.1 The Prague School

At the end of the 19th 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

⁸ The concept or the metaphor of *figure-ground* is very pervasive in several disciplines such as linguistics and philosophy, e.g.: 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: "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." And finally Caffi (1997, 437) employs this notion to illuminate the structure of presupposition: "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."

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 structuralistic 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.⁹

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*.

Daneš (e.g. 1970) extends the thematic relation of the sentence to one of a text, and the newer Prague School (e.g. 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 (1967) who introduced the Praguian distinction of theme and rheme into American structuralistic linguistics. Here, only two aspects should be touched upon: (i) the two sides of information structure, the sentence internal aspect and the textual aspect; and (ii) 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"; these terms correspond to the "aboutness-aspect" and the "discourse anchoring" of a given sentence, respectively.

- (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.

⁹ 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."

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 describes 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

...

3.2 Halliday and the American structuralists

While the Praguean approach locates the information structure in the syntax-semantics interface, Halliday postulates an independent linguistic level for information structure corresponding to certain intonational phenomena. He is in fact the first who uses the term *informationstructure* 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 (1967, 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.

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*), while the latter aspect is treated under the title *givenness*. The thematic structure organizes the linear ordering of the informational units, which is borrowed from the Praguean *theme - rheme* (also: *topic - comment*, or: *topic - focus*) and which 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 (1967, 212) 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 *rheme* for the following: "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 (1967, 202) describes the second aspect as referring 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 points of information focus which indicates what new

information is being contributed." He 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 (1967, 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//

Halliday (1967, 202) states that 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."

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 (1967, 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" as illustrated in (13); or (ii) new information is "contrary to some predicted or stated alternative" as illustrated in (14); or (iii) new is what is "replacing the WH-element in a presupposed question" as illustrated in (15):

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

These three characterizations of *new* lead to three different characterizations of focus, as listed in (16):

- (16) Three kinds of focus
 (i) informative in assertion/addition
 (ii) contrastive in assertion/contradiction

- (iii) focus-question in question/answer pairs

Despite the general assumption of a focus-background structure, there is no straightforward definition or characterization of focus. It rather seems that the concept of "focus" comprises several quite distinct categories, and it is unclear whether there is one common feature save the definition that focus is that what is not background. Therefore, Halliday comes to the conclusion that it seems more plausible to find a definition of *given* than a coherent one for *focus*. He relates givenness to "anaphorically recoverability". Halliday's approach to focus as being the remnant of background paves the way for the view defended in this paper that focus is no independent information unit, but the difference between sentence meaning and discourse meaning expressed in that sentence (see section 5).

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.

3.3 Information packaging

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.

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 resembles the definition of *psychological structuring* of von der Gabelentz (see above). 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."

Prince (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 (17) introduces *John* as a topic and focuses on the object that John drinks. The predicate *drink* is both part of the comment and part of the background in (18). Vallduví (1990, 55) proposes the structure (19) corresponding to his information structure in (20). 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*.

(17) What does John drink?

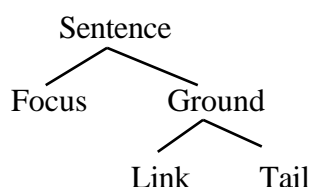
(18) Topic-comment and focus-background structure

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

(19) Information packaging (Vallduví)

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

(20) Information structure as focus-link-tail



Like Chafe and Prince, Vallduví describes the situation very informally: He uses, for example, Heim's metaphor of file cards, but he does not attempt to give a semantic analysis of the phenomena presented. 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.

3.4 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), while presupposition is defined as those inferences that are constant under negation.

In a first approach Chomsky explains the focus-presupposition dichotomy in the following way. (22) is a reasonable answer to (21a)-(21d), 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 (23) for (22), in which the presupposition *John writes poetry* is the embedded sentence and the focus is part of the matrix predicate *is in the garden*.

- (21a) Does John write poetry in his STUDY?
- (21b) Is it in his STUDY that John writes poetry?
- (21c) John doesn't write poetry in his STUDY.
- (21d) It isn't in his STUDY that John writes poetry
- (22) No, John writes poetry in the GARDEN.
- (23) [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 "determine 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, (22) is a proper answer to (21a) 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.

4. The semantics of information structure

Most theories of information structure discussed above assume an independent level of organization of the sentence. Some approaches even state that information structure must be different from semantics 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, see section 3.3). Consequently, these approaches tend to employ other fields like psychology or communication science 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 etc. 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. 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 focal unit. Focus-background effects are informally illustrated by the following three examples. In the simple assertion (24), 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.

- (24) Sam talked to FRED_F.
 (24a) It is part of the background or of the shared knowledge that Sam talked to someone. There are alternatives to Sam under discussion.

In (25), 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.

- (25) Sam only talked to FRED_F.
 (25a) Nobody but Fred is such that Sam talked to him or her.

- (25b) 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

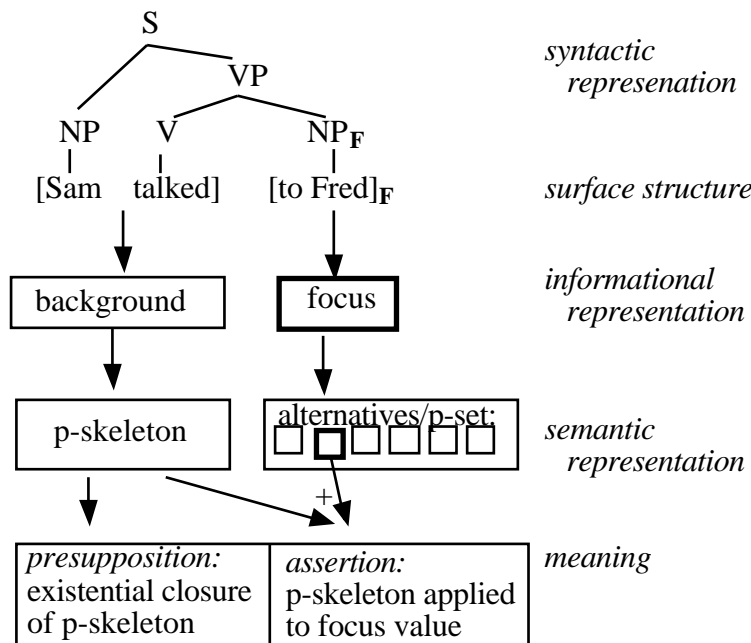
The adverb of quantification in (26) asserts that for most occasions in which Sam invites someone to the movies, it is Fred who is invited. Here, the adverb of quantification is translated into an operator which takes two arguments and compares the two: the set of times when Sam invites someone to the 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 (or more adequately: the number of times t at which Same invites Fred to the movies is greater than the half of the times t at which Same invites someone to the movies). Here, the operator does not quantify over the focus, but the focus indicates how to form the proper domains for the quantifier.

- (26) Sam usually invites $FRED_F$ to the movies.
 (26a) For most times in which Sam invites someone to the movies, he invites Fred to the movies
 (26b) 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 for semantic focus theories can be drawn: The surface structure receives a syntactic representation in terms of constituents plus the focus feature F , and an informational representation, i.e. a partition into background and focus. The focus induces or evokes alternatives in one way or other. The value of the focus, i.e., the ordinary denotation of the focused expression, is part of the set of alternatives, which are also called *p-set*. The background corresponds to a semantic structure that I will call here the *p-skeleton*, following Jackendoff's (1972) *presuppositional skeleton*. The p-skeleton is formed by substituting the focused expressions by appropriate variables.

The p-skeleton, the set of alternatives, and the value of the focus combine in different ways 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. The presupposition in (27) is that Sam talked to someone. Applying the value of p-skeleton to the focus value yields the assertion that Sam talked to Fred, as illustrated in the diagram (27):

(27) Information structure and focus-semantics



The "focus-meaning" of (24) is the felicity condition that Sam could have talked to other individuals in the alternative set induced by the focus on Fred. Thus, the focus in (24) influences the felicity conditions, rather than the truth conditions. However, a sentence with a focus particle exhibits different truth conditions depending on the location of the focus. Focus particles can be translated into quantifiers that operate on the background (p-skeleton), the alternatives and the focus meaning. E.g., the assertion of (25) is that nobody among the relevant alternatives but Fred is such that Sam talked to him.

Semantic theories of focus differ in whether they directly access focus and background, or only one, or none. Direct association with focus or movement (or structured proposition) theories (Jacobs 1983, von Stechow 1991, Krifka 1992) 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. These theories translate the traditional concepts of informational partition into the semantic representation. 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.

4.1 Alternative Semantics

Alternative Semantics distinguishes between two dimensions of meaning, the *ordinary meaning* $\| \cdot \|_O$ and the *alternative meaning* $\| \cdot \|_A$. 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.

Since there are two semantic dimensions, we have to define the compositional interpretation rules for both dimensions. The ordinary interpretation (28a) does not see the focus feature F and, therefore, interprets a focused expression like the unfocused one. The alternative interpretation of a focused expression (28b) creates the set of alternatives. The alternative semantics of an unfocused expression (28c) 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 (28) is instantiated for proper names in (29) and for intransitive verbs in (30):

- (28a) $\| \|_O = \| \|_F \|_O$
 (28b) $\| \|_F \|_A = \text{ALT}(\| \|_O) = D_{\text{type}(\| \|_O)}$
 (28c) $\| \|_A = \{\| \|_O\}$
- (29a) $\|c\|_O = \|c_F\|_O = \mathbf{c}' \quad D_e$
 (29b) $\|c_F\|_A = \text{ALT}(\mathbf{c}') = D_e$
 (29c) $\|c\|_A = \{\mathbf{c}'\}$
- (30a) $\|V\|_O = \mathbf{V}' \quad D_{\langle e, t \rangle}$
 (30b) $\|V_F\|_A = \text{ALT}(\mathbf{V}') = D_{\langle e, t \rangle}$
 (30c) $\|V\|_A = \{\mathbf{V}'\}$

The interpretation of composition rules must be formulated for both ordinary and alternative meanings. For the time being, there is only one composition rule: the application of a predicate to its arguments. The ordinary semantic function of this composition is functional application as in (31). The alternative function of functional application (32) 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.

- (31) $\| \|_O = \| \|_O (\| \|_O)$
 (32) $\| \|_A = \{X(Y) \mid X \in \| \|_A, Y \in \| \|_A\}$

For instance, the application of a predicate to its focused argument is the functional application (33a) of its meaning to the meaning of the argument. The alternative semantics (33b) 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 (33c) 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.

- (33a) $\|V(c_F)\|_O = \mathbf{V}'(\mathbf{c}')$
 (33b) $\|V(c_F)\|_A = \{X(y) \mid X \in \|V\|_A, y \in \|c_F\|_A\}$
 $= \{X(y) \mid X \in \{\mathbf{V}'\}, y \in \text{ALT}(\mathbf{c}')\}$
 (33c) $\|\text{talk to SAM}_F\|_A = \{X(y) \mid X \in \|\text{talk}\|_A, y \in \|\text{SAM}_F\|_A\}$
 $= \{\mathbf{talk}'(y) \mid y \in \text{ALT}(\mathbf{s})\}$

$$= \{d \mid y \mid \mathbf{talk}'(y)(d)\}$$

The definition of the meaning (34) 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 $\|\mathbf{VP}\|_O$ expresses the presupposition, whereas the alternative meaning $\|\mathbf{VP}\|_A$ 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.

$$(34) \quad \|\mathbf{only VP}\|_O = x \left[\|\mathbf{VP}\|_O(x) \ \& \ P \ \|\mathbf{VP}\|_A \ P(x) \quad P = \|\mathbf{VP}\|_O \right]$$

We can now analyze sentence (35). In (35a), 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 $\mathbf{introd}'(s)(j)$, as in (35c). 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 (35d) 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 (35e) 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.

- (35) Mary_{VP}[only_{VP}[introduced Sue_F to John]]
- (35a) $\|\mathbf{Sue}_F\|_O = s$ $\|\mathbf{Sue}_F\|_A = \mathbf{ALT}(s) = D_e$
- (35b) $\|\mathbf{Mary}\|_O = \mathbf{m}$ $\|\mathbf{Mary}\|_A = \{\mathbf{m}\}$
 $\|\mathbf{John}\|_O = \mathbf{j}$ $\|\mathbf{John}\|_A = \{\mathbf{j}\}$
 $\|\mathbf{introduce}\|_O = \mathbf{introd}'$ $\|\mathbf{introduce}\|_A = \{\mathbf{introd}'\}$
- (35c) $\|\mathbf{introduced Sue}_F \text{ to John}\|_O = \mathbf{introd}'(s)(j)$
 $\|\mathbf{introduced Sue}_F \text{ to John}\|_A = \{\mathbf{introd}'(x)(j) \mid x \in \mathbf{ALT}(s)\}$
e.g. $\{\mathbf{introd}'(s)(j), \mathbf{introd}'(a)(j), \mathbf{introd}'(b)(j), \dots\}$
- (35d) $\|\mathbf{only introduced Sue}_F \text{ to John}\|_O = x \left[\mathbf{introd}'(s)(j)(x) \ \& \ P \ \{\mathbf{introd}'(y)(j) \mid y \in \mathbf{ALT}(s)\} \ P(x) \quad P = \mathbf{introd}'(s)(j) \right]$
- (35e) $\|\mathbf{Mary only introduced Sue}_F \text{ to John}\|_O = \mathbf{introd}'(s)(j)(\mathbf{m}) \ \& \ P \ \{\mathbf{introd}'(y)(j) \mid y \in \mathbf{ALT}(s)\} \ P(\mathbf{m}) \quad P = \mathbf{introd}'(s)(j)$

4.2 A problem for focus semantics

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 (36) 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, (36) 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.

Here, we investigate association with focus in definite NPs in order to understand more about the interaction between the semantics of focus and the semantic contribution of NPs with descriptive content as in (37)-(42):

- (36) Sam only talked to [SUE_F]_{NP}.
- (37) Sam only talked to [JOHN's spouse]_{NP}.
- (38) Sam only talked to [the first AMERICAN astronaut in space]_{NP}.
- (39) Sam only talked to [JOHN's mother]_{NP}.
- (40) Sam only talked to [the woman who introduced BOB_F to John]_{NP}.
- (41) Sam only talked to [JOHN's sister]_{NP}.
- (42) Sam only talked to [the DUTCH_F professor]_{NP}.

(36) can be paraphrased as (36a) 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 (37) and (38): In (37), we quantify over persons who have a spouse and, in (38), we quantify over nationalities.

- (36a) Nobody but Sue is such that Sam talked to him/her.
- (37a) Nobody but John is such that Sam talked to his/her spouse.
- (38a) 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 (39a) for (39) 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 (39a), predicts contrary to fact that sentence (39) 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 (39b). Similarly, the paraphrase (40a) predicts contrary to fact that sentence (40) 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.

- (39a) Nobody but John is such that Sam talked to his/her mother.
- (39b) No mother but John's mother is such that Sam talked to her.
- (40a) There is nobody but Bob such that Sam talked to the woman who introduced him/her to John.

- (40b) There is no women who introduces someone to John but the woman who introduces Bob to John such that Sam talks to her.

A second issue concerns the uniqueness condition expressed by the definite NP, which claims in (41) that John has only one sister and in (42) 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 (41a) and (42a): 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 (41a) predicts contrary to fact that (41) 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 (42a) predicts that the sentence is true because it does not contain any German professors. It is obvious that the domain of quantification in (41) is formed by sisters, rather than by alternative to John or unique sisters of a person, and the operator in (42) quantifies over professors, and not over nationalities or unique professors with respect to their nationality. The paraphrases in (41b) and (42b) illustrate that the alternatives to a definite NP do not carry the uniqueness condition of the ordinary meaning of the definite NP.

- (41a) There is no one but John such that Sam talked to his/her sister.
 (41b) There is no sister but John's sister such that Sam talked to her.
 (42a) There is no nationality but being Dutch such that Sam talked to the professor of that nationality.
 (42b) There is no professor but the Dutch professor such that Sam talked to him.

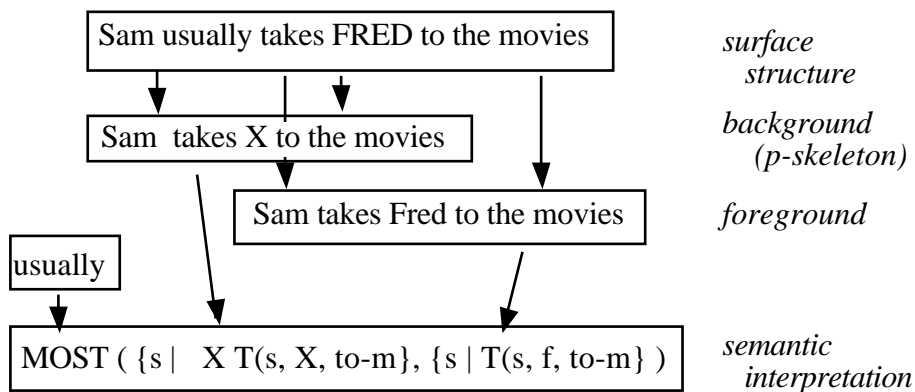
This informal discussion of the computation of alternatives (illustrated in terms of Alternative Semantics, but it holds for the moving approach as well, see Krifka 1996) illustrates the problems of all approaches to focus that assume a focus-background structure, which provides the arguments for the focus particles (for the detailed argument compare von Stechow 1997, 1999 ch. 5). Informally, the main function of the focus seems to be that it is "invisible" for the construction of the domain of quantification, rather than to be the generator of alternatives.

5. A Foreground-Background Semantics

What is called for is a discourse semantics that provides the adequate semantic objects that can be used as arguments of focus operators. In contrast to the dichotomy of the sentence into focus and background I propose two representational units, 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 (43). The operator ranges over sets that are constructed from the foreground and the background representation as in (43b).

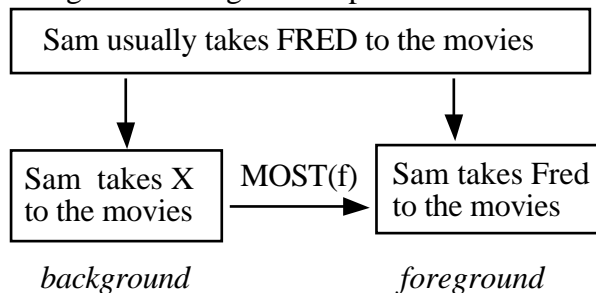
- (43) Sam usually takes FRED_F to the movies.
- (43a) For most times in which Sam takes someone to the movies, he invites Fred to the movies.
- (43b) Most {t | Sam takes someone to the movies at t}
 {t | Sam takes Fred to the movies at t}

(44) Schematic mapping relations for adverbs of quantification

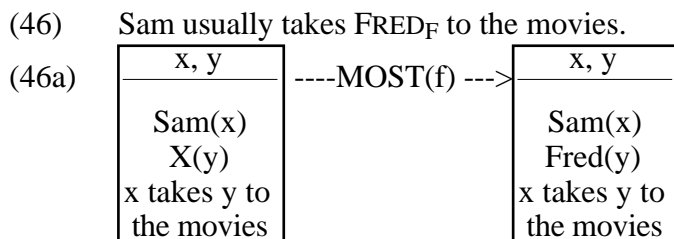


However, I do not define focus operators as ranging over denotations of these two representations, but as ranging over the representations themselves. They express relations between the different semantic representations of a sentence. Since the background contains the same material as the foreground, 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 (45).

(45) Foreground-background representation for focus



Alternatively, one can also represent the two representations as two DRSs that differ with respect to the representation of the focused element. In the background it is represented as the variable *X*, while in the foreground representation its content is fully represented. The adverb of quantification is translated into an operator over (possible) functions from that map the background onto the foreground.



I further assume that the two informational units, the foreground and the background, must be defined with respect to their contribution to the discourse, rather than as to their function in a sentence. The representation of information structure will follow from more general principles of discourse organization. I assume a DRT-like model 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. It expresses the contribution of the sentence that is already available in (or deductible from) the discourse. Thus focus operators can be described as discourse operators that relate the background representation to the foreground representation (or the discourse meaning expressed in a sentence to the ordinary sentence meaning) (cf. von Heusinger (to appear) for a more extensive account of this analysis.).

The theory of information structure sketched in this section radically differs from the approaches discussed earlier, 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 linguistic 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) 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.
- (vi) 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, i.e. discourse-semantic, 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.¹⁰ Furthermore, the theory presented has to be tested against a wide range of data. 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.

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¹⁰ Von Heusinger (to appear) discusses the relation between the information structure developed here and the discourse structure in terms of Discourse Representation Theory.

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