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Processing Word Order Variations and Ellipses: The Interplay of Syntax and Information Structure during Sentence Comprehension

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CHAPTER 1

Introduction and Overview

When we hear or read a sentence, we achieve an interpretation of the incoming acoustic or visual signal with astonishing speed, given that language comprehension is a complex process which requires the integration of a vast amount of different types of information. Firstly, we have to identify words – a process which presupposes the identification of individual phonemes and morphemes. Words are connected to lexical-semantic information, as well as to syntactic features. On the basis of morphosyntactic information like word category, case and verbal inflection, a syntactic structure is projected, which receives, together with the meaning of the single words, a semantic interpretation. But these are not the only types of information which are necessary to understand language. Also the context or discourse in which a sentence is uttered and the sentence prosody, that means, the phrasing and accentuation of lexical material, must be taken into account to extract the whole range of information conveyed by a specific sentence.

It is this complex process that psycholinguistic theories of language comprehension try to model. In doing so, they try to answer the following questions: How are the described types of information represented in the human mind or brain, and at which point in time are they processed? Thereby, models of sentence processing focus on syntactic processing and its interaction with other types of linguistic processes. In the experimental study of this interaction, the investigation of ambiguous sentences plays an important role. An example for ambiguous sentences are word order variations in German. Two examples are given in (1).

(1a) Anna hat behauptet, dass die Tante die Nichten begrüßt *hat*.
Anna has claimed that the aunt$_{\text{nom/sg}}$ *the nieces*$_{\text{acc/pl}}$ *welcomed has*$_{\text{sg}}$
'Anna claimed that the aunt welcomed the nieces.'

(1b) Anna hat behauptet, dass die Tante die Nichten begrüßt *haben*.
Anna has claimed that the aunt$_{acc/sg}$ the nieces$_{nom/pl}$ welcomed have$_{pl}$.
'Anna claimed that the aunt was welcomed by the nieces.'

The German sentences in (1) are identical except for the finite auxiliaries *hat* ('has') vs. *haben* ('have'), that means, these sentences are ambiguous up to the point where the number information of the finite verb can be accessed. The requirement of subject-verb agreement unambiguously tells the processing system which of the participants, *die Tante* ('the aunt') or *die Nichten* ('the nieces'), conducted a specific action and hence is the subject of the sentence. Several studies have shown that sentences like (1b) cause severe processing difficulties in comparison to sentences like (1a). Explanations of this observation mostly refer to differences in the syntactic structure of the two sentence types.

The aim of this thesis is to show that not only syntactic representations play a role in the processing of word order variations. Variations of order affect not only the syntactic structure, but also the *information structure* of a sentence. The information structure of a sentence can be described as its division into *focus* and *background*. *Background* refers to information that is already given by the context; *focus* refers to the part of the sentence that represents new information. The information structure of a sentence highly interacts with its syntactic and prosodic structure.

Chapter 2 introduces linguistic theories which try to explain the abovementioned characteristics of word order variations. Syntactic as well as focus structural analyses are discussed. In addition, it is shown that the type of nominal expression which changes its position in the sentence plays a role in the analyses of word order variations. Here, pronouns in comparison to referential DPs are considered.

Chapter 3 gives an overview of language comprehension models. These models are discussed on the background of empirical studies which investigated the processing of word order variations.

A neurocognitive perspective on language processing is provided in Chapter 4. A neurophysiological method, the measuring of event-related brain potentials (ERPs),

and a neurocognitive model of language comprehension are described. This chapter also discusses studies using the described method for the investigation of word order variations.

Chapter 5, the first experimental part of the thesis, includes three reading studies which look into the processing of word order variations with different DP types. By using ERP measurements, it was possible to differentiate between syntactic and focus structural processing (beside other types of processes). On the basis of these data, it was not possible to decide whether the ERP correlate of focus structural processing additionally reflects implicit prosodic processing. This question motivates the second part of my thesis.

Chapter 6 gives an overview of behavioral as well as ERP studies investigating the processing of focus structure and prosody.

The second experimental part of the thesis is described in Chapter 7. By studying the processing of contrastive ellipses, it is possible to differentiate between the processing of focus structure on the one hand and implicit prosodic processing on the other.

Finally, Chapter 8 provides a summary and general discussion of the experimental results and discusses their implications for models of sentence processing.

CHAPTER 2

Word Order Variations in German: Scrambling and Pronoun Fronting

Natural languages differ with regard to the freedom of word order. Languages like English exhibit a relatively fixed word order in contrast to languages, such as German, which have a relatively free word order. One specific type of word order variation is *scrambling*, the phenomenon of variable constituent order within a clause. Different analyses for this phenomenon have been proposed within generative grammar to account for alternate word orders in various natural languages. One of the first to discuss this phenomenon in generative grammar was Ross (1967). He attributed the freedom of constituent order in languages such as German, Latin and Russian to the existence of a pure stylistic reordering rule (see Corver and van Riemsdijk, 1994). The same is true for Chomsky (1995): He claims that phenomena like scrambling do not belong to the core grammar.

"In early transformational grammar, a distinction was sometimes made between 'stylistic' rules and others. Increasingly, the distinction seems to be quite real: the core computational properties we have been considering differ markedly in character from many other operations of the language faculty, and it may be mistaken to try to integrate them within the same framework of principles. The problems related to XP-adjunction are perhaps a case in point: they may not really belong to the system we are discussing here [...]." (Chomsky, 1995: 324f)

This chapter focuses on approaches toward scrambling which locate the phenomenon inside grammar. In section 2.1, a short introduction to Generative Grammar will be given. In section 2.2, I will concentrate on analyses of scrambling. Syntactic and focus structural characteristics of word order variations will be

discussed. Section 2.3 addresses differences in word order dependent on the type of nominal expression. The last section 2.4 provides a summary of this chapter.

2.1 Basic Concepts of Generative Grammar

In this section, a short introduction to the basic theoretical concepts of Generative Grammar will be given. The main reason for choosing this specific theory of grammar as the basis for the development of my empirical hypotheses is the fact that a large body of work in psycholinguistics, especially in sentence processing, has been conducted on this background[1]. The close relation between parsing research and Generative Grammar has its foundation in Chomsky's early work. He pointed out that grammar theory and language processing are strongly connected:

"We thus make a fundamental distinction between *competence* (the speaker-hearer's knowledge of his language) and *performance* (the actual use of language in concrete situations). [...] The problem for the linguist, as well as for the child learning the language, is to determine from the data of performance the underlying system of rules that has been mastered by the speaker-hearer and that he puts to use in actual performance." (Chomsky, 1965, p. 4)

Chomsky's specific proposals about the nature of linguistic structure (from the transformational "Aspects-Model" (Chomsky, 1965) via "Government and Binding" (Chomsky, 1981, Chomsky & Lasnik, 1993) to "The Minimalist Program" (Chomsky, 1995)) have deeply influenced experimental psycholinguistics since the 1960's. Today, the most influential model in psycholinguistics still is the Government-and-Binding (GB) framework (also known as *Theory of Principles and Parameters*). In the following, I will describe the basic concepts of GB.

[1] Note that alternative grammar theories were also used for the development of psycholinguistic hypotheses (e.g. Lexical-Functional Grammar (LFG, Bresnan, 1982) and Head-driven Phrase Structure Grammar (HPSG, Pollard and Sag, 199
4)).

The GB-model of grammar assumes that our linguistic knowledge consists of different subcomponents. The interplay of lexical, syntactic, phonological and semantic knowledge is illustrated in the so-called *T-Model* in Figure 2.1. The *D(eep)-structure* is constructed on the basis of lexical entries. On this representational level, the rule *Move* α operates, which is responsible for the reordering of constituents (e.g., fronting of wh-elements). The result of this operation is the *S(urface)-structure* of a sentence which serves as the input of two interpretative components, *Phonological Form* (PF) and *Logical Form* (LF). Syntactic structures receive a phonetic representation at PF and a semantic interpretation at LF. It is assumed that the semantic component and the phonological component have no direct access to each other. The relation between the meaning of a sentence and its phonological realization is mediated by S-structure, or the *Syntax-Phonology Interface* and the *Syntax-Semantics Interface* respectively. PF and LF by themselves also serve as interfaces to non-linguistic knowledge. In the terminology of the *Minimalist Program* (Chomsky, 1995), PF representations are the input for the articulatory-perceptual system, whereas LF is connected to the conceptual-intentional system.

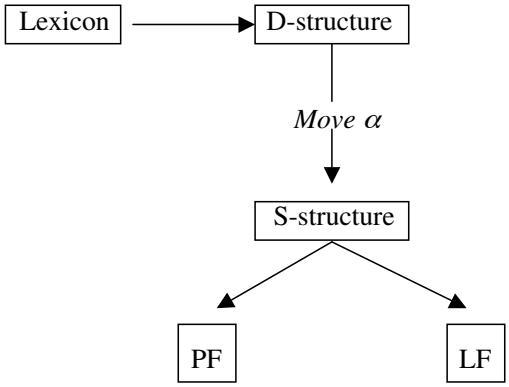

Figure 2.1: T-Model (Chomsky & Lasnik, 1993)

The syntactic component is responsible for the generation of phrase structures. The input to the syntactic component, the lexical entries, include syntactic specifications

like word category information and argument structure information, as well as semantic, morphological and phonological information.

According to the *X-bar* theory (Jackendoff, 1977), the phrase structural representations of syntactic categories arise from the projection of lexical word categories. The lexical categories N(oun), V(erb), A(djective) and P(reposition) project their features and form the phrasal categories of a language. As illustrated in Figure 2.2, the lexical head *X°* projects to a higher level *X′* where the lexical head connects to its complement(s) and modifier(s). At the level *X″* or *XP*, it connects to its Specifier (Spec).

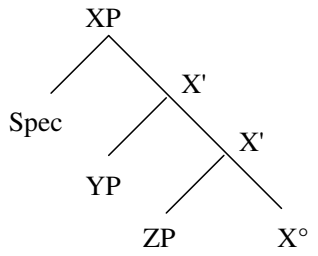

Figure 2.2: Binary left-branching X-bar scheme (Jackendoff, 1977)

Apart from lexical categories, functional categories are responsible for the projection of phrase structures. Examples of functional categories include *Comp* (for complementizer), *Infl* (for inflection) and *Det* (for determiner). In contrast to lexical categories, which are individual items from the lexicon, functional categories can be abstract feature bundles which have no uniform representation in the lexicon.

A detailed phrase structural analysis of German sentences will be given in the next section where I will discuss the relation between D-structure and S-structure with regard to word order variations.

2.2 Scrambling

2.2.1 Syntactic analyses

Following Haider and Rosengren (1998, p. 2), "the term scrambling will be used for the optional change of the base order of phrases within the domain of the lexical head". With regard to German, scrambling is restricted to the middlefield (*Mittelfeld)*, i.e. the array between the finite verb or the complementizer (*V2-position*) and the sentence final verb(s) (*V-letzt-Position*, see Table 2.1, the extraposition domain (*Nachfeld*) is ignored here).

	Vorfeld	*V2-Position*	*Mittelfeld*	*V-letzt-Position*
(2.1a)		daß	der Neffe den Onkel	begrüßt hat.
(2.1b)	Der Neffe	hat	den Onkel	begrüßt.

Table 2.1: A topological classification of German sentences

One instance of scrambling is *subject-object scrambling* as in (1b). For a transitive verb like *begrüßen* ('to greet'), two different orders of the arguments are possible (accordingly, six different argument orders are possible in the case of ditransitive verbs).

NOM > ACC

(1a) Anna hat behauptet, dass der Neffe den Onkel begrüßt hat.
Anna has claimed that the$_{nom}$ nephew the$_{acc}$ uncle welcomed has
'Anna claimed that the nephew welcomed the uncle.'

ACC > NOM

(1b) Anna hat behauptet, dass *den* Onkel *der* Neffe begrüßt hat.
Anna has claimed that the$_{acc}$ uncle the$_{nom}$ nephew welcomed has
'Anna claimed that the uncle was welcomed by the nephew.'

Other types of word order variations like topicalization in the prefield (*Vorfeld*) as in (2) are not classified as instances of scrambling proper.

NOM > ACC

(2a) Der Neffe hat den Onkel begrüßt.

The$_{nom}$ nephew has the$_{acc}$ uncle welcomed

'The nephew welcomed the uncle.'

ACC > NOM

(2b) Den Onkel hat der Neffe begrüßt.

The$_{acc}$ uncle has the $_{nom}$ nephew welcome.

'The uncle was welcomed by the nephew.'

Whereas it is mostly uncontroversial to analyze topicalization as the movement of a constituent to the prefield (wh-movement), there is no consensus with regard to the involvement of *Move* α in scrambling. Two different approaches to scrambling in German are categorized by the *base generation account* (e.g., Bayer and Kornfilt, 1994, Fanselow, 2001) and the *movement account* (e.g., Haftka, 1995, 2004; Haider, 1993; Haider & Rosengren, 1998, 2002). In terms of the T-model, proponents of the base generation account assume that variable word order is the result of free generation of constituents in an arbitrary order at D-structure, whereas according to the movement account there is one basic word order at D-structure, and variable word order is the result of movement operations at S-structure. These different assumptions result in different syntactic representations of scrambled sentences. We adopt the syntactic analysis of German sentences from Haider (1993) who assumes a "minimal" S-structure for German sentences. Referring to the *Principle of Full Interpretation* (Chomsky & Lasnik, 1993), he argues that only VP-projections and one functional projection, namely CP, are needed to represent the German sentence structure. According to Haider, there is no evidence for further functional projections in German.

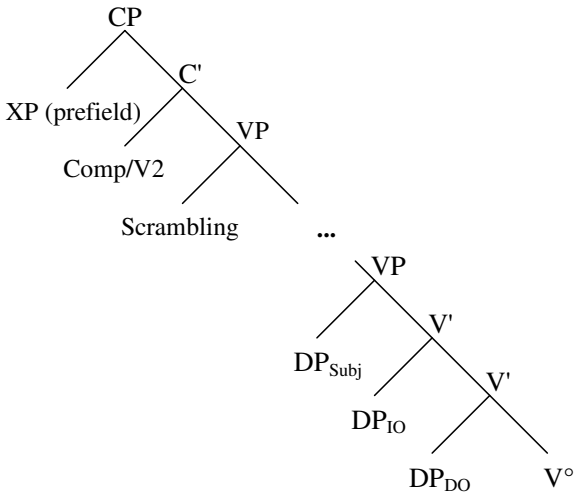

Figure 2.3: German sentence structure with two VP shells (Haider, 1993)

Figure 2.3 represents Haider's analysis of the German sentence structure. The whole middlefield consists of a projection of the verbal head. According to Fukui & Speas (1986), the nodes on the projection line of a lexical head are not categorically distinct. Despite the abdication of functional projections for the German middlefield, Haider suggests a more complex analysis with a stacked shell structure. The first shell hosts the projection of the argument structure of the verb. As a proponent of a movement account of scrambling, he classifies this projection as the base order of the arguments. Haider & Rosengren (2002) assume that this base order is the result of a direct mapping of the thematic structure, which is encoded in the verb's lexical entry, onto the syntactic structure. The highest ranked argument ends up in the highest position of the first verb-shell. The ranking of the argument positions in the thematic structure is determined by the argument structure of the verbal head (see e.g., Bierwisch, 1988; Primus, 1999, Wunderlich, 1997). The thematic or conceptual roles associated with specific verb classes are closely linked to case marking. Haider & Rosengren (2002) suggest five different verb classes with distinct morphosyntactic patterns to be possible base orders for nominal arguments in German.

(3)	NOM > ACC	e.g., bedauern ('to regret')
	ACC > NOM	e.g., ängstigen ('to frighten')
	NOM > DAT	e.g., helfen ('to help')
	DAT > NOM	e.g., gefallen ('to please')
	NOM > DAT > ACC	e.g., zeigen ('to show')
	NOM > ACC > DAT	e.g., widmen ('to devote')

The thematic roles associated with these different morphosyntactic patterns are mapped on the syntactic positions *Subject > Indirect Object (IO) > Direct Object (DO)* (see Figure 2.1).

In the extended verbal projection, otherwise denoted as the second shell, Haider (1993) postulates a specific landing place for scrambled constituents[2]. The moved constituents are adjoined to an extended verbal projection. Arguments of the verb that are moved out of the first verbal projection leave a *trace* in their base position. A trace is a phonetically empty copy of the moved constituent, an *empty category*. According to the Binding Theory, an empty category has to be c-commanded by its antecedent (the moved constituent) to be bound and interpreted.

(4) *c-command*

α c-commands β if α does not dominate β and every γ that dominates α dominates β. (Chomsky and Lasnik, 1993)

Whereas traces are not visible for the PF-component, they are relevant for interpretation and therefore visible at LF to fulfill the *theta criterion* which claims that each argument bears only one theta or thematic role and only one theta role is assigned to one argument (Chomsky, 1981). As seen before, the thematic roles are assigned in the base positions of the arguments in the first verb shell. If a constituent was moved, the thematic role is assigned via a chain that connects the

[2] He assumes a further projection shell as a landing position for pronouns. This third VP shell will be described in section 2.3.1.

moved constituent with the trace in its base position (Chomsky and Lasnik, 1993). Haider & Rosengren (2002) assume that the type of movement involved in scrambling is adjunction: constituents are adjoined to VP. Other proponents of the movement account of scrambling suggest that scrambling is substitution, i.e. movement to specifier positions of functional projections (e.g. Haftka 1995, 2004)[3]. We will come to this analysis of scrambling in connection to the analysis of pronoun fronting in section 2.3.1**.**

The assumptions of the movement account just described result in a more complex syntactic representation for scrambled sentences compared to the sentences with the base order (see example (5); for translations, the reader is referred to example (1)). (5b) illustrates that scrambling under a movement analysis yields an antecedent-gap configuration.

base order NOM > ACC

(5a) ..., $_{CP}$[dass $_{VP}$[der Neffe $_{V'}$[den Onkel begrüßt hat]]]

scrambling ACC > NOM

(5b) ..., $_{CP}$[dass $_{VP}$[den Onkel$_i$ $_{VP}$[der Neffe $_{V'}$[t_i begrüßt hat]]]]

'...that the nephew welcomed the uncle.'

base order NOM > ACC

(6a) ..., $_{CP}$[dass $_{VP}$[der Neffe $_{V'}$[den Onkel begrüßt hat]]]

base order ACC > NOM

(6b) ..., $_{CP}$[dass $_{VP}$[den Onkel $_{V'}$[der Neffe begrüßt hat]]]

'...that the nephew welcomed the uncle.'

Example (6) shows that according to a base generation account, there is no complexity difference between the order NOM > ACC and the order ACC > NOM. No traces are involved in the ACC > NOM order in (6b).

[3] In the huge literature on scrambling, there is also disagreement with regard to the type of landing position for dislocated elements (A-positions versus A'- positions). Because this distinction plays no role for my empirical hypotheses (see section 5.1), I will not go into further detail. For a survey of the different analyses of scrambling, see Corver and van Riemsdijk, 1994; Haider, 2000).

At this point, the question arises whether there is evidence for movement involved in scrambling. One would expect to see properties associated with an antecedent-gap configuration. Haider and Rosengren (2002) propose two tests for figuring out whether scrambling involves chain formation. The first of these is provided by the syntax-semantics interface, namely the computation of scope. Frey (1993) has provided evidence that scrambling leads to scope ambiguities. This phenomenon is explained by the fact that a chain crosses a quantifier that c-commands the base position of the scrambled constituent. The surface position of a quantified phrase as well as the base position of its trace can define its c-command domain (Aoun and Li, l993).

(7a) ..., dass mindestens ein Onkel jeden Neffen begrüßt hat.
... that at least one uncle$_{nom}$ every nephew$_{acc}$ welcomed has

(7a') ∃∀: There is at least one uncle who welcomed every nephew.

(7b) ..., dass mindestens einen Neffen$_i$ jeder Onkel t_i begrüßt hat.
..., that at least one nephew$_{acc}$ every uncle$_{nom}$ welcomed has

(7b') ∃∀: There is at least one nephew who welcomed every uncle.

(7b") ∀∃: For every uncle, there exists at least one nephew who has welcomed him.

As illustrated in (7b), the ambiguity is caused by the doubled c-command relation between the two DPs. The subject (*every uncle*) is c-commanded by the scrambled object and at the same time c-commands the trace of the scrambled constituent. Therefore, two interpretations are possible: One that reflects the surface order of the arguments as in (7b'), and one in which the scrambled constituent is reconstructed at its base position as in (7b").

Haider and Rosengren (2002) interpret the scope ambiguity in (7b) as evidence for the distinction between an argumental base order and a derived order which involves a chain between a moved constituent and a gap in its base position.

The second test put forward by Haider and Rosengren is supplied by the syntax-phonology interface. This test refers to the focus potential of scrambled word order in comparison to the assumed base order. Before I will describe this test in the next section, a short introduction to focus in general will be given.

2.2.2 Focus structural analysis

The focus structure of a sentence can be described in *information structural* terms. The information structure of a sentence represents its division into *focus* and *background* (see e.g., Rochemont, 1986; Selkirk, 1984; Stechow, 1991). While *background* refers to information that is already given by the context, *focus* refers to the part of the sentence that represents new information. The described information structure might best be illustrated by question answer-pairs in the examples in (8). (8a) shows that the whole answer can be new information and, therefore, be focused ($[...]_F$ indicates the focus structure, nuclear accents are indicated by capitals). As illustrated in (8b), the focus of the sentence can also be partial. The new information in the answer includes only one constituent. The rest of the sentence is given by the context, and therefore belongs to background information. (8c) shows an example for a sentence with *contrastive focus* (indicated by $[...]_{CF}$). Contrastive focus can appear in correction contexts, i.e., one speaker uses grammatical entities against which another speaker protests with a sentence nearly identical except for a prosodically marked corrective element (see Steube, 2001).

(8a) What happened yesterday?
[Johnny bought a PREsent]$_F$
(Topic) (Comment)

(8b) What did Johnny buy yesterday?
Johnny bought [a PREsent]$_F$
(Topic) (Comment)

(9) Did Jimmy buy a present yesterday?
[JOHnny]$_{CF}$ bought a present.
(Topic) (Comment)

Another information structural partition is called *topic-comment* (see e.g., Jacobs, 2001; Vallduvi and Engdahl, 1996). The examples in (8) and (9) show that this division is independent of the focus-background structure if the term topic is restricted to *aboutness topics*, i.e. the topic is an expression about whose referents the rest of the sentence (the comment) predicates (Frey, 2000; Reinhart, 1981; Steube, Alter and Späth, 2004)[4]. The topic of a sentence can be new information as in (8a), given information as in (8b) or contrastive information as in (9). Prototypically, topics precede the comment. Prototypical syntactic positions for topics in German are in the prefield (SpecCP) or at the front of the middlefield, between the finite verb and sentential adverbs (see Frey, 2000).

In the following, the main emphasis will be on the focus-background division.

The focus-background division is not merely a pragmatic phenomenon, but also affects parts of the grammar. In semantics, information structure is expressed by referential properties of DPs. Background information is normally expressed by definite DPs and anaphoric pronouns whereas focused information is expressed by indefinite and definite DPs. In contrast to definite DPs that belong to background information for which specific and generic interpretations are available, definite DPs in focus have to refer uniquely[5].

Information structure also affects the syntactic and prosodic representations of a sentence. In many languages, the word order can change depending on the pragmatic status of the arguments. This is true for scrambling in German (see examples (10)-(12)).

[4] Reinhart (1981, 1995) differentiated between *aboutness topics* and *familiarity topics*. The referents of familiarity topics have to be mentioned in prior discourse. In this conception, topics are background constituents.

[5] See Bosch and van der Sandt (1994) and Kadmon (2000) for an overview of the semantic and pragmatic literature on focus-background structure. Dretske (1972) could show that focus structural characteristics affect the semantic interpretation, especially the truth conditions, of sentences (see also Büring 1995, 1997; Umbach; 2001; Späth, 2003, among others)

Similarly to the question discussed in section 2.2.1 whether there is a syntactically motivated base order, one could ask whether there is something like a base order with regard to focus structural characteristics of sentences. Höhle (1982) tried to clarify the notion of "normal word order" in German. He pointed out that this is only possible if one considers the prosodic properties of different word orders. Like the word order, the accent pattern of a sentence can be normal, or *unmarked,* or *marked*. He tried to diagnose the marked and unmarked word orders and accent patterns by using what is called *question test*. The notion of markedness can then be defined in terms of contextual restrictions: The more restrictions a sentence imposes on the context in which it can be uttered felicitously, the more marked it is (see also Weskott, 2002).

As we can see in the examples (10)-(11), the focus of the sentence varies with the different contexts, whereas the *focus exponent* (the constituent that bears the nuclear accent) and hence the accent position remain the same.

(10a) What happened?
Anna hat behauptet, [dass der Neffe den ONkel begrüßt hat]$_F$

(10b) What did the nephew do?
Anna hat behauptet, dass der Neffe [den ONkel begrüßt hat]$_F$

(10c) Who did the nephew welcome?
Anna hat behauptet, dass der Neffe [den ONkel]$_F$ begrüßt hat.
Anna has claimed that the nephew$_{nom}$ the uncle$_{acc}$ welcomed has
'Anna claimed that the nephew welcomed the uncle.'

(11a) What happened to the uncle?
Anna hat behauptet, dass den Onkel [der NEffe begrüßt hat]$_F$

(11b) Who welcomed the uncle?
Anna hat behauptet, dass den Onkel [der NEffe]$_F$ begrüßt hat.
Anna has claimed that the uncle$_{acc}$ the nephew$_{nom}$ welcomed has
'Anna claimed that the uncle was welcomed by the nephew.'

As illustrated in (10), the sentences with canonical word order (subject before object) are compatible with three different focus structures: Wide focus in (10a) with the whole complement clause in focus[6], narrow focus on the object and the verb in (10b), and narrow focus on the object DP in (10c). The sentence with non-canonical word order object-before-subject in (11) is only compatible with two question contexts and consequently can have only two different narrow foci (object and verb + object). The wide focus reading is not available for the scrambled word order. Despite the fact that the focus exponent is in the same position as in the sentences in (10), it cannot project focus to the whole complement clause. This can be explained in pragmatic terms. The word order in German is highly influenced by different information structural factors. Apart from definiteness (e.g., Jacobs, 1988; Lenerz, 1977) and weight of DPs (Behagel, 1909; Lenerz, 1977), one important factor is the informational status of DPs. It is assumed that given information typically precedes new information (see e.g., Abraham, 1992; Lenerz, 1977: Steube, 2000). This assumption explains word order variation in information structural terms. The scrambled word order in (11) is only licensed if the object is background and the subject new information. Information that is already given by the context has to be moved out of the focus domain. But this explanation cannot capture the fact that it is also possible to focus the subject as illustrated in (12) or the scrambled object as illustrated in (13).

(12) Who welcomed the uncle?
Anna hat behauptet, dass [der NEffe]$_F$ den Onkel begrüßt hat.
Anna has claimed that the nephew$_{\mathbf{nom}}$ the uncle$_{\mathbf{acc}}$ welcomed has
'Anna claimed that the nephew welcomed the uncle.'

[6] I will consider focus structural characteristics of the scrambling domain only (the complement clause). With canonical word order, it is also possible to have the whole sentence in focus.

(13) Emma has claimed that the father was welcomed by the nephew.
Anna hat behauptet, dass [den ONkel]$_{CF}$ der Neffe begrüßt hat.
Anna has claimed that the uncle$_{acc}$ the nephew$_{nom}$ welcomed has
'Anna claimed that the uncle was welcomed by the nephew.'

Example (12) shows that it is also possible to focus a constituent that precedes given information. The sentence in (13) is an example of a contrastive topic. It contradicts the commonly held assumption that a scrambled object cannot be focused (but see Neeleman, 1994, on *focus scrambling*). Steube (2001) shows that corrections have their own information structure[7]. The contrastively focused constituent [...]$_{CF}$ constitutes the focus of the sentence. The rest of the sentence represents background information.

Another approach to focus structure, which might handle the problem of narrow focus on the subject or contrastive focus on the scrambled object, concentrates on the correspondence between sentence focus and the location of sentence stress. Reinhart (1995) relates focus to two different stress rules, an unmarked and a marked one.

The unmarked stress rule is adopted by Cinque (1993). According to his *Null Theory of Phrase Stress*, the assignment of sentence stress depends on the recursive side of a language and the depth of embedding of a constituent in the syntactic tree. He assumes that the most deeply embedded verbal constituent receives the nuclear accent. This prosodic rule correctly predicts the position of the nuclear accent in the examples in (10) and (11). Reinhart (1995) proposes that this rule creates a *focus set* which contains any sequence of constituents of VP which includes the main stress

[7] With contrastive focus, movements are possible which are ungrammatical in categorical sentences (see Steube, 2001, p. 231f):
(i) [AN]$_{CF}$ hat er das Licht gemacht, nicht aus.
On has he the light made, not off.
'On he turned the light, not off.'
In addition, there are prosodic differences between contrastive focus and focus in categorical sentences (see e.g.; Alter, Mleinek; Rohe, Steube & Umbach, 2001; Bolinger, 1961, Chafe, 1974; Couper-Kuhlen, 1984; 1984; Féry, 1993; Ladd, 1983; Pierrehumbert and Hirschberg, 1990). But see also Krahmer and Swerts (2001) who did not find reliable differences between prosodic realization of contrast and new information.

of VP (see the three possible foci in example (10)). The appropriate focus is selected at the interface to pragmatics. As seen above, the actual focus structure of a sentence is determined by the context in which the sentence is embedded. The described focus set is assumed to be the unmarked focus set. To account for cases like examples (12) and (13), a different focus set is obtained by applying a marked stress rule that relocates stress on the constituent that needs to be focused. This rule applies only when the unmarked rule is not able to create the appropriate focus set. In this case, the focus exponent cannot project wide focus. Only narrow focus on the subject is possible. Neeleman and Reinhart (1998) claim that there are two marked stress rules: *destressing* of given information (d(iscourse)-linked phrases) and *stress strenghtening*. Only stress strenghtening changes the focus set and blocks focus projection.

In contrast to the information structural explanations mentioned above, Reinhart (1995) gives a prosodic motivation for object scrambling in Dutch (p. 34):

(14a) Dat ik gisteren het BOEK las.
that I yesterday the book read

(14b) Dat ik het boek gisteren LAS.
that I the book yesterday read
'that I read the book yesterday.'

It is assumed that the temporal adverb ('yesterday') marks the base position of the object in (14a). Reinhart assumes that scrambling takes places to change the focus set. The focus set of (14a) includes narrow focus on the object, (14b) includes narrow focus on the verb. However, in both sentences the wide focus reading is also available. Therefore, the unmarked stress rule is applied. This explanation does not capture the characteristics of subject-object scrambling in German. As illustrated in (11), the scrambled sentence does not allow for a wide focus reading. It is *more marked* than the canonical word order in (10).

Within generative grammar, a syntactic explanation of this observation is given (e.g., Haider and Rosengren, 2002). In this approach, the focus structural and prosodic representations of the canonical and scrambled word orders can be directly derived from the syntactic structure. It is assumed that the whole utterance can only be focused (*wide focus*) if the constituent carrying the nuclear accent (*focus exponent*) is in its base position and in the sister position of the verbal head. According to Cinque (1993), a phrase's main stress is assigned to its most deeply embedded constituent. If there is no other focus structural information given by the context, the focus projects. This stress pattern is associated with a wide focus reading. The whole complement clause is in focus like in (10a).

If the phrasal stress falls on a constituent higher in the structure, as in the examples (12) and (13), the focus does not project (Haider, 1993, 2000). The sentence receives a narrow or contrastive focus reading[8]. Under a movement account of scrambling, this is also true for the example in (11). The most deeply embedded constituent would be a trace and hence cannot be accented. A constituent higher in the structure bears the nuclear accent and, therefore, the focus cannot project to the whole complement clause.

What this account cannot explain is the difference between (11) on the one hand and (12) and (13) on the other. The focus domain of a scrambled sentence with neutral accent (example (11)) can include the verb, whereas a relocated stress cannot. Only narrow focus on the stressed constituent is possible.

The described focus structural analyses of scrambling showed that at least three factors (contextual, prosodic and syntactic information) influence the focus structural characteristics of a sentence. We saw that theories which only look at one of these factors cannot explain the whole spectrum of focus structural phenomena in connection with scrambling. Therefore, I will try to unify the different analyses.

I assume that scrambling is highly influenced by information structural factors. With respect to word order, one could generalize that typically given information

[8] But note that contrastive focus in non-scrambled sentences is not restricted to narrow focus, i.e. the correction of one constituent. A correction sentence can also protest against a whole preceding sentence. It highly depends on the context (see Steube, 2001).

precedes new information and topics are located in the prefield or at the front of the middlefield. For the prosodic representation, it can be concluded that given information is destressed and new or contrastive information includes at least one stressed constituent.

If no further contextual restrictions are imposed and all constituents are in their base positions, the sentence accent is assigned to the most deeply embedded verbal constituent and focus can project to the whole complement clause or the whole sentence. This seems to be the most unmarked sentence type. In the following, this will be called the *default structure* (see example (10)).

Contextually given constituents are destressed and tend to move to the left. If subject-object scrambling takes place, the sentence accent is assigned to the most deeply embedded visible constituent of the verb. Contrary to Reinhart's (1995) assumption, the focus set changes with destressing. The destressed constituent is outside the focus domain. The focus domain maximally includes the subject in its base position and the verb. Therefore, a sentence like (11) is more marked than the default structure. This fact can be explained by the syntactic structure. At the surface, the sentence accent is in its default position next to the verb. But under a movement account, there is a trace which is the most deeply embedded constituent. Therefore, the sentence accent is assigned to a constituent higher in the syntactic tree and, as a consequence, the focus cannot project. The difference between the example (11) and the examples in (12) and (13) suggests that it is necessary to differentiate between stress in the default position at the surface and relocation of stress to a non-default position. It seems that the accent's default position at the surface allows the extension of the focus domain to the verb which is not allowed with accent on the subject or scrambled object.

Contextually given constituents can also remain in their base position. Then, new information is marked by a non-default stress assignment. The "relocation" of sentence accents constrains focus projection most of all. Only a narrow focus reading is possible (see example (12)). The same is true for example (13). The focus cannot project with nuclear accent on the scrambled constituent.

The analysis of German sentences with transitive verbs showed that different factors play a role for the focus structural characteristics of a sentence. First of all, contextual information in terms of the given-new distinction determines the actual focus of a sentence. Reversely, syntactic and prosodic characteristics determine with which contexts an actual sentence is compatible. The syntactic and prosodic structure decide whether and how the focus exponent is able to project focus.
In this section, only sentences with definite referential DPs were considered. We will see in the next section that the type of DP also influences the syntactic, prosodic and focus structural characteristics. The main emphasis will be on the difference between referential DPs and pronouns.

2.3 Pronoun Fronting

2.3.1 Syntactic Analyses

Jacobs (1988) points to order regularities that are dependent on the type of DP: definite DPs precede indefinite DPs and pronouns precede referential DPs. In the following, the focus will be on the order differences between referential definite DPs and pronouns. The following section is restricted to personal pronouns (e.g., *er, sie, ihn, ihm, ihr*). These pronouns are strong pronouns, i.e. they can be accented, except for the personal pronouns *man* and *es* which are classified as weak pronouns (see Cardinaletti and Starke, 1995).
It seems that the order of unstressed pronouns is subject to constraints other than the order of referential DPs. As illustrated in the examples in (15), pronouns normally precede referential DPs, irrespective of their case and syntactic function (Lenerz, 1977).

(15a) Otto hat behauptet, dass er den ONkel begrüßt hat.
Otto has claimed that he the uncle$_{acc}$ welcomed has
'Otto claimed that he welcomed the uncle.'

(15b) Otto hat behauptet, dass ihn der ONkel begrüßt hat.
Otto has claimed that him the uncle$_{\textbf{nom}}$ welcomed has
'Otto claimed that the uncle welcomed him.'

(16a) NOM > ACC > DAT
..., dass er ihn ihr VORgestellt hat.
... that he him$_{acc}$ her$_{dat}$ introduced has
'... that he introduced her to him.'

(16b) NOM > DAT > ACC
..., dass der Mann dem Mädchen den JUNgen vorgestellt hat.
... that the man$_{nom}$ the girl$_{dat}$ the boy$_{acc}$ introduced has
'... that the man introduced the boy to the girl.'

In addition, the order of pronominal objects differs as compared to referential DPs. As illustrated in (16) (see also section 2.2), the unmarked word order differs depending on DP type in a sentence with a ditransitive verb like *vorstellen* ('to introduce').

(17a) *..., dass ihn ihr wahrscheinlich er VORgestellt hat.
..., that him$_{acc}$ her$_{dat}$ probably he introduced has
'... that probably he introduced him to her.'

(17b) ..., dass dem Mädchen den Jungen wahrscheinlich der MANN vorgestellt hat.
... that the girl$_{dat}$ the boy$_{acc}$ probably the man$_{nom}$ introduced has
'... that probably the man introduced the boy to the girl.'

(18a) *..., dass ihr er ihn VORgestellt hat.
... that her$_{dat}$ he him$_{acc}$ introduced has
'... that he introduced her to him.'

(18b) ..., dass dem Mädchen der Mann den JUNgen vorgestellt hat.
... that the girl$_{dat}$ the man$_{nom}$ the boy$_{acc}$ introduced has
'... that the man introduced the boy to the girl.'

The ungrammatical example in (17a) shows that an unstressed pronoun cannot remain in its base position. In contrast, (17b), the sentence with referential DPs, is highly marked, i.e. it imposes specific restrictions on the context in which it can be uttered felicitously, but is not ungrammatical. It seems that pronouns have to move to the left periphery of the middlefield. The examples in (18) illustrate that the relative order of pronouns is fixed (NOM > ACC > DAT) whereas the relative order of referential DPs is not (Lenerz, 1992). As seen in section 2.2.2, the order of referential DPs highly depends on information structural characteristics.
Various syntactic analyses were suggested for the explanation of the differences between referential DPs and pronouns outlined above. Mostly uncontroversial, at least for movement accounts, is the assumption that pronouns receive their case in the same base positions as referential DPs. There is much less agreement with regard to the type of movement and the landing positions of pronouns in comparison to referential DPs. Following analyses of pronoun movement in Dutch, Schmidt (1992) argues that pronoun fronting is an instantiation of clitic movement which is analyzed as X°-movement (head movement). Lenerz (1992) convincingly argues against this analysis and shows that pronoun movement has to be analyzed as XP-movement. One of his arguments points to the fact that unstressed pronouns in German appear in the prefield (Spec, CP), a position which can be occupied by maximal projections only (see example (19)).

(19) Er hat ihn ihr VORgestellt.
He has introduced him$_{acc}$ her$_{dat}$
'He introduced him to her.'

For the landing positions of pronouns in the middlefield, Haider (1993) assumes that pronouns move to a third VP shell, the so-called *Wackernagel area* (WP, see Figure 2.4).

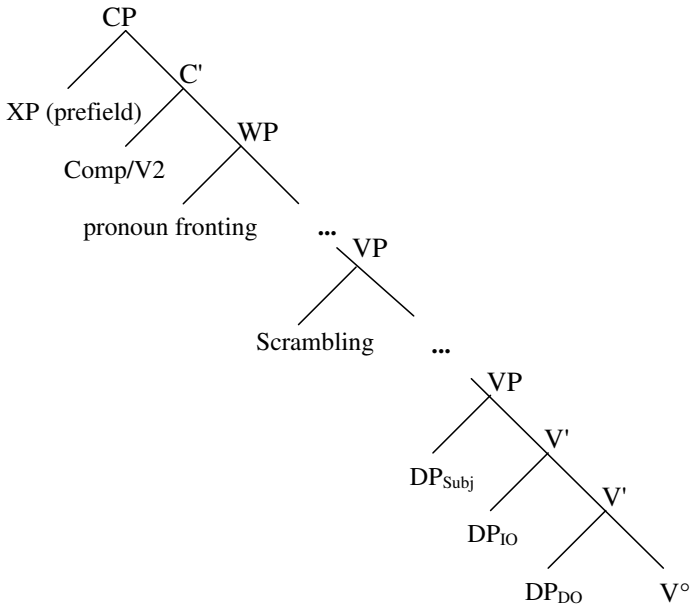

Figure 2.4: German sentence structure with three VP shells (Haider (1993))

The Wackernackel area is described as the position(s) to the left of modal particles and sentential adverbs (see example (20)).

(20) ..., daß er_i ihn_j ihr_k vielleicht t_i t_k t_j VORgestellt hat.
... that he him_{acc} her_{dat} perhaps introduced has
'... that he perhaps introduced him to her.'

As illustrated in example (21), it seems that this area is also the landing position for scrambled DPs.

(21) ..., daß den Jungen$_i$ vielleicht der Mann der Frau t$_i$ vorgestellt hat.
... that the boy$_{acc}$ perhaps the man$_{nom}$ the woman$_{dat}$ introduced has.
'... that perhaps the man introduced the boy to the woman.'

A referential DP cannot interrupt the chain of pronouns (see example (22)), but the subject DP, as a topic, can precede the pronouns (see example (23)).

(22) *..., daß er den Jungen ihr vorgestellt hat.
..., *that he the boy$_{acc}$ her$_{dat}$ introduced has.*
'... that he introduced the boy to her.'

(23) ..., daß der Mann ihn ihr VORgestellt hat.
..., *that the man$_{nom}$ him$_{acc}$ her$_{dat}$ introduced has.*
'... that the man introduced him to her.'

At the moment, it seems unclear whether it is possible to differentiate between the landing position for pronouns on the one hand and that of referential DPs on the other. As shown in example (23), pronouns do not necessarily precede all referential DPs which renders the assumption of a specific syntactic position WP for pronouns questionable.
Lenerz (1992) and Haider and Rosengren (1998) assume that there are no syntactic differences between scrambling and pronoun fronting. Both DP types are XPs that adjoin to the extended verbal projection.
Haftka (1995, 2004) also assumes that scrambled DPs and pronouns move to the same landing site. In contrast to Haider (1993) and Haider and Rosengren (1998, 2003), who analyze scrambling and pronoun fronting as adjunction to VP, she assumes that constituents move to specifier positions of functional heads. Inspired by Rizzi's (1997) split CP analysis, she postulates several information structurally motivated functional projections. Above Rizzi's *Finite Phrase*, a further functional

projection exists, *the topic phrase* which accommodates anaphoric elements, pronouns, as well as scrambled DPs.

Except for the different analyses of scrambling and pronoun fronting as adjunction or substitution, all XP-analyses of pronoun fronting agree that there is no syntactic difference between the movement of referential DPs and pronouns. The authors explain the different behavior of the different DP types in terms of prosody, information structure and referential characteristics of pronouns. These analyses will be discussed in the following section.

2.3.2 Focus Structural Analyses

A first motivation for a non-syntactic explanation of order differences between pronouns and referential DPs is the observation that only unstressed pronouns have to move out of VP. A stressed pronoun can remain in its base position (see example (24) in comparison to (17a)).

(24) ..., dass ihn$_j$ ihr$_k$ wahrscheinlich ER t$_k$ t$_j$ gezeigt hat.
..., *that him$_{acc}$ her$_{dat}$ probably he showed has*
'... that probably he showed him to her.'

Two characteristics of pronoun word order in contrast to the order of referential DPs were described in the preceding section: The unmarked order NOM > ACC > DAT and the apparently obligatory movement out of VP.

Haider and Rosengren (1998) tried to explain the difference in the unmarked order in prosodic terms. The authors assume that this order reflects the avoidance of the weak accusative pronoun *es* in the neutral focus position. *Es* cannot be accented and can therefore not appear in the focus position (see example (25a)).

(25a) ..., *daß er ihm es gezeigt hat.
... *that he him it shown has*
(25b) ..., daß er es ihm/IHM gezeigt hat.
... that he it him shown has
'... that he showed it to him.'

With this explanation, which refers to the nuclear stress rule, the question remains open as to why a strong pronoun like *ihm* can also appear unstressed in the focus position (see example (25b)). Nevertheless, the order might be an effect of prosody. Metrical phonology (e.g., Liberman and Prince, 1977; Selkirk, 1984) describes the rhythmic structure of a word or sentence as a sequence of strong and weak syllables. In this framework, the pronoun *es* would be classified as a weak syllable and the pronoun *ihm* as a strong one. According to Selkirk's (1984) *Principle of Rhythmic Alternation*, the ideal rhythm is a strong-weak alternation. (25a) violates this principle (two strong syllables, *er* and *ihn*, followed by two weak syllables, *es* and *ge*) whereas (25b) is in accordance with the strong-weak alternation. Support for this explanation seems to come from the fact that the order ACC > DAT is only obligatory for the weak *es*. Strong pronouns can also appear in the order DAT > ACC. It is assumed that (26b) is more marked than (26a). My intuition is that there is no - or at least no big - difference between the two orders.

(26a) ..., daß er ihn ihr VORgestellt hat.
... that he him$_{acc}$ her$_{dat}$ introduced has
(26b) ..., daß er ihr ihn vorgestellt hat.
... that he her$_{dat}$ him$_{acc}$ introduced has
'... that he introduced her to him.'

To conclude, the observed order differences between pronouns and referential DPs can be explained in rhythmic terms and seems to be restricted to the weak pronoun *es*.

The second difference between pronouns and referential DPs concerns the preference of pronouns for moving to the left periphery of the middlefield. Haftka (1995, 2004), Haider and Rosengren (1998), Lenerz (1992) and Steube (2000) explain the obligatory movement of the unstressed variants in information structural terms. As anaphoric expressions, pronouns refer to background information which generally has to precede new information (see section 2.2.1). Pronouns are not referential by their own. They refer to individuals that are given by the context. Pronouns are generally used to refer to discourse-salient entities or discourse topics (e.g., Ariel, 1990).

A third difference between scrambling and pronoun fronting are the focus structural representations of subject versus object fronting. In the scrambled sentences (10a) and (11a) in section 2.2.1 (repeated as (27)), it was demonstrated that the focus structural characteristics change with word order variation. This is only true for scrambling, but not for pronoun fronting.

(27a) Anna hat behauptet, [dass der Neffe den ONkel begrüßt hat]$_F$
Anna has claimed that the nephew$_{\mathbf{nom}}$ the uncle$_{\mathbf{acc}}$ welcomed has

(27b) Anna hat behauptet, dass den Onkel [der NEffe begrüßt hat]$_F$
Anna has claimed that the uncle$_{\mathbf{acc}}$ the nephew$_{\mathbf{nom}}$ welcomed has
'Anna has claimed that the nephew welcomed the uncle.'

(28a) Anna hat behauptet, dass sie [den ONkel begrüßt hat]$_F$
Anna has claimed that she the uncle$_{\mathbf{acc}}$ welcomed has
'Anna has claimed that she welcomed the uncle.'

(28b) Anna hat behauptet, dass sie [der ONkel begrüßt hat]$_F$
Anna has claimed that she the uncle$_{\mathbf{nom}}$ welcomed has
'Anna has claimed that the uncle welcomed her.'

The examples in (28) illustrate that there is no focus structural difference between the subject-before-object order and the object-before-subject order. For the focus

structure, it plays no role whether a subject- or an object-pronoun was moved out of the focus domain. As for the scrambled sentences, only the complement clauses will be considered. In both sentences, the pronoun refers to an antecedent which appears earlier in the sentence and therefore belongs to given, non-focused information.

The analyses in the last two sections showed that there is no reason to assume a difference in the syntactic representation of scrambling and pronoun fronting. The different behavior of pronouns can be explained by prosodic and information structural characteristics of pronominal DPs.
In the following section, I will sum up the analyses of scrambling and pronoun fronting. Additionally, I will give an outlook on the topic of the following chapers, the processing of word order variations.

2.4 Summary and Outlook

Following Haider and Rosengren (1998, 2002), I adopted a movement account of scrambling and pronoun fronting. The phenomena of scope ambiguity and focus projection in connection with scrambling discussed above seem to support this assumption (but see Fanselow, 2001 for arguments against a movement analysis). Further evidence for the involvement of traces in scrambling comes from psycholinguistic studies which will be reported in the next chapter.
As seen in the last two sections, there seems to be no reason to assume different syntactic representations for scrambling and pronoun fronting. The different order regularities can be explained by the observed information structural and prosodic differences.
It was also argued that object movement of referential DPs changes the focus structure in comparison to the base order. The scrambled sentence is more marked than the sentence with base order. This is not the case for pronoun fronting. Subject movement and object movement have the same focus structural effects. It remains

to be seen in the following chapter whether these assumptions are compatible with the results of psycholinguistic studies.

The different focus structural characteristics of scrambled and non-scrambled word orders seem to interact with different types of linguistic information, namely semantic, prosodic and syntactic information. The question arises as to whether these different types of linguistic representations can be kept apart in investigating language processing. I will discuss this question in the light of the experimental results described in the next two chapters and my own experimental studies in more detail.

The next chapter will give an overview of the numerous behavioral studies on the processing of word order variations. Before doing so, I will discuss different models of language comprehension.

CHAPTER 3

The Processing of Word Order Variations

Language comprehension constitutes a complex task which requires the processing and integration of different kinds of linguistic information. The language processor has to identify phonemes and syllables on the basis of phonological information. Words, being connected to lexico-semantic information have to be individuated by morphological and syntactic information. In auditory comprehension, the prosodic contour has to be mapped onto the syntactic structure which is assigned to a string of words to yield the semantic-pragmatic interpretation of that string. Whereas almost all models of language comprehension assume that these different levels of representations and processes exist and are involved in language comprehension, there is no consensus about the point in time at which different types of linguistic (and non-linguistic) information come into play. In the following, the focus will be put on models of the *parser*, i.e. the syntactic processing system. I will restrict myself to models of symbolic processing (for a connectionist approach, see e.g., McClelland, 1987).

3.1 Parsing Models

Models of the human parser have been developed and validated primarily on the basis of reading experiments. In this line of research, syntactically ambiguous sentences play an important role. Locally ambiguous sentences which lead to processing difficulties at the point of disambiguation are called *garden-path sentences*. The most famous garden-path sentence is shown in (1).

(1) The horse raced past the barn fell.

At the point of disambiguation (the verb *fell*), severe processing difficulties are observed for sentences of this type (Bever, 1970). There is a clear preference for analyzing the verb *raced* as an active past-tense verb and not as the beginning of a reduced relative clause. Therefore, the last word of the sentence cannot be integrated in the sentence structure. Garden-path effects that were found for reduced relatives and many other sentence types strongly support the commonly held assumption that sentence processing proceeds *incrementally*, i.e., the parser does not wait for all lexical units of a sentence, but begins its syntactic (and semantic) analysis of the sentence with the first incoming lexical element(s) (e.g., Just and Carpenter, 1980; Tyler and Marslen-Wilson, 1977). This processing phenomenon is captured by Frazier and Rayner (1988) in terms of the constraint given in (2).

(2) *Left-to-Right Constraint*

Each item is incorporated into a constituent structure representation of a sentence (essentially) as the item is encountered (Frazier and Rayner, 1988, p. 263)

To explain the occurrence of garden-path effects, models of syntactic processing have to answer the question of how the parser builds up a syntactic structure when confronted with ambiguities. A further topic with which sentence processing research has been concerned from the beginning is the question whether other types of linguistic knowledge (e.g., semantic information) or general world knowledge (e.g., plausibility of sentences) influence syntactic processing. With respect to the first question, two types of models can be differentiated, namely *parallel* versus *serial* models. For ambiguous sentences, a parallel account considers multiple syntactic analyses at the same time, whereas a serial parser projects only a single syntactic structure. Unrestricted parallel accounts have problems explaining garden-path effects for a sentence like (1): If all syntactic analyses are available to the parser, there should be no processing difficulty. Therefore, parallel models restrict their parallelism in different ways (see Pickering, Clifton and Crocker, 2000, for an

overview of different processing theories). Currently, the most influential type of parallel model is the constraint-based account (e.g., MacDonald, 1997; Tanenhaus, Spivey-Knowlton and Hanna, 2000). In these models, different syntactic analyses are weighted according to how compatible they are with a range of constraints. All sources of (non-)linguistic information are assumed to interact in processing at once. This leads us to the second question. Again, two types of models can be differentiated: *interactive* models like constraint-based accounts assume that all types of linguistic (lexical, semantic, prosodic ...) and non-linguistic information (plausibility, context, world knowledge ...) influence parsing. Modular models assume that the parser uses only syntactic information for structure building.

The different assumptions will be illustrated by means of two different models, the serial and modular *garden-path model* (Frazier, 1979, 1987a, 1990) and the parallel and interactive *referential-support model* (Crain and Steedman, 1985; Altmann and Steedman, 1988)[9].

3.1.1. The Garden-Path Model

Frazier (1987a, 1990) distinguishes between two processing stages, the *first pass parse* and the *second pass parse*. In the first stage, a syntactic structure is built on the basis of word category information. After identifying the syntactic category of a word, the parser projects the phrase structure according to the X-bar theory (see section 2.1). This initial structure building is guided solely by syntactic principles (see (3) and (4), Frazier, 1987a, p. 562)[10]:

(3) *Minimal Attachment*

Do not postulate any potentially unnecessary nodes.

[9] Modularity and serial parsing on the one hand and interactivity and parallel parsing on the other hand, do not presuppose each other. There are also serial interactive and parallel modular models (see Strohner, 2003, for an overview of different model types).

[10] Similar *economy* principles are assumed by other authors, as e.g. *Minimal Everything* by Inoue and Fodor, 1995. Gorrell (1995) proposes a parsing principle called *Simplicity*: 'No vacuous structure building'.

(4) *Late Closure*

If grammatically permissible, attach new items into the clause or phrase currently being processed (i.e. the phrase or clause postulated most recently).

Empirical evidence for these parsing principles is provided by garden-path effects for sentences like (1). According to *Minimal Attachment*, the parser builds the minimal syntactic structure which is the main clause analysis. The last incoming word cannot be integrated into the structure. Therefore, the parser has to *reanalyze* the phrase structural representation. Reanalysis represents the second processing stage in the garden-path model (second pass parse). In this phase, thematic, semantic and pragmatic information is also consulted to evaluate the syntactic analyses of the first pass parse. Not only syntactic incongruency initiates reanalysis; other types of (non-)linguistic information can also signal misanalyses. An example for this phenomenon is given in (5) (Rayner, Carlson and Frazier, 1983).

(5) The spy saw the cop with the revolver.

To sum up, the garden-path model assumes two temporally dissociated processing stages: First, a syntactic structure is built on the basis of syntactic information (word category, X-bar) solely. This phrase structure representation is evaluated by means of different types of linguistic and (non-)linguistic information. However, other models assume that non-syntactic information is indeed involved in initial structure building.

3.1.2 The Referential-Support Model

Crain and Steedman (1985) and Altmann and Steedman (1988) presume a parallel processing mechanism. In case of ambiguity, the parser computes all possible syntactic structures and chooses one of them by means of semantic and pragmatic information. The authors assume that, during language comprehension, the hearer constructs a *discourse model*, i.e. a mental representation of the discourse in which

referents of linguistic expressions are established. The selection of one syntactic structure is guided by two principles (Altmann and Steedman, 1988, p. 201ff):

(6) *The Principle of Referential Support*
An NP analysis which is referentially supported will be favoured over one that is not.

An analysis receives referential support by a specific context. For the sentence in (1), this principle would predict that the main clause analysis is supported by a context in which only one horse is mentioned whereas the reduced relative analysis is supported by mentioning more than one horse. In this case, the reduced relative singles out one referent from a set of alternatives.

For the processing of sentences without a preceding context, another principle was formulated:

(7) *The Principle of Parsimony*
A reading which carries fewer unsupported presuppositions will be favoured over one that carries more.

This principle correctly predicts processing difficulties for the garden-path sentence in (1). The main clause analysis presupposes only one horse, whereas the reduced relative analysis triggers a more complex presupposition with a set of horses (see Crain and Steedman, 1985).

In conclusion, the two different processing models make the same predictions with regard to processing difficulties on the sentence level. For the processing of contextually embedded sentences, however, the predictions differ. The garden-path model predicts that there should be no influence of referential support on initial parsing. In contrast, the prediction of the referential-support model is that

processing difficulties should disappear, or at least become smaller, when a non-minimal analysis is supported by a specific context. For English, a lot of empirical evidence for both predictions has been accrued (e.g., Altmann and Steedman, 1988; Rayner, Carlson and Frazier, 1983; Rayner, Garrod and Perfetti, 1992), and therefore, no final decision with respect to the psychological validity or adequateness of these two alternative views can be made. In the next section, the two models will be evaluated on the basis of studies that investigated the processing of word order variations in German and Dutch.

3.2 Syntactic Preferences in the Processing of Word Order Variations

Word order variations are one of the most extensively investigated phenomena in German sentence processing research. In contrast to English, German has a relatively free word order (see chapter 2). Flexible word order allows the surface position of a verbal argument in a sentence to be dissociated from its syntactic function. Several types of word order variations can be differentiated. Psycholinguistic research most frequently considered three types of structures: relative clause ambiguities, topicalization and scrambling. Studies which investigated relative clauses with ambiguous relative pronouns in German have shown evidence for a preference for a subject-initial reading (Friederici, Mecklinger, Spencer & Donchin, 2001; Mecklinger, Schriefers, Steinhauer & Friederici, 1995; Schriefers, Friederici & Kühn, 1995). This preference was also observed for Dutch (Frazier, 1987b; Mak, 2001; Van Gompel, 1995). Additionally, there is evidence for a subject-before-object preference for topicalized DPs in German and Dutch (Bayer & Marslen-Wilson, 1992; Farke, 1994; Frazier & Flores d'Arcais, 1989; Frisch, Schlesewsky, Saddy & Alpermann, 2002; Hemforth, 1993; Kaan, 1997; Muckel, 2002; Meng, 1995; Meng & Bader, 2000a; Scheepers, Hemforth & Konieczny, 2000; Schlesewsky, Fanselow, Kliegl & Krems, 2000). In the following section, we will focus on the processing of scrambled sentences. In this section, I will only discuss studies which used behavioral measures (ratings,

questionnaires, reaction times, eye movements). Neuropsychological studies on the processing of word order variations will be discussed in chapter 4.

Studies on scrambling have investigated both ambiguous and unambiguous sentence types. The processing of both types revealed a clear and robust preference for the canonical word order[11].

In a series of experiments using sentences with case marked DPs and different behavioral methods, Pechmann, Uszkoreit, Engelkamp and Zerbst (1994, 1996) found a clear preference for the canonical word order in sentences with ditransitive verbs in comparison to scrambled sentences (see examples in (8))[12].

(8a) Dann wird der Dirigent dem Geiger den Taktstock geben.
Then will the$_{nom}$ conductor the$_{dat}$ violinist the$_{acc}$ baton give

(8b) Dann wird den Taktstock der Dirigent dem Geiger geben.
Then will the$_{acc}$ baton the$_{nom}$ conductor the$_{dat}$ violinist give
'Then, the conductor will give the baton to the violinist.'

In these examples, the parser can assign the syntactic functions on the basis of explicit case marking on the determiners, *der* versus *dem* versus *den*. But why is it that the processing of the non-canonical sentences lead to measurable difficulties? This can be explained by recourse to the movement account of scrambling. As illustrated in the examples in (8'), the syntactic structure of the canonical word order is less complex than the structure of the scrambled word order. In comparison to (8a'), (8b') involves a trace in the base position of the accusative object.

(8a') [$_{CP}$ Dann [$_{C'}$ wird [$_{VP}$ der Dirigent [$_{V'}$ dem Geiger [$_{V'}$ den Taktstock geben]]]

(8b') [$_{CP}$ Dann [$_{C'}$ wird [$_{VP}$ den Taktstock$_i$ [$_{V'}$ der Dirigent [$_{V'}$ dem Geiger [$_{V'}$ t$_i$ geben]]]]

[11] In the following, I will use the term *canonical* for the order subject-before-object and *scrambled* for the order object-before-subject.

[12] The authors investigated the six possible different orders and found graded acceptability judgments. This result is interpreted as evidence for the order rules formulated by Uszkoreit (1986).

The existence of traces can also explain processing difficulties in locally ambiguous sentences. Meng and Bader (2000b) investigated word order variations in embedded wh-clauses like (9). Feminine or neuter DPs are lexically ambiguous between nominative and accusative case, and therefore give rise to locally ambiguous sentences as in (9).

(9a) Alle wollten wissen, welche Politikerin$_i$ t$_i$ die Minister getroffen *hat*.
All wanted know which politician$_{nom}$ the minister$_{acc}$ met has
'Everyone wanted to know which politician had met the ministers.'

(9b) Alle wollten wissen, welche Politikerin$_i$ die Minister t$_i$ getroffen *haben*.
All wanted know which politician$_{acc}$ the ministers$_{nom}$ met have
'Everyone wanted to know which politician the ministers had met.'

In the examples in (9), there is no explicit case marking on the determiners. Both DPs can be either nominative or accusative, but the first DP is marked for singular, the second for plural. The sentences are locally ambiguous until the number information of the finite verb (the auxiliaries *hat* ('has') vs. *haben* ('have')) can be accessed. The requirement of subject-verb agreement unambiguously tells the parser which of the DPs is the subject of the sentence. The authors used the method of *speeded grammaticality judgments* which requires participants to judge the grammaticality of a sentence as quickly and as accurately as possible. The results revealed a preference for the canonical word order subject-before-object. Error rates and reaction times were higher for the non-canonical word order. This result is compatible with a parsing principle which was formulated in the framework of the serial and modular garden-path model (see section 3.1.1) in which parsing preferences are explained in purely syntactic terms.

(10) *Active Filler Hypothesis*

When a filler of a category XP has been identified in a non-argument position, such as COMP, rank the option of assigning its corresponding gap to the sentence over the option of identifying a lexical phrase of category XP. (Clifton and Frazier, 1989, p. 292)

The Active-Filler Hypothesis, originally formulated to explain evidence from the processing of relative clauses in Dutch (Frazier, 1987b) can also be applied to word order variations like the examples in (9). When the parser identifies the moved wh-phrase, the *filler*, it assigns the corresponding *gap* or trace as soon as possible, i.e. at the base position of the subject. When the parser arrives at the auxiliary in (9b), which signals the object-before-subject order, it has to reanalyze the previously established syntactic structure. The gap has to be reassigned to the base position of the object.

Several behavioral studies have reported processing difficulties also for ambiguous scrambled sentences like (11b) in comparison to the canonical word order in (11a) (e.g., Bader, 1996; Bader and Meng, 1999; Scheepers, 1998)

(11a) Anna hat behauptet, dass die Tante die Nichten begrüßt *hat.*
Anna has claimed, that the aunt $_{nom}$ *the nieces*$_{acc}$ *welcomed has*
'Anna has claimed that the aunt has welcomed the nieces.'

(11b) Anna hat behauptet, dass die Tante$_i$ die Nichten t_i begrüßt *haben.*
Anna has claimed, that the aunt$_{acc}$ *the nieces*$_{nom}$ *welcomed have*
'Anna has claimed that the nieces have welcomed the aunt.'

The *Active Filler Hypothesis* cannot be applied to this type of structure, because no active filler can be identified in first-pass parsing. In contrast to a wh-phrase, a DP like *die Tante* ('the aunt') can either be in its base position like in (11a) or can be scrambled like in (11b). Starting from the Active Filler Hypothesis, De Vincenzi (1991) formulated a parsing principle to capture experimental results from the

processing of ambiguities in Italian that can also be applied to subject-object ambiguities involving scrambling:

(12) Minimal Chain Principle

Avoid postulating unnecessary chain members at Surface-Structure, but do not delay required chain members.

This principle predicts the occurrence of a garden-path effect for sentences with non-canonical word order again on the basis of syntactic information only: The preferred syntactic representation is contradicted at the point of disambiguation, and therefore reanalysis becomes necessary. The task of reanalysis can be described as the introduction of a filler-gap dependency into the phrase structure.

To sum up, the processing difficulties observed with scrambled sentences can be explained by models which assume that the parser chooses only one syntactic structure in first-pass parsing by means of syntactic principles like *Minimal Attachment* or the *Minimal Chain Principle*. These principles, which correctly predict garden-path phenomena in sentences described above on the basis of phrase structural representations only, have problems explaining differences in the strength of a garden-path effect, i.e. the difficulty of recovering from a garden-path. Regarding the processing of word order variations, this issue will be discussed in the next section.

3.3 Garden-path strength in the processing of word order variations

In the last years, several studies have shown that garden-path strength can be influenced by different types of non-syntactic information, e.g. semantic information, the point of disambiguation, and prosody (see e.g., Fodor and Inoue, 1994, 2000; for an overview, see Fodor and Ferreira, 1998). In what follows, I will focus on the effects of morphological and contextual information on the ease of

reanalysis in the processing of word order information. Furthermore, the effects of different DP types will be discussed.

3.3.1 Morphological Information: Case versus Number Agreement

Meng (1998), Meng and Bader (2000b), and Schlesewsky, Fanselow, Kliegl and Krems (2000) have presented evidence that the type of morphological information which disambiguates subject-object ambiguities plays an important role for the ease of reanalysis. These studies show that disambiguation by subject-verb agreement via number (see example 13) leads to stronger garden-path effects in the non-canonical word orders ((13b) and (14b)) than disambiguation by case (see example (14), Bader, Meng, Bayer and Hopf, 2001, pp. 273f).

(13a) Ich weiß nicht, welche Frau$_i$ t$_i$ die Professoren *besuchte*.
I know not, which woman the professors visited$_{sg}$
'I don't know, which woman visited the professors.'

(13b) Ich weiß nicht, welche Frau$_i$ die Professoren t$_i$ *besuchten*.
I know not, which woman the professors visited$_{pl}$
'I don't know, which woman the professors visited.'

(14a) Ich weiß nicht, welche Frau$_i$ t$_i$ *den* Professor besuchte.
I know not, which woman the$_{acc}$ professor visited
'I don't know, which woman the professor visited.'

(14b) Ich weiß nicht, welche Frau$_i$ *der* Professor t$_i$ besuchte.
I know not, which woman the$_{nom}$ professor visited
'I don't know, which woman visited the professor.'

This difference is not predicted on the basis of the phrase structural representation. In both sentences (13b) and (14b), the parser has to reassign the syntactic functions and has to introduce a new filler-gap dependency.

Fodor and Inoue (2000) explained this phenomenon in the framework of their *diagnosis model* (Fodor and Inoue, 1994). This model, which is also serial and

modular like the garden-path model, explains differences in garden-path strength for non-preferred structures at the cost of deducing which structural alterations are needed. This *ease of diagnosis* depends on the effectiveness or informativeness of the *symptom*, that is, the element signaling an error in a particular structure. Reanalysis is easy whenever the detected problem points the parser's attention back to the original error in the first-pass parse and shows how to fix it. Fodor and Inoue (2000) assume that the informativeness of case differs from that of number. Whereas the 'wrong' case of the second DP in (14b) directly leads to a change of the case of the ambiguous first DP, the 'wrong' number information of the auxiliary in (13b) leads to the same result indirectly. In contrast to case, the number of a DP is a feature which cannot be changed. Therefore, the parser has to recognize via subject-verb agreement that the repair of the structure requires a change of case.

It could be shown that not only phrase structural information plays a role for reanalysis, but also morphosyntactic features like case and number. This observation is compatible with a serial and modular parser. In the following two sections, we will see whether information structural manipulations can influence syntactic processing which would be evidence against a modular parser.

3.3.2 Contextual information

Bayer and Marslen-Wilson (1992) investigated globally ambiguous sentences like (16) in a *self-paced reading* study. With this method, words or phrases are presented to participants who determine the pace of presentation of the segments by themselves. The sentences were preceded by a context like (15) which supports an object-before-subject reading of (16) (see Bayer and Marslen-Wilson, 1992, pp. 19f).

(15) *OS supporting context*

Neulich gab es einen Brand in der Innenstadt. In der Zeitung stand, dass eine Frau von Feuerwehrmännern aus ihrer brennenden Wohnung befreit wurde.

'Recently there was a fire somewhere in the city. The newspaper said that the fire-brigade freed a woman from her burning apartment.'

(16) Später stellte sich heraus, dass die Frau die Hausmeisterin gerettet hat.

Later it turned out that the woman $_{nom/acc}$ *the janitor* $_{nom/acc}$ *rescued has.*

'Later it turned out that it was the woman who rescued the janitor.'

'Later it turned out that it was the janitor who rescued the woman.'

The authors found no evidence for contextual influences on the subject-first preference. The contexts which support the object-before-subject reading did not reduce the subject-first preference for globally ambiguous sentences. This can be interpreted as evidence against an interactive model like the referential-support model (see section 3.1.2). This model assumes that contextual information should influence the selection of the syntactic structure for ambiguous sentences. However, closer inspection of the example reveals that the absence of contextual influences could also be attributed to the fact that both word orders are possible continuations of the preceding context which is shown in the examples in (17).

(17a) *OS order*

Später stellte sich heraus, dass die Frau [die HAUSmeisterin]$_{CF}$ t_i gerettet hat.

Later it turned out that the woman the janitor rescued has.

'Later it turned out that it was the janitor who rescued the woman.'

(17b) *SO order*

Später stellte sich heraus, dass [die FRAU die HAUSmeisterin]$_{CF}$ gerettet hat.

Later it turned out that the woman the janitor rescued has.

'Later it turned out that it was the woman who rescued the janitor.'

The contrastively focused constituent can either be 'the janitor', which corrects the claim that it was the fire-brigade which rescued the woman, or, alternatively, 'the janitor' and 'the woman' can be contrastively focused, which corrects the claim that it was the woman who was rescued and that the fire-brigade was the rescuer.

Another self-paced reading experiment which investigated context effects on the processing of scrambled sentences was reported by Meng, Bader and Bayer (1999). The authors used locally ambiguous and unambiguous sentences which were preceded by a neutral context or a focusing wh-question.

(18a) *neutral context*

Was war gestern los?

'What happened yesterday?'

(18b) *SO-supporting context*

Wen hat der Opa/die Oma besucht?

'Who the grandfather/the grandmother visited?'

(18c) *OS-supporting context*

Wer hat den Opa/die Oma besucht?

'Who visited the grandfather/the grandmother?'

(19a) *SO order*

Ich glaube, dass der Opa/die Oma einige der Kinder besucht hat.

I believe that the$_{nom}$ grandfather/the grandmother$_{nom}$ some of the children$_{acc}$ visited has.

'I believe that the grandfather/grandmother visited some of the children.'

(19b) *OS order*

Ich glaube, dass den Opa/die Oma einige der Kinder t_i besucht haben.

I believe that the$_{acc}$ grandfather/the grandmother$_{/acc}$ some of the children$_{nom}$ visited have.

'I believe that some of the children visited the grandfather/grandmother.'

The results show that the processing difficulty for OS structures like (19b) disappear with an OS supporting context (18c) in comparison to the neutral context (18a), but only for the unambiguous sentences. The ambiguous OS sentences showed no influence of the supporting context.

First of all, these results demonstrated an effect of the focus structural manipulation by means of wh-questions. In unambiguous scrambled sentences, processing difficulties disappeared when the subject was narrowly focused. In contrast, ambiguous scrambled sentences did not benefit from narrow focusing. Bader, Meng, Bayer and Hopf (2000) pointed out that this could be the result of a possible continuation of the OS-context by a sentence with canonical word order (see example (20))

(20) Ich glaube, dass die Oma von den Kindern besucht wurde.
I believe that the grandmother by the children visited was.
'I believe that the grandmother was visited by the children.'

At least on the first DP, a subject-before-object order is compatible with the context. Together with the structural subject-first preference, this could explain the fact that the processing of ambiguous scrambled sentences in a supporting context can still elicit a garden-path effect.

In this section, we saw that research regarding the processing of scrambled sentences in contexts provides rather inconclusive results. The same is true for other types of word order variations: In contrary to Bayer and Marslen-Wilson (1992) who also investigated topicalization, Weskott (2002) could show that context can influence the processing of non-canonical word orders. For the processing of relative clause ambiguities, Lipka, Kopp and Pechmann (2000) also found a context effect.

On the basis of these data, it cannot be decided whether contextual information influences the choice of a syntactic structure or not. We saw that the contexts used in the abovementioned studies are not restrictive enough: the sentences with OS-

order were not the only possible continuation. But nevertheless, the study by Bader et al. (1999) leads us to the conclusion that information structural manipulations can have an effect on the processing of scrambled sentences. In the following section, it will be shown that information structural characteristics dependent on DP type influence the processing of word order variations, and that they do so even in isolated sentences.

3.3.3 DP type information

Kaan (2001) investigated the processing of relative clauses in Dutch and could show that the referential status of DPs modulates the subject-first preference in Dutch. She used sentences like the examples in (21):

(21a) De buurjongen die **de meisjes** gisteren met een opmerking heeft proberen te pesten ..
The neighbour boy who the girls yesterday with a remark has tried to tease …
'The boy next door who tried to tease the girls with a remark yesterday …'

(21b) De buurjongen die **de meisjes** gisteren met een opmerking hebben proberen te pesten
The neighbour boy who the girls yesterday with a remark have tried to tease…
'The boy next door who the girls tried to tease with a remark yesterday …'

(21c) De buurjongen die **jullie** gisteren met een opmerking heeft proberen te pesten …
The neighbour boy who you-(pl) yesterday with a remark has tried to tease …
'The boy next door who tried to tease you with a remark yesterday …'

(21d) De buurjongen die **jullie** gisteren met een opmerking hebben proberen te pesten …
The neighbour boy who you-(pl) yesterday with a remark have tried to tease …
'The boy next door who you tried to tease with a remark yesterday …'

The second DP in the relative clause, the DP after the relative pronoun, was either a definite referential DP (*de meisjes* – 'the girls') or a pronoun (*jullie* – 'you'). Since the pronouns were always deictic, they had no explicit antecedent in the sentences itself. The sentences were locally ambiguous with respect to word order. The number marking of the finite verb determined whether the relative clause was a subject-first (*heeft* – 'has') or object-first (*hebben* – 'have') structure.

In a self-paced reading experiment, Kaan found, besides a penalty for both OS sentences, a difference between sentences (21b) and (21d), the OS sentences with a referential DP and those with a pronoun. Reading times measured after the finite verb revealed that the subject-first preference was significantly smaller in the sentences with pronouns than in the sentences with referential DPs. Her explanation of this effect refers to information structural notions. It applies to the difference in the discourse status of the DPs' referents. Both definite DPs and pronouns tend to refer to *given information,* that is, to elements which are familiar to the hearer. In contrast to definite DPs, pronouns have a stronger tendency to refer to discourse-salient entities or discourse topics, which are more frequently encoded as subjects than non-subjects (Ariel, 1990; Givón, 1983; see also section 2.3.2). Further evidence in support of the specific status of pronouns comes from a series of studies that showed a clear preference for interpreting pronouns as coreferent with the subject as the default topic (e.g., Brennan, 1995; Reinhart and Reuland, 1991). In addition, pronouns themselves occur in subject position more often than referential DPs (Prince, 1992). The results of these different studies lead to the conclusion that it is more likely for a pronoun to be the subject than for a referential DP.

Bader and Meng (1999) looked into the processing of German scrambled sentences with referential DPs in comparison to sentences with moved pronouns. Like in Kaan's (2001) study, the sentences were disambiguated by the number information of the finite verb. In contrast to the Dutch sentences, the pronoun was the first DP in a complement clause and was coreferent with the subject in the matrix clause (see example (22) and (23); Bader and Meng, 1999, p. 127):

Scrambling

(22a) Die Direktorin hat erzählt, dass **die neue Lehrerin** einige der Kollegen angerufen hat.
The director has said, that the new teacher some the colleagues phoned has
'The director said that the new teacher phoned some of the colleagues.'

(22b) Die Direktorin hat erzählt, dass **die neue Lehrerin**$_i$ einige der Kollegen t_i angerufen haben.
The director has said, that the new teacher some the colleagues phoned have
'The director said that some of the colleagues phoned the new teacher.'

Pronoun movement

(23a) Die Direktorin hat erzählt, dass **sie** einige der Kollegen angerufen hat.
The director$_{fem}$ has said, that she some the colleagues phoned has
'The director said that she phoned some of the colleagues.'

(23b) Die Direktorin hat erzählt, dass **sie**$_i$ einige der Kollegen t_i angerufen haben.
The director$_{fem}$ has said, that she some the colleagues phoned have
'The director said that some of the colleagues phoned her.'

With a speeded grammaticality judgment task, they found a difference between OS-sentences with referential DPs as illustrated in (22b) and OS-sentences with pronouns as in (23b)[13]. Sentences with pronouns were judged as grammatical significantly more often than sentences with referential DPs. This difference was not predicted on the basis of Kaan's (2001) results. According to her interpretation, there should be a stronger subject-first preference for the sentences with a pronoun, which is prototypically coreferent with the subject, than for sentences with referential DPs. Bader and Meng (1999) interpreted the observed difference as a reflection of another information structural difference between the two conditions, namely the focus-background division. (see section 2.2.2). The sentences with pronouns are compatible with the same focus structure, independent of word order, whereas sentences with referential DPs require a change of their information

[13] Note that the syntactic representation of (23a) given by Bader and Meng (1999) is incomplete. The SO-sentence with the pronoun also includes a trace as illustrated in (i) (see section 2.3.1):
(i) Die Direktorin hat erzählt, dass sie$_i$ t_i einige der Kollegen angerufen hat.
I will come to this fact in the discussion of my first experiment in section 5.1.3.

structural representation as a function of word order, more precisely, a change of focus structure in the OS order as illustrated in (22') and (23')[14].

(22') *wide focus*: Was hat die Direktorin erzählt? *What did the director say?*
(22a') Die Direktorin hat erzählt, dass [die neue Lehrerin einige der Kollegen angerufen hat]$_F$
(22'') *narrow focus*: Wer hat die neue Lehrerin angerufen? *Who did call the new teacher?*
(22b') Die Direktorin hat erzählt, dass die neue Lehrerin$_i$ [einige der Kollegen]$_F$ t_i angerufen haben.

(23') *wide focus*: Was hat die Direktorin erzählt? *What did the director say?*
(23a') Die Direktorin hat erzählt, dass *sie* [einige der Kollegen angerufen **hat**]$_F$
(23b') Die Direktorin hat erzählt, dass *sie$_i$* [einige der Kollegen t_i angerufen **haben**]$_F$

The sentence (22a') with canonical word order has a wide focus reading. The whole complement clause is new information and hence the focus of the sentence. It is a suitable answer to the wide focus question (22')[15]. (22b') requires narrow focus on the second DP, the subject, and is a suitable answer to the narrow focus question (22''). (23a') and (23b') are both suitable answers to the wide focus question in (23'). The wide focus includes the complement clause beginning with the second DP. The pronoun itself belongs to background information, as it is coreferent with the first DP of the sentence (*die Direktorin*).

According to Bader and Meng, the following picture arises for the processing of subject-object ambiguities in German complement clauses: The parser prefers the SO order for both DP types. The canonical word order corresponds to a wide focus reading. If the parser arrives at the auxiliary in sentences with non-canonical word order, it has to reanalyze the syntactic structure by means of establishing a filler-gap dependency. In OS-sentences with referential DPs, an additional revision of the

[14] The examples are the same as the sentences in (22) and (23), where the reader is referred to for translations. It has to be noted that the focus structural representation in (22b') is not the only possible one. As illustrated in (i), the focus of the sentence could also include the verb.
(i) Die Direktorin hat erzählt, dass die neue Lehrerin$_i$ [einige der Kollegen t_i angerufen haben]$_F$
[15] (22a') could also be a suitable answer to the question '*What happened?'* with the whole sentence in focus.

focus structure is required which is not necessary for sentences with pronouns. The consideration of focus structural characteristics of scrambled sentences explains the processing differences caused by different DP types.

But how are these results compatible with Kaan's (2001) explanation of her findings? She would predict the reverse pattern for the sentences used by Bader and Meng (1999). According to her results, there should be a stronger subject preference in the sentences with pronouns than in the sentences with referential DPs: The structural position of the pronoun as well as its discourse status supported a subject interpretation. If we look again at the sentences in (3) used by Kaan (2001), it is obvious that there is no focus structural difference between the sentences with referential DPs and the sentences with pronouns. Kaan observed a bias towards a subject interpretation of pronouns as the second argument in a relative clause in comparison to referential DPs. According to the results of Bader and Meng (1999), this bias seems to be superimposed by focus structural revision, which is only necessary for complement clauses with referential DPs, but not for those with pronouns.

One problem for an integrative interpretation of the two studies is the fact that the studies were conducted in different languages (Dutch vs. German) and with different sentence structures (relative clauses with a preceding topicalized DP and a deictic pronoun vs. complement clauses with an anaphoric pronoun preceded by a matrix clause). A further difference between the two studies concerns the interpretation of their results: Whereas Kaan assumes that information structure influences syntactic processing directly, and takes her results to support an interactive model, Bader and Meng argue that their results are compatible with a modular model. Focus structural characteristics do not influence syntactic reanalysis, but elicit an additional type of revision process.

3.4 Summary and Outlook

It has been shown that garden-path effects in the processing of word order variations that were reported in several studies can be explained (1) by the structural assumptions put forward in chapter 2, namely the postulation of traces in scrambled sentences, and (2) by assumptions concerning the architecture of the parser, that is, by assuming a serial parser.

Differences of garden-path strength dependent on morphosyntactic information can also be captured by a serial and modular model (diagnosis model). Studies which investigated contextual influences on parsing showed rather incompatible results. It remains an open question whether discourse information can influence first-pass parsing which would support interactive models like the referential-support model (this point will be further discussed in section 8.2).

Studies on DP type effects also provide inconclusive results. Evidence for two different processing preferences dependent on DP type are reported. The question arises whether it is possible to find evidence for different information structural influences on processing (focus structure vs. the DPs' discourse status) in the same language and the same linguistic structure. A second question concerns the independency of syntactic processing: Do the referential and focus structural characteristics of different DP types influence syntactic processing directly (which would support an interactive model), or are they processed independently (which would support a modular model)?

I tried to answer this question by using event-related brain potentials (ERPs), a fine-grained, online measurement with high temporal resolution, which allows for the differentiation of distinct processes in a multi-dimensional fashion. Before turning to the description of my three ERP experiments, the experimental method will be described in more detail, and a neurocognitive model of language comprehension will be discussed. Additionally, ERP studies which investigated subject-object ambiguities will be reported. These results, together with the studies already reported, will form the background against which the predictions for my own study will be formulated.

CHAPTER 4

The Neurocognitive Perspective on Language Processing

As described in the preceding chapter, a large portion of the work in psycholinguistics has tried to determine the time-course of the different types of processes involved in language comprehension. Parsing models differ with regard to the (in-)dependency of syntactic processing from other types of linguistic and non-linguistic processes. To investigate the interplay of syntactic and focus structural representations during the processing of word order variations with different DP types, I chose a neurophysiological method, namely the measurement of event-related brain potentials (ERPs). ERPs are a fine-grained, online measurement of the brain's activity with high temporal resolution which allows for the differentiation of distinct processes in a multi-dimensional fashion.

In section 4.1, a short description of the method will be given. Section 4.2 introduces ERP components correlated with the processing of language. A neurocognitive model of language comprehension will be discussed in section 4.3. The last section 4.4 gives an overview of studies which investigated the processing of word order variations using ERPs.

4.1 Measuring Event-Related Brain Potentials

Event-related brain potentials (ERPs) are small changes in the electrical activity of the brain, which occur in response to visual or cognitive events and which are obtained by using electrodes placed on the scalp. This non-invasive measurement technique is illustrated in Figure 4.1. A sentence is visually or auditorially presented to a participant. While he or she reads or hears the sentence, the ongoing electroencephalogramm (EEG) is recorded. The potential changes which can be elicited by visual or auditory stimuli are much smaller than the background activity of the brain and can hardly be identified in the continuous EEG. By averaging

portions of the EEG time-locked to the onset of repeated stimuli of the same type, a characteristic pattern of waveforms, the ERPs, can be extracted from the background noise.

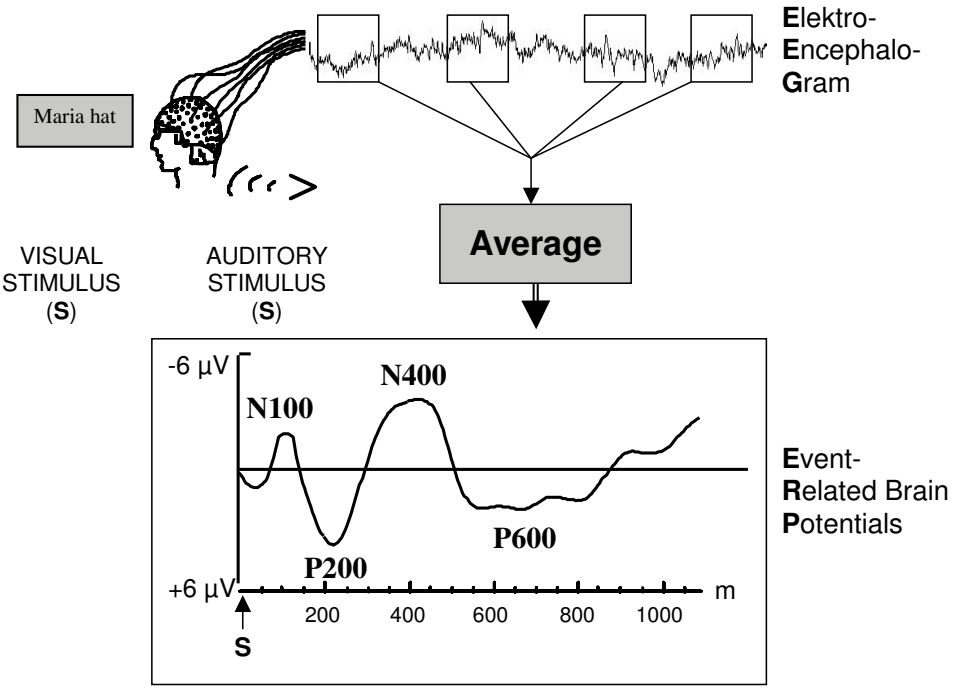

Figure 4.1: EEG measurement and averaging and idealized ERP components

The basic assumption underlying ERP research is that different types of experimental manipulations elicit different patterns of brain activity. ERP patterns or components can be characterized by means of the following parameters: *polarity* (negative vs. positive), *topography* (the distribution over the scalp), *latency* (the time -onset, peak and duration- at which the effect is visible) and *amplitude* (the "strength" of the effect). The parameters that are most often used to name ERP components are the polarity and the peak latency (N100, P200, N400, P600; see Figure 4.1). Note that throughout this work, negativity is plotted upwards and

positivity is plotted downwards. Early ERP components like N100 and P200 are called *exogenous* components. Whereas exogenous ERP components are mainly driven by physical properties of the stimulus, later *endogenous* components like N400 and P600 reflect cognitive processes, which are dependent on the general state of the participant, attentional processes, experimental task, and so on (e.g., Coles and Rugg, 1995; Regan, 1989) [16].

In the following, several ERP components will be introduced which were correlated with functionally different processes in the domain of sentence processing.

4.2 ERPs in Sentence Processing

The first ERP component that can be connected to language processing is the *N400 component*, a negative deflection which appears typically between 300 and 500 ms after the presentation of the critical word at centro-parietal electrode sites[17]. This component which was first reported by Kutas and Hillyard (1980), is correlated with *semantic* processing. This component occurs with the processing of semantic anomalies, e.g. a semantically inappropriate word which does not fit in the preceding context (see example (1))[18].

(1) He spread the warm bread with <u>socks</u>.

In the field of sentence processing, the N400 is interpreted as reflecting difficulties with the integration of a new word in the current semantic representation of the sentence. Though the integration of a content word generally gives rise to this component, this deflection becomes more pronounced with a higher degree of

[16] The described differentiation between exogenous and endogenous components is not uncontroversial. It has been shown that the N100 and P200 are also sensitive to attentional processes (e.g., Näätänen, 1992; Woldorff, Hansen and Hillyard, 1987).

[17] ERPs only provide relative measures, i.e., an effect results from the comparison of two conditions which minimally differ before or on the critical word. For the description of the experiments in this section, I will only cite the critical 'anomalous' conditions.

[18] Words or positions in a sentence at which the effect under discussion was measured or will be expected are underlined.

unexpectedness (*cloze probability*, see Taylor, 1953) of the critical word (Kutas and Hillyard, 1984). In addition, different types of lexical-semantic manipulations modulate the N400, e.g., word frequency (Van Petten and Kutas, 1990), repetition (Van Petten, Kutas, Kluender, Mitchiner and Mc Carthy, 1994), lexical status (Nobre and McCarthy, 1994) and discourse context (van Berkum, Hagoort and Brown, 1999; Salmon and Pratt, 2002).
An N400 was also observed for violations of argument structure like in example (2) (see Friederici and Frisch (2000).

(2) *Anna weiß, dass der Kommissar den Banker abreiste.
Anna knows that the inspector$_{nom}$ *the banker*$_{acc}$ *departed*

After two verbal arguments, an intransitive verb like *abreisen* ('to depart') which only requires one argument, cannot be integrated in the sentence context.

For *syntactic* processing, three components have been identified: an *early left anterior negativity* (ELAN), a later *left anterior negativity* (LAN) and a *late posterior positivity* (P600).
The ELAN component, a negative waveform which is observable between 150 and 200 ms post onset of the critical word, has been found to occur with phrase structure violations (see example (3), Hahne and Friederici, 2002)

(3) *Das Eis wurde im gegessen.
The ice cream was in-the eaten

Sentence (3) is ungrammatical because of the unfulfilled phrase-structural requirements of the preposition. The preposition has to be followed by a noun phrase, but is actually followed by the sentence-final verb.
The ELAN has been observed for sentences with regular words (e.g., Hahne, 2001; Hahne and Friederici, 2002; Friederici, Pfeifer, & Hahne, 1993; Neville, Nicol,

Barss, Foster, & Garrett, 1991) as well as for sentences with morphologically marked pseudowords (Hahne and Jescheniak, 2001).

The second ERP component that is correlated with syntactic processing is also a left-anterior negative component, but appears later than the ELAN component and is called the LAN. This component is generally observed between 300 and 500 ms and appears with morphosyntactic violations of subject-verb agreement (Kutas and Hillyard, 1983; Osterhout and Mobley, 1995, see example (4)).

(4) *The elected officials hopes to succeed.

This component was also found for violations of gender agreement in determiner phrases (Gunter, Friederici and Schriefers, 2000) and case marking (Friederici and Frisch, 2000). Although in most of the studies the LAN appeared at left anterior electrode sites, studies which investigated morphosyntactic violations also showed negativities that had quite different distributions: Friederici and Frisch (2000) found a left-lateralized negativity in the central region after a case marking violation and Kaan (2002) revealed a bilaterally distributed negativity at central and posterior sites after a subject-verb agreement error.

The third ERP pattern that is associated with syntactic processing is the P600 component, a positive deflection which develops from 500 ms onwards. It has been found for non-preferred syntactic structures in garden-path sentences (Hagoort, Brown and Groothusen, 1993; Osterhout and Holcomb, 1992, 1993; see example (5)).

(5) The broker *persuaded* to sell the stock was sent to jail.

In example (5), the verb *persuaded* is ambiguous between a main verb and a reduced relative clause interpretation. As discussed in Chapter 3, the main verb

interpretation is strongly preferred by the parser. Severe processing difficulties were observed in the disambiguating region in behavioral studies and were interpreted as the reflection of reanalysis of the previously built structure. Therefore, the finding of a P600 at such positions is also correlated with reanalysis. The P600 component was also observed for subject-object ambiguities in German. A detailed description of these studies will follow in section 4.4.

The P600 has been found not only for non-preferred syntactic structures in garden-path sentences, but also for different kinds of syntactic violations, often in combination with one of the aforementioned negativities (e.g., Coulson, King and Kutas, 1998; Friederici and Frisch, 2000; Gunter et al., 2000). It seems that the reanalysis processes reflected by this component are always initiated, regardless of whether a reanalysis is effective in the specific sentence context or not. P600 effects are not only found in correlation with reanalysis processes, but they are also elicited by increased syntactic integration costs (Kaan, Harris, Gibson and Holcomb, 2000; Fiebach, Schlesewsky and Friederici, 2001) and a higher degree of syntactic complexity (Friederici, Hahne and Saddy, 2002). Friederici et al. (2002) could show that the distribution of the P600 varies with the type of process involved. Whereas the complexity-related positivity appeared at frontal electrode sites, the repair- or reanalysis-related positive waveform was more centroparietally distributed. The P600 does not only vary with regard to its distribution, but also in its time-course. The different temporal characteristics appeared with the processing of different types of word order variations will be discussed in section 4.4.

A correlate of *prosodic* processing, the so-called *Closure Positive Shift* (CPS), has been observed in correlation with prosodic phrasing. This ERP component occurred 200-400 ms after an intonational phrase boundary (indicated by #, see examples in (6)) in acoustic sentence material (Steinhauer, Alter and Friederici, 1999; Steinhauer, 2003), as well as after an intonational phrase boundary induced by a comma in visual material (Steinhauer and Friederici, 2001; Steinhauer, 2003).

(6a) Peter verspricht Anna zu arbeiten # und das Büro zu putzen.
Peter promises Anna to work and the office to clean
'Peter promises Anna to work and to clean the office.'

(6a) Peter verspricht # Anna zu entlasten # und das Büro zu putzen.
Peter promises Anna to relieve and the office to clean
'Peter promises to relieve Anna and to clean the office.'

The verb *verspricht* ('to promise') is ambiguous between a transitive interpretation in (6a) and an intransitive interpretation in (6b). The prosodic cues, i.e., the presence or absence of an intonational phrase boundary, provide information about the interpretation of the ambiguous verb and the underlying syntactic structure. Steinhauer et al. (1999) could show that prosodic boundaries are interpreted as phrase structural boundaries. They found an N400 and a P600 component for sentences with a incongruent intonational phrase boundary (see example (7)).

(7) Peter verspricht # Anna zu arbeiten # und das Büro zu putzen.
Peter promises Anna to work and the office to clean
'Peter promises Anna to work and to clean the office.'

This indicates that participants first detected the mismatch between the argument structure of the intransitive verb *zu arbeiten* ('to work') and the preceding context resulting in lexical integration problems reflected by the N400 and syntactic reanalysis reflected by the P600.

In the next section, a neurocognitive model of language comprehension will be described which associtates the ERP components just described to different processing stages.

4.3 A Neurocognitive Model of Language Comprehension

Friederici (1999, 2002, to appear) proposes a neurocognitive model of language comprehension. This model, referring to the Garden-Path Model (Frazier, 1987b, Frazier and Rayner, 1982, see section 3.3.1), assumes different independent stages in language processing.

Phase 1, which is associated with the ELAN component, corresponds to the stage of *first pass parse* in the Garden-Path Model. The parser builds up the minimal syntactic structure on the basis of pure syntactic information, namely word category information. If an incoming element does not fit the rules of the grammar (X-bar theory, see section 2.1), it cannot be integrated into the current structure.

In *Phase 2*, lexically based information becomes available, e.g. lexical meaning of content words, case and gender information, argument structure and thematic roles. In this stage, semantic and morphosyntactic integration (N400, LAN) processes take place in parallel, but independent of each other.

In *Phase 3*, which is correlated with the P600 component, syntactic, thematic and semantic representations are mapped onto each other. When the mapping of syntactic and interpretative representations fails, the parser has to reanalyze the syntactic structure. Based on the diagnosis model proposed by Fodor and Inoue (1994, see section 3.3), Friederici (1998) argued that the onset and duration of the P600 effect reflects different subprocesses during the structural revision process. The empirical evidences for this assumption will be discussed in the following section for the processing of word order variations in German.

The neurocognitive model just described assumes that the three processing phases work in a serial manner. However, the question arises whether and how processing difficulties in one phase affect processing in the next phase. Under the assumption of seriality, processes of Phase 1 may influence processes of Phase 2 and Phase 3, but not vice versa. A number of experiments demonstrate that this prediction is correct. These experiments crossed phrase structure violations either with semantic violations (Friederici, Steinhauer and Frisch, 1999; Hahne and Friederici, 2002, see

example (8)) or with argument structure violations (Frisch, Hahne and Friederici, 2004, see example (9)) on the critical item.

(8) *Die Burg wurde im gefüttert.
The castle was in-the fed.

(9) *Der Garten wurde am gearbeitet.
The garden was on-the worked

For the double violations in sentences like (8) and (9), the resulting ERP pattern is analogous to that found for a phrase structure violation alone (ELAN and P600). An N400, the correlate of semantic and argument structural violations, was not observed. This 'blocking' of the N400 by a phrase structural violation indicates that once the word category of an item does not fit in the current phrase structural representation, the parser abandons further lexical processing. These results further indicate that syntactic structure building precedes interpretative processes and that semantic or thematic processing cannot influence the first pass parse which is also in direct agreement with the Garden-Path Model. In contrast, these results are not compatible with interactive models like constraint-based models (e.g., McDonald, 1997; Tanenhaus et al., 2000; see section 3.1) which assume that all types of linguistic information are simultaneously applied.

In contrast to the serial dependency of Phase 1 and Phase 2, the temporal characteristics of the LAN and the N400 components associated to Phase 2 demonstrate that semantic and morphosyntactic information are processed in parallel. The question arises as to whether theses two processes interact. Gunter et al. (2000) investigated sentences like the examples in (10).

(10) Sie befährt den Land auf einem kräftigen Kamel.
she travels the$_{masc}$ land$_{neuter}$ on a strong camel

The experiment crossed a gender mismatch with a cloze probability manipulation at the position of the critical word and found both an LAN as a correlate of morphosyntactic processing and an N400 correlated with semantic processing. In addition, the authors could show that the N400 is not influenced by the gender mismatch and the LAN appeared independent of the semantic expectancy of the critical word. Similar results were shown by a study that also crossed syntactic and semantic violations at the critical word in Italian (De Vincenzi, Job, Di Matteo, Angrilli, Penolazzi, Ciccarelli and Vespignan, 2003; see also Friederici, Gunter, Hahne and Mauth, 2004). As the study by Gunter et al., this study also shows that semantic processes in Phase 2 influence processing in Phase 3. The results revealed a reduced P600 component for sentences like (10) where the critical word has a low cloze probability in comparison to words with a high cloze probability.

All in all, the reported results support models that take first pass parsing to be independent with regard to semantic information, and allow interpretative processes to come into play only at a later stage. In contrast, prosodic information influences initial structure building. Further studies have to be done to integrate prosodic processing, specifically the time course of processing different types of prosodic information, into the described neurocognitive model of language comprehension (see section 8.2 for a further discussion of this topic).

The results also show that semantic and syntactic processes work in parallel, but independently, at a second stage. An integration of these different types of information appears to take place in a third processing phase. If a mismatch between different types of representations appear, processes of reanalysis or repair are initiated.

With the background of the described neurocognitive model of language comprehension, the following section discusses ERP studies which investigated the processing of different types of word order variations.

4.4 ERPs and the Processing of Word Order Variations

As in the behavioral literature on the processing of word order variations, ERP studies investigated ambiguous as well as unambiguous sentence types (see chapter 3). There seem to be clear differences for the processing of sentences with unambiguously case marked DPs in comparison to the processing of sentences with case ambiguous DPs. Let us begin with studies that investigated unambiguous sentences with word order variations in German.

Rösler, Pechmann, Streb, Röder and Henninghausen (1998) investigated scrambled sentences, similar to the sentence material used by Pechmann et al. (1994, 1996, see section 3.2).

(11a) Dann hat der Vater dem Sohn den Schnuller gegeben.
Then has the$_{nom}$ father the$_{dat}$ son the$_{acc}$ pacifier given

(11b) Dann hat dem Sohn der Vater den Schnuller gegeben.
Then has the$_{dat}$ son the$_{nom}$ father the$_{acc}$ pacifier given

(11c) Dann hat den Schnuller der Vater dem Sohn gegeben.
Then has the$_{acc}$ pacifier the$_{nom}$ father the$_{dat}$ son given
'Then, the father gave the pacifier to the son.'

The results revealed a number of different effects. I will focus on an effect that was elicited by the first DP in sentences (11b), the dative object, and (11c), the accusative object in comparison to (11a), the subject. Sentences with scrambled word order in (11b) and (11d) showed a frontal negativity between 300 and 450 ms, with a slight asymmetry towards the left (see also Matzke, Mai, Nager, Rüsseler and Münte, 2002 for a comparable effect on a dislocated object in topicalized structures). The authors interpret this effect as an LAN component which they correlate with working memory load insofar as an argument that cannot be immediately assigned to its structural position must be held in working memory (for this interpretation of the LAN, see also King and Kutas, 1995; Kluender and Kutas, 1993) and argued against the perspective that scrambling is associated with purely

syntactic processing difficulties. For a further explanation of the LAN effect, they refer to the focus structural characteristics of scrambled sentences, i.e. to the difference between a wide and a narrow focus reading associated with canonical and non-canonical sentences (see section 2.2.2).

Schlesewsky, Bornkessel & Frisch (2003) investigated the same sentence types (see example (11)) and also found a widely distributed negativity between 300 and 450 ms (*scrambling negativity*) for scrambled DPs which they correlate, in contrast to the memory-load-explanation by Rösler et al., with pure syntactic processes. Evidence for this explanation came from another sentence type included in this study, namely sentences with moved pronouns, which revealed no negativity for dislocated pronominal objects (see examples in (12)).

(12a) Gestern hat er dem Sohn den Schnuller gegeben.
Yesterday has he$_{nom}$ the$_{dat}$ son the$_{acc}$ pacifier given
'Yesterday, he gave the pacifier to the son.

(12b) Gestern hat ihm der Vater den Schnuller gegeben.
Yesterday has him$_{dat}$ the$_{nom}$ father the$_{acc}$ pacifier given
'Yesterday, the father gave the pacifier to him.

(11c) Gestern hat ihn der Vater dem Sohn gegeben.
Yesterday has him$_{acc}$ the$_{nom}$ father the$_{dat}$ son given
'Yesterday, the father gave it to the son.

The authors argue that this result contradicts the explanation given by Rösler and colleagues. If the negativity would reflect increased memory load, it should also appear in non-canonical sentences with pronouns, since they also must be held in working memory until they can be integrated into their base position. The alternative explanation refers to syntactic differences between scrambled DPs and moved pronouns (*Wackernagelposition*, see section 2.3.1). Sentences with object pronouns in front of the subject DP are canonical sentences in comparison to

scrambled sentences. Nevertheless, even though this result is evidence against the memory-load explanation, the correlation of the negativity with focus structural differences between scrambled and non-scrambled sentences is still an alternative interpretation. In chapter 2, I argued that there are no syntactic differences between sentences with scrambled DPs and sentences with moved object pronouns. The different behavior can be explained in information structural terms. I will come back to this explanation for the negativity found in the two studies just described in the context of my own experiments in the next chapter.

Not only negative ERP patterns were found for the processing of unambiguously case marked sentences. Bornkessel, Schlesewsky and Friederici (2003a) observed a positivity between 300 and 500 ms for sentences with object-experiencer verbs like in example (13b) in comparison to (13a).

(13a) ..., dass der Priester dem Gärtner folgt und ...
... that the$_{nom}$ priest the$_{acc}$ gardener follows and ...
'... that the priest follows the gardener and ...'

(13b) ..., dass der Priester dem Gärtner imponiert und ...
... that the$_{nom}$ priest the$_{acc}$ gardener impresses and ...
'... that the priest impresses the gardener and ...'

This effect was independent of the word order of the two case marked DPs. As described in section 2.2.1, verb classes differ with regard to the base order of their arguments which results from the mapping of the arguments' thematic hierarchy. Bornkessel and colleagues interpret this early positivity as the correlate of thematic reanalysis. The fact that this effect was independent of the syntactic structure of the sentences, the authors proposed a processing model which is incorporated in Friederici's neurocognitive model of language comprehension (see the preceding section 4.3). The model assumes two parallel processing routes in phase 2, the syntactic route which applies in ambiguous sentences and the thematic route which

refers to the case marking in unambiguous sentences (*argument dependency model*, see also Bornkessel, 2002; Schlesewsky and Bornkessel, 2004).
An early positivity was also found for ambiguous sentences. Friederici and Mecklinger (1996) investigated subject-object ambiguities in relative clauses and complement clauses like the examples in (14) and (15).

(14a) Das ist die Professorin$_i$, die$_i$ t$_i$ die Sekretärinnen gesehen *hat*.
This is the professor who$_{nom}$ the secretaries$_{acc}$ seen has
‚This is the professor who has seen the secretaries.

(14b) Das ist die Professorin$_i$, die$_i$ die Sekretärinnen t$_i$ gesehen *haben*.
This is the professor who$_{acc}$ the secretaries$_{nom}$ seen have
‚This is the professor who the secretaries have seen.

(15a) Er wusste, dass die Professorin die Sekretärinnen gesehen *hat*.
He knew that the professor$_{nom}$ the secretaries$_{acc}$ seen has
‚He knew that the professor has seen the secretaries.'

(15b) Er wusste, dass die Professorin$_i$ die Sekretärinnen t$_i$ gesehen *haben*.
He knew that the professor$_{acc}$ the secretaries$_{nom}$ seen have
‚He knew that the professor was seen by the secretaries.'

With respect to the relative clauses in (14a) and (14b), the authors observed two positivities at the disambiguating auxiliary for the object-initial relative clauses, an early one between 300 and 400 ms and a late one between 600 and 900 ms[19]. Scrambled sentences like (15b), in contrast, elicited only one positivity between 500 and 900 ms. The authors interpreted the positivity for the non-canonical complement clauses and the early positivity for the object-initial relative clauses as correlates of syntactic reanalysis of the preferred word order (subject before object). Friederici (1998) argued that the different durations of the positivities for the two sentence types reflect a difference in the difficulty of reanalysis. In (14b) the parser only has to change the grammatical function of the already identified filler from

[19] For a late positivity for ambiguous scrambled sentences, see also Matzke et al. who found a comparable effect when the sentence were disambiguated by the case marking of the second DP.

subject to object whereas in (15b) a new filler-gap dependency has to be computed. The difference in the onset of the effect is interpreted as the difference in the ease of diagnosing the syntactic problem. This interpretation is based on the diagnosis model proposed by Fodor and Inoue (1994, see section 3.3) which explains differences in garden-path strength for non-preferred structures as the cost of deducing the necessary structural repair operations. Friederici (1998) argued that diagnosis of misanalysis may be harder in low frequency structures and in heavily marked focus structures like the scrambled sentence (7b)[20]. The additional late positivity for the object-initial relative clauses was interpreted in terms of experimental context. In a study by Mecklinger, Schriefers, Steinhauer and Friederici (1995) which investigated only relative clauses, an early positivity, but no evidence for a later positive effect was found. The sentence material in the two studies differed in that the latter consisted exclusively of relative clauses whereas the former study included different sentence types. Therefore, the late positivity might be the result of the mixed sentence material.

Another possible explanation for the additional late positivity found for the relative clauses, according to Kaan (2001, see section 3.3.3), could be the referential status of the antecedent of the relative pronoun. The antecedent of the pronoun, the definite DP in the matrix clause in (14) (*Das ist die Professorin, die …*), is the topic of the sentence. The topic is encoded as the subject which is assumed to be the prototypical syntactic encoding of a topic. As already reported, Kaan (2001) found a preference for a subject interpretation of ambiguous relative pronouns when they were followed by a referential DP. This preference was reduced if the following DP was a pronoun which also refers prototypically to a topic. As an add-on to Kaan's explanation, this could be accounted for by the competition of two *subject-like* elements, a relative pronoun and a personal pronoun. If so, the additional late positivity found by Friederici and Mecklinger (1996) could then be explained as an

[20] Friederici, Mecklinger, Spencer, Steinhauer and Donchin (2001) investigated the same sentence types and also found comparable effects: An early and a late positivitiy for the relative clauses and only a late positivity for the complement clauses. They applied a spatio-temporal prinicipal component analysis to the ERP data and separated subcomponents which were interpreted as different processes.

effect of a subject preference for a relative pronoun, triggered by information structural characteristics of pronouns, in comparison to a referential DP in a complement clause where no late positivity was found[21].

To conclude, three different ERP components were reported in correlation with the processing of word order variations. First, a negativity on case-marked scrambled DPs which was correlated either with syntactic processing or with the processing of focus structural characteristics of scrambled sentences. Second, an early positivity which could be correlated with thematic reanalysis in unambiguously case-marked sentences as well as with syntactic reanalysis in ambiguous relative clauses. For ambiguous scrambled sentences, a late positivity was found which was also correlated with syntactic reanalysis. The different time-course of the positivities correlated with syntactic reanalysis was explained in terms of the ease of diagnosis and the difficulty of the reanalysis. An additional late positivity was observed for ambiguous relative clauses, but not for scrambled sentences. This effect could be interpreted as the result of different information structural characteristics of different DP types.

In the next chapter, I will present three ERP experiments which investigated the processing of word order variations with different DP types. Before turning to the description of the experiments, specific predictions for these experiments can be formulated on the basis of the theoretical considerations in chapter 2 and the empirical results described in chapter 3 and 4.

[21] Admittedly, within this approach it remains unclear, why Mecklinger et al. (1995) only found an early but no additional late positive effect.

CHAPTER 5

The Processing of Subject-Object Ambiguities with Different DP Types: Syntactic and Information Structural Processes

5.1 Experiment 1: Referential DPs and Pronouns

For my first experiment, the results and explanations reported in the preceding chapters lead us to several specific hypotheses for an ERP study that uses sentences like (1) and (2).

Scrambling

(1a) Anna hat behauptet, dass [die Tante die Nichten begrüßt hat]$_F$
Anna has claimed that the aunt$_{nom/sg}$ *the nieces*$_{acc/pl}$ *welcomed has*$_{sg}$
'Anna has claimed that the aunt welcomed the nieces.'

(1b) Anna hat behauptet, dass die Tante$_i$ [die Nichten]$_F$ t_i begrüßt haben
Anna has claimed that the aunt$_{acc/sg}$ *the nieces*$_{nom/pl}$ *welcomed have*$_{pl}$.
'Anna has claimed that the aunt was welcomed by the nieces.'

Pronoun movement

(2a) Anna hat behauptet, dass sie [die Nichten begrüßt hat]$_F$
Anna has claimed that she$_{nom/sg}$ *the nieces*$_{acc/pl}$ *welcomed has*$_{sg}$
'Anna has claimed that she welcomed the nieces.'

(2b) Anna hat behauptet, dass sie$_i$ [die Nichten t_i begrüßt haben]$_F$
Anna has claimed that she$_{acc/sg}$ *the nieces*$_{nom/pl}$ *welcomed have*$_{pl}$.
'Anna has claimed that she was welcomed the nieces.'

Hypothesis (1)

For the scrambled sentences, (1b) in comparison to (1a), I predict a positive component reflecting syntactic reanalysis of the preferred word order, comparable to the one found by Friederici and Mecklinger (1996) and Friederici et al. (2001). For the sentences with a moved pronoun, (2b) in comparison to (2a), I predict a

positivity comparable to that seen for syntactic reanalysis in sentences with referential DPs. In chapter 2, I argued that there is no syntactic difference between the movement of a referential DP and the movement of a pronominal object. Therefore, the correlate of syntactic reanalysis should not be modulated by the different DP type. If the interpretation of the negativity observed for scrambled DPs by Schlesewsky et al. (2003) as a reflection of a syntactic difference between the two non-canonical sentence types is correct, this syntactic difference might be reflected in a modulation of the positivity.

Hypothesis (2)
If the differences between the behavior of referential DPs and pronouns are correctly described by focus structural characteristics (see chapter 2), an additional ERP effect for non-canonical sentences with referential DPs should be found which should not be elicited by sentences with a moved object pronoun. According to Bader and Meng (1999, see section 3.3.3), this additional effect could be interpreted as a correlate of focus structural revision, which is only necessary for sentences with a moved referential DP (see example (1b)). If focus structural characteristics play a role in the processing of scrambled sentences which is also suggested by Rösler et al. (1998, see section 4.4) as an explanation for the observed negativity on scrambled DPs, the correlate of focus structural revision might be a negative ERP deflection.

Hypothesis (3)
If the interpretation of the late positivity for relative clauses described in section 4.4, found by Friederici and Mecklinger (1996) and Friederici et al. (2001), is correct, namely that it reflects processing difficulties triggered by an information structurally-driven bias towards a subject interpretation for pronouns, an additional late positive effect for the non-canonical sentences with pronouns would be expected.
These hypotheses were tested in Experiment 1.

5.1.1 Method

Participants

Thirty students of the University of Leipzig (mean age 24.1, age range 19-29, 15 female) participated in the experiment. All participants were right-handed native speakers of German and had normal or corrected-to-normal vision.

Materials

The experimental sentences[22] were constructed on the basis of a verb list, consisting of 100 transitive verbs. The verbs were combined with two DPs to form the complement clause. The first DP was either a referential DP or a pronoun, and the second DP was a referential DP. The first DP in the sentences was always feminine singular and the second DP plural. Repetition of the same nouns was avoided as much as possible. Verbs and nouns were selected such that both DPs were equally likely to be the agent or patient of the action denoted by the verb. To control this target symmetry more systematically, two different lists of sentences were constructed. In the second list, the order of referential DPs was inverted for 50 items. The verbal complex consisted of the lexical verb and an auxiliary which was marked for either singular or plural. To avoid wrap-up effects in the ERP, the sentences continued after the auxiliary with a local or temporal modifier (see Table 5.1). Finally, a matrix clause was constructed using 100 female proper names and 5 different clause-embedding matrix verbs.

Four different sentence versions were constructed (see Table 5.1). The four sentence versions corresponded to the full crossing of the factors *DP type* (pronoun vs.

[22] It should be noted that in the present experiments, no filler items were used. In contrast to behavioral studies, ERP analyses need a considerably larger number of items per condition to gain a good signal to noise ratio. Therefore, ERP studies often do not use additional filler items in order to keep the length of the experiment reasonable for the participants. Steinhauer, Mecklinger, Friederici and Meyer (1997) demonstrated that the proportions of non-canonical word orders in an experimental session did not modulate the ERP components. In addition, the design was maximally counterbalanced to exclude strategic effects.

referential DP) and *word order* (subject-object vs. object-subject). The final set of experimental sentences presented to a participant consisted of 50 sentences for each of the four critical conditions, resulting in a total of 200 sentences per participant. Each participant saw two versions of one quadruple. The two versions differed with regard to word order and DP type.

Referential DP, subject before object
Anna hat behauptet, dass die Tante die Nichten begrüsst hat während die Rede gehalten wurde.
(*Anna has claimed, that the aunt the nieces welcomed has while the audience addressed was.*)
Referential DP, object before subject
Anna hat behauptet, dass die Tante die Nichten begrüsst haben während die Rede gehalten wurde.
(*Anna has claimed, that the aunt the nieces welcomed have while the audience addressed was.*)
Pronoun, subject before object
Anna hat behauptet, dass sie die Nichten begrüsst hat während die Rede gehalten wurde..
(*Anna has claimed, that she the nieces welcomed has while the audience addressed was.*)
Pronoun, object before subject
Anna hat behauptet, dass sie die Nichten begrüsst haben während die Rede gehalten wurde..
(*Anna has claimed, that she the nieces welcomed have while the audience addressed was.*)

Table 5.1: Example sentences for each of the four critical condition in Experiment 1

After the presentation of a sentence, participants were required to answer a comprehension question. The questions were in the passive voice and asked for the patient of the action as illustrated in (3):

(3a) Wurde die Tante gesehen?
'Was the aunt seen?'

(3a') Wurde sie gesehen?
'Was she seen?'

(3b) Wurden die Nichten gesehen?
'Were the nieces seen?'

Question type (3a) was presented as frequently as (3b). The comprehension task required the answer 'yes' as equally often as the answer 'no'.

The sentences were pseudo-randomized with the following constraints: trials of one quadruple were separated by at least fifty trials, trials with the same DP type or the same word order were not presented in more than three consecutive trials; not more than two trials with the same matrix verb were presented in succession; and questions with the same required answer were not presented in more than five successive trials. Eight experimental lists were created which were pseudo-randomized in parallel two times.

Procedure

The sentences were presented word by word except for the referential DPs: determiner and noun were presented as a whole. The words and phrases were presented in the center of a computer screen. The presentation of a sentence was preceded by a fixation point, which appeared for 500 ms followed by a pause of 100 ms. Words were presented for 500 ms. Determiner and noun were presented together for 700 ms. The duration of the inter-stimulus interval was 100 ms. The presentation of a sentence was followed by a 1000 ms pause, after which a question mark was presented for 500 ms to signal the beginning of the comprehension question. Then, the comprehension question appeared on the screen in the same presentation mode as the sentences. After a pause of 100 ms, 'yes' and 'no' appeared on the screen to indicate the values assigned to the two hand-held push-buttons. Participants were given maximally 2500 ms to press one button. After an answer had been given or after 2500 ms, participants got feedback in terms of the presentation 'correct' or 'incorrect' for 1000 ms. After a pause of 1000 ms, the fixation point of the next trial appeared. Participants were asked to avoid blinks and other movements during the presentation of the sentences and to restrict blinks and movements to the presentation and answering of the comprehension question.

The presentation of the 200 sentences constituting an experimental session was carried out in 8 blocks of 25 sentence-question pairs. Each condition occurred approximately equally often in each block. The assignment of the values 'yes' and 'no' to the left and right push-buttons was counterbalanced across participants. Prior

to the experimental session, 20 practice trials were presented. The experiment itself lasted approximately 1.25 hours. Including electrode preparation, an entire session lasted no longer than 2.5 hours.

EEG Recording

The EEG was recorded with 26 AgAgCL-electrodes, which were fixed at the scalp by means of an elastic cap (Electro Cap International) and placed in the following electrode sites (labelled according to the nomenclature proposed by the American Encephalographic Society (Sharbourgh, Chatrian, Lesser, Lüders, Nuwer and Picton, 1991)): FP1, FPZ, FP2, F7, F3, FZ, F4, F8, FT7, FC3, FC4, FT8, T7, C3, CZ, C4, T8, CP5, CP6, P7, P3, PZ, P4, P8, O1, O2. The ground electrode was positioned above the sternum. The recordings were referenced against the left mastoid. The activity over the right mastoid was actively recorded and did not reveal any condition specific variation. All recordings were re-referenced to linked mastoids offline. The vertical electrooculogram (EOGV) was recorded bipolar from electrodes placed above and below the right eye. The horizontal EOG (EOGH) was recorded bipolar from positions of the outer canthus of each eye. Electrode impedances were kept below 5 kΩ. All EEG and EOG channels were amplified using a Twente Medical System DC amplifier and recorded continuously with a digitization rate of 250 Hz. The ERPs were filtered off-line with 8 Hz low pass for the plots, but all statistical analyses were computed on non-filtered data.

Data Analysis

For the behavioral data, error rates and reaction times for answering the comprehension questions were analyzed. Trials answered incorrectly were excluded from the reaction time analysis. Reaction times and error percentages per condition and per subject were used as data entries in a repeated measures analysis of variance (ANOVAs), with the factors WORD ORDER and DP-TYPE.

For the ERP data, only trials with correct responses entered the analysis. Trials containing occular, amplifier-saturation or other artefacts were also excluded (EOG

rejection above 40 μV). The EEG data per participant and condition were averaged from the onset of the disambiguating auxiliary to 1000 ms post onset, before grand-averages were computed over all participants. The averages were aligned to a 200 ms pre-stimulus baseline.

For the statistical analyses of the ERP data, ANOVAs were calculated for mean amplitude values per time window per condition. Time windows were chosen on the basis of previous studies and visual inspection of the data. To allow for a quantification of hemispheric differences, the three midline electrodes and the lateral positions were analysed separately. For the midline electrodes, the analysis included the variables DP-TYPE (referential DP vs. pronoun), WORD ORDER (SO vs. OS) and ELECTRODE (FZ, CZ, PZ). Instead of the variable ELECTRODE, the analyses for the lateral electrodes included two topographical variables: REGION (anterior vs. central vs. posterior) and HEMISPHERE (left vs. right). Crossing the two factors for the lateral electrodes resulted in the following six regions of interest (ROIs): left anterior (F7, F3, FT7), right anterior (F8, F4, FT8), left central (T7, C3, CP5), right central (T8, C4, CP6), left posterior (P7, P3, O1) and right posterior (P8, P4, O2). If the variable DP-TYPE and WORD ORDER revealed an at least marginally significant interaction ($p < .10$) with one or both of the topographical factors, a further analysis was conducted on a lower level, i.e., separately for each ROI.

No main effects of or interactions between topographical factors will be reported. In order to avoid excessive type 1 errors due to violations of sphericity, I applied the correction of Huynh and Feldt (1970) when the analysis involved factors with more than one degree of freedom in the numerator.

5.1.2 Results

Behavioral Data

	Ref. DP - SO	**Ref. DP - OS**	**Pronoun - SO**	**Pronoun - OS**
Error rates	4.8 %	14.0 %	2.3 %	6.8 %
Reaction times	378 ms	367 ms	377 ms	360 ms

Table 5.2: Error rates and reaction times for all four conditions in Experiment 1

With regard to error rates, a repeated measures ANOVA revealed highly significant main effects of DP-TYPE ($F(1,29) = 42.27$, $p < .0001$), WORD ORDER ($F(1,29) = 35.14$, $p = .0001$ and a highly significant interaction between the two factors ($F(1,29) = 14.68$, $p = .001$). Sentences with non-canonical word order (object-first) gave rise to higher error rates than their canonical counterparts: *referential DPs,* WORD ORDER ($F(1,29) = 43.92$, $p = .0001$); *pronouns*, WORD ORDER ($F(1,29) = 13.72$, $p = .0009$). Sentences with referential DPs in front of the subject evoked higher error rates than the sentences with a pronoun as the first argument: *subject-object,* DP-TYPE ($F(1,29) = 17.48$, $p = .0002$); *object-subject*, DP-TYPE ($F(1,29) = 34.67$, $p = .0001$).

The analysis of the reaction times also revealed a significant main effect of WORD ORDER ($F(1,29) = 9.69$, $p < .01$), but no significant main effect of DP-TYPE ($F < 1$) and no interaction ($F < 1$). Unexpectedly, reaction times were shorter for object-first sentences.

ERP Data

Figure 5.1 shows the grand averages for the sentences with referential DPs, subject-first vs. object-first, at the position of the disambiguating auxiliary (*hat* vs. *haben*, 1000 ms post onset). The sentences with non-canonical word order show a left anterior negativity, an early positivity followed by a right lateral negativity.

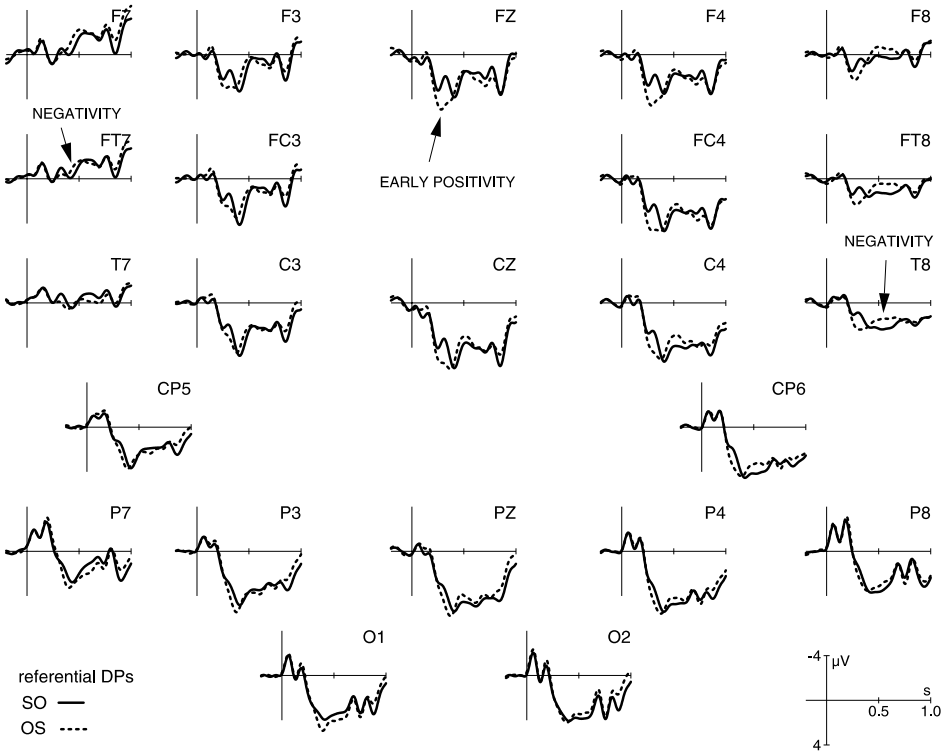

Figure 5.1: Grand Average ERPs elicited by the auxiliary (onset at the vertical line) for sentences with referential DPs, subject-first (SO) vs. object-first (OS). Negativity is plotted upwards.

The grand averages at the auxiliary for the sentences with pronouns, subject-first vs. object-first are presented in Figure 5.2. Here, the non-canonical word order shows a left anterior negativity and an early and a late positivity.

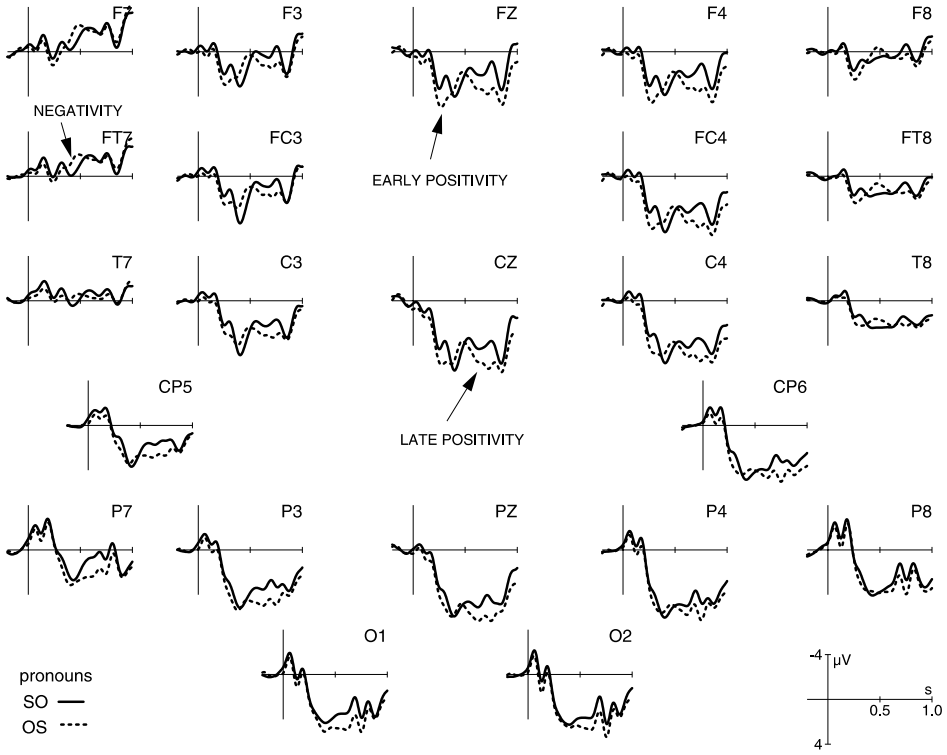

Figure 5.2: Grand Average ERPs elicited by the auxiliary for sentences with pronouns, subject-first (SO) vs. object-first (OS).

For the statistical analysis of the effects seen in the grand averages, three different time windows were chosen: 250 – 350 ms post onset of the auxiliary for the early positivity, a 350 – 500 ms time window for the left anterior negativity, a 500 – 600 ms time window for the right lateral negativity and, for the late positivity, 600 – 800 ms.

250-350 ms time window

The global analysis of the lateral electrodes revealed a significant main effect of WORD ORDER ($F(1, 29) = 6.15$, $p = .02$) and a marginally significant main effect of DP-TYPE ($F(1,29) = 3.20$, $p = .08$). Additionally, there were interactions of DP-TYPE x REGION ($F(2,58) = 4.34$, $p = .02$), WORD ORDER x REGION ($F(2,58) = 4.12$, $p = .02$), DP-TYPE x HEMISPHERE ($F = 1,29) = 8.57$, $p = .007$), WORD

ORDER x HEMISPHERE ($F(1,29) = 4.62$, $p = .04$) and WORD ORDER x REGION x HEMISPHERE ($F(2,58) = 4.13$, $p = .04$).

The analyses for each ROI showed an effect of WORD ORDER with a fronto-central distribution: left anterior ($F(1,29) = 7.77$, $p = .009$), right anterior ($F(1,29) = 9.38$, $p = .005$), left central ($F(1,29) = 6.08$, $p = .02$), right central ($F(1,29) = 7.12$, $p = .01$). In the two posterior ROIs, only an effect of DP-TYPE (which was not significant in other regions) was found: left posterior ($F(1,29) = 4.54$, $p = .04$), right posterior ($F(1,29) = 15.26$, $p = .0005$).

The global analysis of the midline electrodes revealed a main effect of WORD ORDER ($F(1,29) = 11.31$, $p = .002$). Additionally, two interactions were found: DP-TYPE x REGION ($F(2,58) = 4.20$, $p = .02$) and WORD ORDER x REGION ($F(2,58) = 11.24$, $p < .0001$).

The separate analyses of the three midline electrodes showed a main effect of WORD ORDER at FZ ($F(1,29) = 16.18$, $p = .0004$), CZ ($F(1,29) = 11.31$, $p = .002$) and PZ ($F(1,29) = 5.04$, $p = .03$). At PZ, a significant effect of DP-TYPE was also found.

In sum, the results for the first time window demonstrated a highly reliable early fronto-central positivity for the sentences with non-canonical word order (see Figure 5.1 and 5.2). No interaction of WORD ORDER and DP-TYPE was found. The two posterior lateral ROIs and the posterior midline electrode PZ showed a main effect of DP-TYPE. This seems to be the result of a more positive-going waveform for sentences with pronouns in comparison to referential DPs (see Figure 5.3).

Figure 5.3 shows grand averages for the sentences with referential DPs in comparison to sentences with pronouns at the position of the disambiguating auxiliary. The sentences with pronouns show a more positive-going waveform at posterior electrode sites.

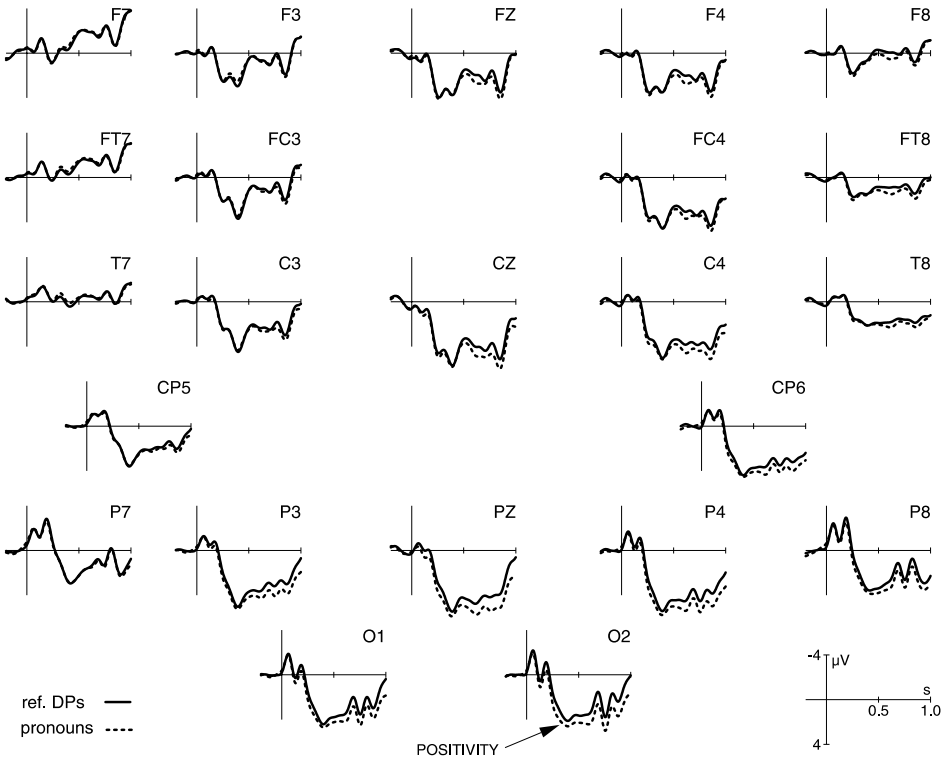

Figure 5.3: Grand Average ERPs elicited by the auxiliary for sentences with referential DPs vs. pronouns.

350-500 ms time window

The global analysis of the lateral electrodes revealed a highly significant three-way interaction for WORD ORDER x REGION x HEMISPHERE ($F(2,58) = 14.21$, $p = .0002$) and a significant interaction for DP-TYPE x HEMISPHERE ($F(1,29) = 4.75$, $p = .04$) and a marginally significant interaction of DP-TYPE x REGION ($F(2,58) = 2.89$, $p = .06$).

The analyses for each ROI showed effects of WORD ORDER only in the left anterior ROI ($F(1,29) = 8.67$, $p = .006$). A significant effect of DP-TYPE was found for the right posterior ROI ($F(1,29) = 7.00$, $p = .01$).

The global analysis of the midline electrodes revealed no significant effects.

In sum, the results for the second time window revealed a left anterior negativity for the sentences with non-canonical word order, independent of DP-TYPE (see Figure

5.1 and 5.2). As in the first time window, a more positive-going waveform was found for sentences with pronouns in comparison to sentences with referential DPs (see Figure 5.3).

500-600 ms time window

The global analysis of the lateral electrodes revealed a marginally significant main effect of DP-TYPE ($F(1,29) = 3.82$, $p = .06$). Interactions were found for DP-TYPE x HEMISPHERE ($F(1,29) = 6.85$, $p = .01$), WORD ORDER x HEMISPHERE ($F(1,29) = 9.05$, $p = .005$), WORD ORDER x REGION x HEMISPHERE ($F(2,58) = 5.14$, $p = .02$) and DP-TYPE x WORD ORDER x HEMISPHERE ($F(1,29) = 2.73$, $p = .10$).

The analyses for each ROI showed effects of DP-TYPE in the right hemisphere only: right anterior- DP-TYPE ($F(1,29) = 6.34$, $p = .02$), right central – DP-TYPE ($F(1,29) = 3.54$, $p = .07$. Additionally, there was an effect of WORD ORDER in the left posterior ROI ($F(1,29) = 8.29$, $p = .007$).

To resolve the three-way interaction of the factors DP-TYPE, WORD ORDER and HEMISPHERE, the relevant ROIs were analysed for referential DPs and pronouns separately. Right central, there was a significant effect of WORD ORDER only for the referential DPs ($F(1,29) = 5.91$, $p = .02$). A significant effect of WORD ORDER, for the pronouns only, was found in the left posterior ROI ($F(1,29) = 11.71$, $p = .002$).

The global analysis of the midline electrodes revealed a significant main effect of DP-TYPE ($F(1,29) = 6.21$, $p = .02$) and a marginally significant interaction DP-TYPE x WORD ORDER ($F(1,29) = 3.76$, $p = .06$).

Analyses for the different DP-types showed a marginally significant effect of WORD ORDER for the pronouns ($F(1,29) = 3.41$, $p = .07$). The analysis for the referential DPs revealed no effect.

In sum, the results for the second time window demonstrated a reliable right central negativity for the sentences with non-canonical word order which was only found for the referential DPs (see Figure 5.1). At the midline electrodes and in the left

posterior ROI, only a positivity for the non-canonical sentences with pronouns was observed (see Figure 5.2). This effect is the beginning of the late positivity which was most pronounced in the third time window.

600-800 ms time window

The global analysis of the lateral electrodes revealed a highly significant main effect of DP-TYPE ($F(1,29) = 10.32$, $p = .003$), a marginally significant effect of WORD ORDER ($F(1,29) = 3.86$, $p = .06$) and significant interactions of DP-TYPE x WORD ORDER ($F(1,29) = 9.10$, $p = .005$), DP-TYPE x REGION ($F(2,58) = 3.65$, $p = .06$), DP-TYPE x HEMISPHERE ($F(1,29) = 6.67$, $p = .02$) and WORD ORDER x REGION x HEMISPHERE ($F(2,58) = 4.08$, $p = .04$)

The analyses of each ROI showed effects of DP-TYPE in the following ROIs: right anterior ($F(1,29) = 6.08$, $p = .02$), right central ($F(1,29) = 7.34$, $p = .01$), left posterior ($F(1,29) = 6.11$, $p = .02$) and right posterior ($F(1,29) = 19.58$, $p = .001$). An effect of WORD ORDER was only found in the left posterior ROI ($F(1,29) = 10.07$, $p = .004$).

Resolving the interaction of DP-TYPE and WORD ORDER, analyses for referential DPs showed no significant effects and no interactions. In the analyses for the pronouns, there was a highly significant effect of WORD ORDER ($F(1,29) = 11.18$, $p = .002$).

The global analysis of the midline electrodes revealed a highly significant main effect of DP-TYPE ($F(1,29) = 13.70$, $p = .0009$), a significant main effect of WORD ORDER ($F(1,29) = 4.65$, $p = .04$), a highly significant interaction for DP-TYPE x WORD ORDER ($F(1,29) = 12.70$, $p = .001$) and marginally significant interactions for WORD ORDER x ELECTRODE ($F(1,29) = 3.20$, $p = .06$).

The analyses for each ELECTRODE revealed a significant effect of WORD ORDER only at CZ ($F(1,29) = 7.82$, $p = .009$).

Analyses for referential DPs showed no significant effect of WORD ORDER. For the pronouns, a highly significant effect of WORD ORDER was found ($F(1,29) = 12.57$, $p = .001$).

In sum, only the sentences with pronouns elicited a highly reliable widely distributed late positivity for the non-canonical word order (see Figure 5.2).

5.1.3 Discussion

In part, the behavioral data of Experiment 1 showed results similar to those reported by Bader and Meng (1999). The error rates were higher for object-first than for subject-first sentences, and for non-canonical sentences with referential DPs in comparison to sentences with pronouns. In contrast to the study by Bader and Meng, higher error rates for referential DPs in comparison to pronouns in the canonical order were found, but this difference was smaller than in the non-canonical sentences. This might be the result of the different tasks (speeded grammaticality judgement vs. comprehension question).

The reaction time data showed the reverse pattern: For both DP-types, reaction times were shorter for sentences with canonical word order. Higher error rates and shorter reaction times might be the result of a speed-accuracy trade-off.

It is arguable as to how meaningful the behavioral data are as they must be considered to be quite off-line; the sentences continued for 2500 ms after the point of disambiguation and there was a pause of 1500 ms between the offset of the sentence and the presentation of the question. In addition, participants were not instructed to make a speeded decision.

For the ERP data, three hypotheses were formulated on the basis of several studies using behavioral as well as neurophysiological methods.

(1) The first hypothesis predicted a positive component as the correlate of syntactic reanalysis for the sentences with non-canonical word order, independent of DP type. The data show a fronto-central positivity (250 – 350 ms post onset of the auxiliary) for object-first sentences. This effect is interpreted as a reflection of the diagnosis and reanalysis of the non-preferred word order. As argued above, this revision process is necessary for object-first sentences with referential DPs as well as for those with pronouns. No modulation of the positivity dependent on DP type was

observed. This result speaks against the assumption of a syntactic difference between scrambled referential DPs and moved pronominal objects.
Additionally, a left-anterior negativity between 350-500 ms for the sentences with non-canonical word order was found. This might be an instantiation of an LAN as a reflection of a morphosyntactic mismatch between the expected and the actual form of the auxiliary (for a more detailed description of this ERP component, see section 4.2). On the basis of the preferred SO structure, the parser expects the singular form of the auxiliary. The plural auxiliary in the OS order violates this morphosyntactic expectation.
In addition, a more positive-going waveform between 250-500 ms for pronouns at posterior electrode sites, independent of word order, was observed. This may reflect a more complex syntactic analysis of sentences with pronouns in contrast to those with referential DPs. As shown in section 2.3.1, pronouns are moved elements, in the canonical and in the non-canonical word order. In both word orders, the pronoun has to be moved out of the VP whereas referential DPs in the canonical word order remain in their base positions inside the VP (see Lenerz, 1992).

(2) On the basis of the focus structural analyses of word order variations in chapter 2, an additional process was predicted for sentences with referential DPs, reflecting focus structural revision which was not necessary in sentences with pronouns.
A right central negativity (500 – 600 ms post onset of the auxiliary) was observed that was only visible for non-canonical sentences with referential DPs. As sentences with pronouns did not show a comparable effect in this time window, this negativity is interpreted as the correlate of focus structural revision. Rösler et al. (1998) found a frontal negativity which they associated with focus structural processing. Whether both effects can be interpreted as correlates of the same process, will be discussed in section 8.2 in more detail.
(3) The third hypothesis formulated for object-first sentences with pronouns predicted a late positive effect as the reflection of a process triggered by the discourse status of the pronoun's antecedent. A widely distributed positive-going

waveform (600 – 800 ms post onset of the auxiliary) was found for these sentences. This result is compatible with Friederici et al. (2001), who also found a comparable late positivity for relative clauses with non-canonical word order. In light of Bader and Meng's (1999) results, it seems that this discourse-related process is less costly than the focus structural revision necessary for sentences with referential DPs. Abandoning an information-structurally-driven preference for the pronoun to be the subject seems to be easier than reassigning a new focus structure.

To summarize, four clearly differentiated ERP effects at the disambiguating auxiliary were observed, which can be correlated with different processes relevant for the interpretation of non-preferred word orders. The results suggest that not only the syntactic representation of a sentence plays a role in the processing of word order variations, but also information structural characteristics like focus structure and discourse status of DPs. All in all, the results of Experiment 1 confirm the initial predictions. Nevertheless, three open issues remain.

The first issue concerns the time course of the early positivity which was correlated with syntactic reanalysis. Why is there a clear difference in the latency and the duration of the early positivity elicited in the present study and the positivity for sentences with moved referential DPs reported by Friederici and Mecklinger (1996) and Friederici et al. (2001)? Whereas the positivity in the present study was significant between 250 and 350 ms, the positivity observed for scrambled sentences in the previous studies appeared between 500 and 900 ms. A possible reason for this difference could be the difference in the sentence materials between the studies: In the present experiment, the first noun phrase was always singular and the second one was plural. Therefore, the diagnosis of the syntactic problem in the sentences with non-preferred word order was very easy: the auxiliary *haben* (‘have’) signals the object-first order in all cases. The previous studies varied the number of the first and second noun phrases. As a consequence, the diagnosis of the syntactic problem and the reanalysis (the reassignment of syntactic functions) should be more difficult in those compared to the present study. According to

Friederici (1998), the onset of the correlate of syntactic reanalysis reflects the difficulty or ease of diagnosing the 'symptom' of the misanalysis whereas the duration corresponds to the difficulty of reanalysis itself. Whether this is the correct interpretation of the observed difference will be investigated in Experiment 3.

The second remaining issue concerns the negativity found in Experiment 1. Why did previous studies not find a correlate of focus structural revision for scrambled sentences? A possible reason for this could be the temporal overlap of the positivity and the negativity in the previous studies. The proposed possible answer to this question will also be tested in Experiment 3.

Before presenting Experiment 3, I will address a third critical issue which concerns the material used in Experiment 1, namely the crucial characteristic of the feminine pronoun *sie* ('she'). This element is not only case ambiguous (nominative vs. accusative), but also ambiguous with respect to number (singular vs. plural). Therefore, another possible explanation of the late positivity found for non-canonical sentences with pronouns could be this additional ambiguity. With the plural interpretation of the pronoun, object-first sentences can in principle also be read as grammatical subject-first sentences, even if this analysis is pragmatically inadequate because the plural pronoun would not have an explicit antecedent. If this interpretation were correct, the late positivity could be a reflection of a rechecking process of the pronoun's reference (participants know the 'right' interpretation of the pronoun because of feedback). In order to rule out this alternative explanation of the late positivity, Experiment 2 was conducted.

5.2 Experiment 2: Reference Variation of Pronouns

Experiment 2 was set up to test whether the late positivity which was found for sentences with moved pronouns in Experiment 1 could be a reflection of the additional number ambiguity of feminine personal pronouns. For this purpose, sentences like (2), repeated for convenience as (4), were compared with sentences like (5).

(4a) Anna hat behauptet, dass sie die Nichten begrüsst hat.
Anna has claimed that she$_{\text{nom/sg}}$ *the nieces*$_{\text{acc/pl}}$ *welcomed has*$_{\text{sg}}$
'Anna has claimed that she welcomed the nieces.'

(4b) Anna hat behauptet, dass sie$_i$ die Nichten t_i begrüsst haben.
Anna has claimed that she$_{acc/sg}$ *the nieces*$_{nom/pl}$ *welcomed have*$_{pl}$.
'Anna has claimed that she was welcomed by the nieces.'

(5a) Was Anna betrifft, behauptet man, dass sie die Nichten begrüsst hat.
What Anna concerns, claims one that she$_{\text{nom/sg}}$ *the nieces*$_{\text{acc/pl}}$ *welcomed has*$_{\text{sg}}$
'Concerning Anna, one claims that she welcomed the nieces.'

(5b) Was Anna betrifft, behauptet man, dass sie$_i$ die Nichten t_i begrüsst haben.
What Anna concerns, claims one that she$_{acc/sg}$ *the nieces*$_{nom/pl}$ *welcomed have*$_{pl}$.
'Concerning Anna, one claims that she was welcomed by the nieces.'

In the sentences in (4) which also were used in Experiment 1, the pronoun preferably refers to the antecedent *Anna*. This is the pragmatically most appropriate interpretation not only for the sentences in (4), but also for those in (5). As illustrated in (6), the analysis of the pronoun as a plural one referring to a (not further mentioned) group of people is only grammatical for (4b), but not for (5b).

(6a) Anna$_i$ hat behauptet, dass sie$_{i/j}$ .... → sie = singular or plural

(6b) Was Anna$_i$ betrifft, behauptet man, dass sie$_{i/*j}$ ... → sie = only singular

Therefore, the plural analysis of the ambiguous pronoun should not be accessible in (5b). The late positivity as a reflection of a rechecking process of the pronoun's reference should be modulated in comparison to (4b), which allows for the plural interpretation of the pronoun.

5.2.1 Method

Participants

Twenty students of the University of Leipzig (mean age 23.7, age range 20-29, 10 female) participated in the experiment. All participants were right-handed native speakers of German and had normal or corrected-to-normal vision.

Materials

The same sentence pairs with pronominal DPs as in Experiment 1 were used. To vary the pronoun's reference, I constructed new matrix clauses for the same embedded clauses (see Table 5.3).

+ plural, subject before object
Anna hat behauptet, dass sie die Nichten begrüsst hat während die Rede gehalten wurde.
(*Anna has claimed, that she the nieces welcomed has while the audience addressed was*)
+ plural, object before subject
Anna hat behauptet, dass sie die Nichten begrüsst haben während die Rede gehalten wurde.
(*Anna has claimed that she the nieces welcomed have while the audience addressed was*)
- plural, subject before object
Was Anna betrifft, behauptet man, dass sie die Nichten begrüsst hat während ...
(*What Anne concerns, claims one, that she the nieces welcomed has while ...*)
- plural, object before subject
Was Anna betrifft, behauptet man, dass sie die Nichten begrüsst haben während ...
(*What Anne concerns, claims one, that she the nieces welcomed have while ...*

Table 5.3: Example sentences for each of the four critical condition in Experiment 2

The four sentence versions corresponded to the full crossing of the factor *reference* (+ plural vs. - plural) and *word order* (subject-object vs. object-subject).

The same pseudo-randomized lists as in Experiment 1 were used. I replaced the sentences with referential DPs by the sentences with the newly created sentences with the impossible plural interpretation of the pronoun.

Procedure, EEG Recording and Data Analysis were the same as in Experiment 1.

5.2.2 Results

Behavioral Data

	+ plural - SO	**+ plural - OS**	**- plural - SO**	**- plural - OS**
Error rates	6.1 %	9.5 %	5.2 %	7.1 %
Reaction times	389 ms	380 ms	370 ms	372 ms

Table 5.4: Error rates and reaction times for all four conditions in Experiment 2

With regard to error rates, a repeated measures ANOVA revealed significant main effects of REFERENCE ($F(1,19) = 5.21$, $p = .03$) and WORD ORDER ($F(1,19) = 6.11$, $p = .02$, but no significant interaction between the two factors ($F(1,19) = 2.34$, $p > .10$).

Sentences with non-canonical word order (object-first) gave rise to higher error rates than their canonical counterparts. Sentences with a possible plural pronoun interpretation evoked higher error rates than the sentences with a pronoun that can only refer to its singular antecedent.

The analysis of the reaction times also revealed a significant main effect of REFERENCE ($F(1,19) = 5.49$, $p = .03$), but no significant main effect of WORD ORDER ($F < 1$) and no interaction ($F < 1$). Reaction times were longer for sentences with a possible plural pronoun interpretation in contrast to the sentences with a singular-only interpretation of the pronoun.

ERP Data

Figure 5.4 shows grand averages for the sentences without a possible plural interpretation of the pronoun, subject first vs. object-first, at the position of the disambiguating auxiliary (*hat* vs. *haben*, 1000 ms post onset). The sentences with non-canonical word order show a fronto-central early positivity and a following late positivity.

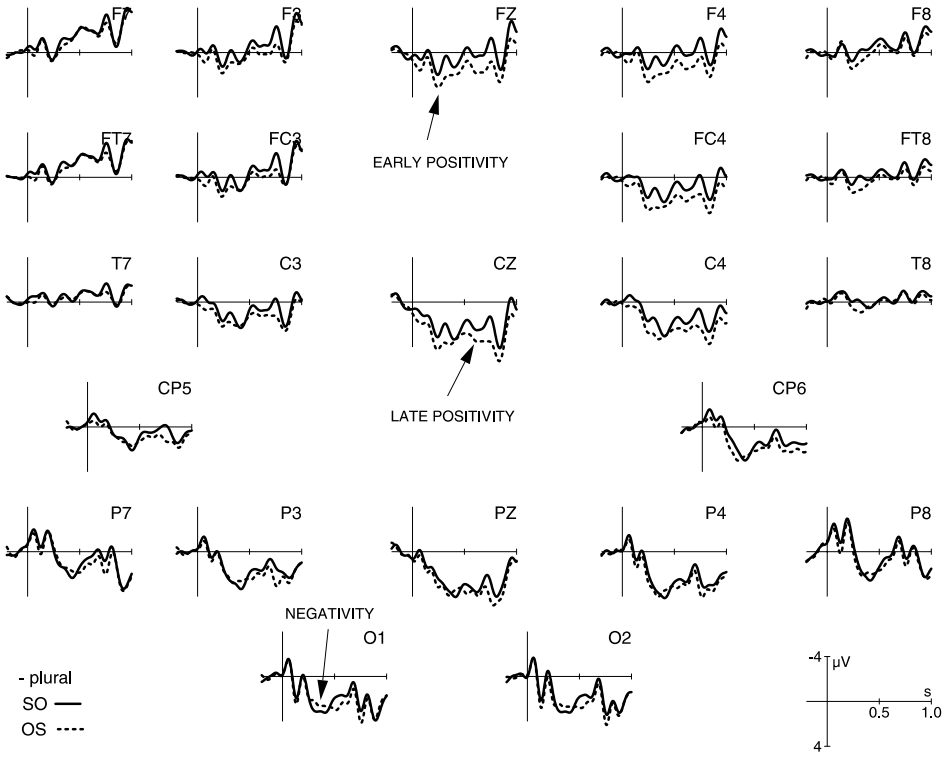

Figure 5.4: Grand Average ERPs elicited by the auxiliary for sentences with pronouns without a possible plural interpretation (- plural), subject-first (SO) vs. object-first (OS).

The grand averages at the auxiliary for the sentences with a possible plural interpretation, subject-first vs. object-first, are presented in Figure 5.5. Here, the sentences with non-canonical word order reveal a fronto-central early positivity followed by a late positivity.

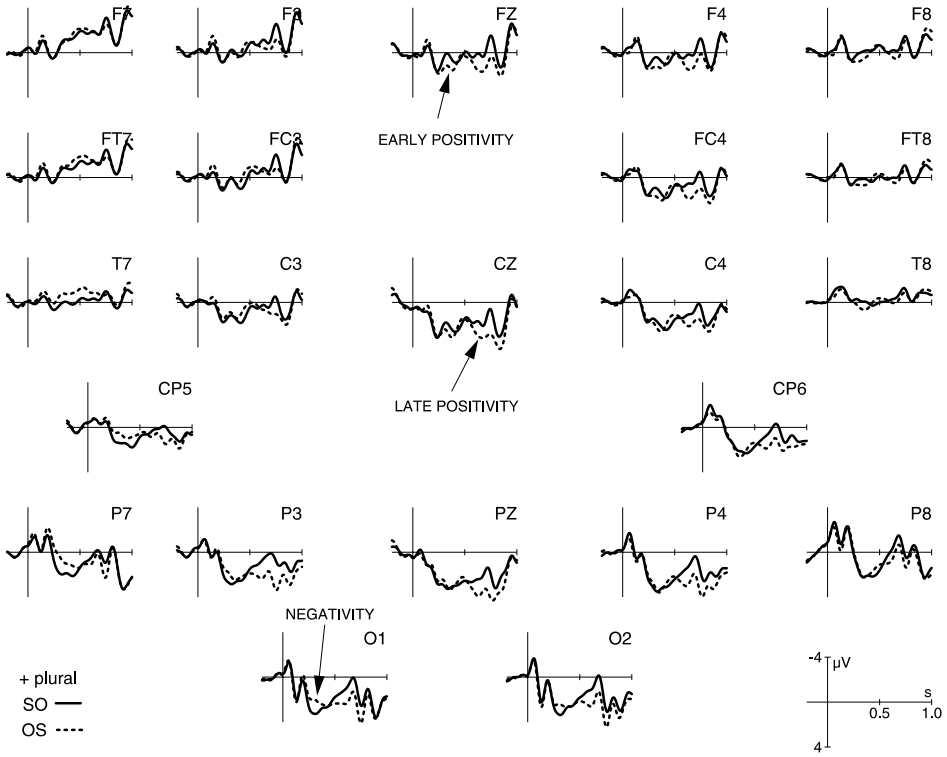

Figure 5.5: Grand Average ERPs elicited by the auxiliary for sentences with pronouns with a possible plural interpretation (+ plural), subject-first (SO) vs. object-first (OS).

For the statistical analyses, four different time windows were chosen (the same as in Experiment 1): 250 – 350 ms post onset of the auxiliary for the early positivity, 350-500 ms for the left-anterior negativity, 500-600 ms for the right-central negativity and, for the late positivity, 600 - 800 ms. In Experiment 1, I found no effect for sentences with pronouns between 500-600 ms. I also chose this time window to replicate this result.

250 – 350 ms time window

The global analysis of the lateral electrodes revealed no significant main effects, but interactions of WORD ORDER x REGION ($F(2,38) = 20.70$, $p \leq .0001$) and WORD ORDER x HEMISPHERE ($F(1,19) = 9.43$, $p = .006$).

The analyses of each ROI showed an effect of WORD ORDER in the following ROIs: right anterior ($F(1,19) = 7.03$, $p = .02$), right central ($F(1,19) = 4.17$, $p = .05$) and left posterior ($F(1,19) = 4.36$, $p = .05$).

The global analysis of the midline electrodes revealed no significant main effects, but a highly significant interaction of WORD ORDER x REGION ($F(2,38) = 15.90$, $p < .0001$). The separate analyses of the three midline electrodes showed a significant effect of WORD ORDER at FZ ($F(1,19) = 5.95$, $p = .02$) and CZ ($F(1,19) = 4.48$, $p = .05$).

In sum, the results for the first time window demonstrated an early fronto-central positivity for the non-canonical word order. In addition a more negative-going waveform in the left posterior ROI for the non-canonical word order were found, (see Figure 5.4 and 5.5).

The 350-500 ms time window showed no significant effects.

500-600 ms time window

The global analysis of the lateral electrodes revealed no significant main effects, but interactions of WORD ORDER x REGION ($F(2,38) = 3.80$, $p = .05$) and WORD ORDER x REGION x HEMISPHERE ($F(2,38) = 2.56$, $p = .10$). Resolving the interactions, a marginally significant effect of WORD ORDER in the left posterior ROI ($F(1,19) = 3.85$, $p = .06$) and a significant effect in the right posterior ROI ($F(1,19) = 4.28$, $p = .05$) were found.

The global analysis of the midline electrodes revealed only a marginally significant interaction of REFERENCE x ELECTRODE ($F(2,38) = 2.79$, $p = .07$), but no significant effect of REFERENCE at the three different electrodes.

To sum up, the third time window showed the beginning of the late positivity at posterior electrode sites. This effect is more pronounced and widely distributed in the following last time window.

600 – 800 ms time window

The global analysis of the lateral electrodes showed a highly significant main effect of WORD ORDER ($F(1,19) = 10.78$, $p = .004$), but no effect of REFERENCE ($F < 1$) and no significant interactions.

The global analysis of the midline electrodes also revealed a highly significant main effect of WORD ORDER ($F(1,19) = 16.82$, $p = .0006$), no significant effect of REFERENCE and no interactions.

In sum, the results for the fourth time window demonstrated a highly reliable widely distributed late positivity for the sentences with non-canonical word order, independent of the pronoun's reference.

5.2.3 Discussion

The behavioral data of Experiment 2 suggest that the manipulation of the reference of the pronoun had an effect. Error rates were higher and reaction times were longer for sentences with a possible plural interpretation for the pronoun than for sentences with a singular meaning only, independent of word order. The potential ambiguity of the pronoun's reference seems to make processing more difficult. The error rates also revealed an effect of word order. Higher error rates were observed for sentences with non-canonical word order in comparison to their canonical counterparts.

The ERP data showed effects of word order, but no effect of the reference manipulation. For sentences with a possible plural interpretation of the pronoun as well as for the pronouns without such a number ambiguity, a more negative-going waveform in the left posterior ROI for the non-canonical word order was found. Despite the slightly different distribution and time-course, it is argued that this left-lateralised negativity resembles the effect that was found in Experiment 1 (350-500 ms) and was related to morphosyntactic processing. Studies which investigated morphosyntactic violations also showed negativities that had quite different distributions (see section 4.2): Friederici and Frisch (2000) found a left-lateralized negativity in the central region after a case marking violation and Kaan (2002) revealed a bilaterally distributed negativity at central and posterior sites after a

subject-verb agreement error. However, it remains a question for further research what exactly determines the temporal and distributional characteristics of this early negativity.

The early positivity as the correlate of diagnosis and reanalysis was also not modulated by the reference variation. A fronto-central positivity between 250 and 350 ms for non-canonical sentences was found. The syntactic processes of diagnosis and reanalysis seem to be independent of the referential characteristics of the pronoun.

As in Experiment 1, no right-central negativity as a correlate of focus structural revision for sentences with pronouns was observed.

With Experiment 2, an alternative explanation of the late positivity in Experiment 1 was tested. The late positivity was interpreted as an effect of a subject preference driven by the discourse status of pronouns. But one could have argued that this effect found for non-canonical sentences is due to the additional number ambiguity of the pronoun. With a plural interpretation of the pronoun, object-first sentences can also be grammatical subject-first sentences, even if this analysis is pragmatically inadequate. Under this aspect of the ambiguity, the late positivity could have been viewed as a reflection of a rechecking process of the pronoun's reference. The ERP data did not reveal any evidence for this alternative explanation. In the late time window (600-800 ms), only an effect of word order was found, but no effect of the pronoun's reference and no interaction of the two factors. The variation of the reference did not modulate the late positivity[23].

[23] Like the number ambiguity, the matching of case and syntactic function did not lead to a modulation of the late positivity. The antecedents in the matrix clauses in (11) and (12) differ with regard to case and syntactic function, but not in terms of their discourse status. In both cases, 'Anna' is the topic of the sentence. It seems that the discourse-driven subject preference for pronouns reflected in the late positivity did not depend on the encoding of the topic as a subject. Nevertheless, it might be the case that the subject bias is dependent on the discourse status of its antecedent. Evidence for this interpretation comes from a study by Hemforth & Konieczny (2002). They found a preference for pronouns to be coreferent with the topic. Whether the late positivity

Further evidence against a preferred plural interpretation of a number ambiguous pronoun in non-canonical word orders comes from a study by Bader, Bayer and Häusler (2003). The authors compared sentences like (7) and (8).

(7a) Maria sagte, dass **sie** einige Leute gesehen **hat**.
(7b) Maria sagte, dass **sie** einige Leute gesehen **haben**.
*Maria said that **she/her/they/them** some people seen **has/have***
(8a) Maria sagte, dass **sie** von einigen Leuten gesehen **wurde**.
(8b) Maria sagte, dass **sie** von einigen Leuten gesehen **wurden**.
*Maria said that **she/her/they/them** by some people seen **was/were***

The sentences in (7) are of the same type as the sentences I used in the present experiment. Thus, the pronoun can be either singular or plural. (8b) is only grammatical if the pronoun is analysed as a plural one. Their results showed that in the non-canonical order, participants had a clear preference for the revision of the preferred syntactic structure over the revision of the pronoun's reference.

To sum up, no effect of the pronoun's reference on the syntactic processes of diagnosing a syntactic problem and reanalysing the preferred syntactic structure (early positivity) was observed.

The manipulation of the reference also had no effect in the late time window (late positivity). Consequently, the alternative explanation of the late positivity as a reflection of the additional number ambiguity of the feminine pronoun *sie* ('she') can be excluded. It is assumed that the late positivity is a result of an information-structurally-driven subject preference for pronouns triggered by the topic-hood of its antecedent.

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can be modulated by the discourse status of the pronoun's antecedent, has to be clarified in further studies.

5.3 Experiment 3: Number Variation of Referential DPs

Experiment 3 tries to answer the question of why there is a clear difference in the latency and duration of the early positivity elicited in the present study and the positivity reported for some previous studies investigating scrambled sentences (e.g., Friederici and Mecklinger, 1996; Friederici et al., 2001). For relative clauses, but not for scrambled sentences, Mecklinger et al. (1995) also found an early positivity. The authors assumed that relative clauses in comparison to scrambled sentences allow for a faster diagnosis and revision. This leads to the hypothesis that latency might reflect the ease of diagnosis (Friederici, 1998).

A reason for this difference in latency and duration could be a difference in the ease of diagnosing the symptom of the misanalysis and the ease of reanalysis in the two studies. As already mentioned, it has been shown in several studies that the difficulty of recovering from a garden-path depends on different types of information (see e.g., Fodor and Ferreira, 1998; Fodor and Inoue, 1994, 2000; Meng and Bader, 2000; see section 3.3 for a more detailed discussion). Experiment 1 and the previous ERP studies differ with regard to the sentence materials. In the present study, the first noun phrase was always a singular noun and the second noun a plural one. Therefore, the diagnosis of the syntactic problem in the sentences with non-preferred word order was very easy: the auxiliary *haben* ('have') signals the object-first order in all cases. The previous studies varied the number of the first and the second noun phrase and, consequently, the structural positions of the DPs and the number of the auxiliary. As a consequence, the diagnosis of the syntactic misanalysis and the reanalysis (reassignment of syntactic functions) should be more difficult.

This hypothesis was tested with the variation of the number of the first and second noun within the same sentence material as in Experiment 1. This experiment also tried to answer the question of why the previous studies did not find a correlate of focus structural revision for scrambled sentences. One reason for this could be the temporal overlap of the positivity and the negativity in the previous studies.

5.3.1 Method

Participants

Twenty students of the University of Leipzig (mean age 23.2, age range 20-29, 10 female) participated in the experiment. All participants were right-handed native speakers of German and had normal or corrected-to-normal vision.

Materials

The same sentence pairs with referential DPs as in Experiment 1 were used. To vary the number of the nouns, two sentence lists were constructed (see Table 5.5).

List 1
first noun singular, subject before object (SO)
Anna hat behauptet, dass die Tante die Nichten begrüsst hat während die Rede gehalten wurde.
(*Anna has claimed, that the aunt the nieces welcomed has while the audience addressed was*)
first noun plural, object before subject (OS)
Anna hat behauptet, dass die Nichten die Tante begrüsst hat während die Rede gehalten wurde.
(*Anna has claimed, that the nieces the aunt welcomed has while the audience was addressed*)
List 2
first noun plural, subject before object (SO)
Anna hat behauptet, dass die Nichten die Tante begrüsst haben während ...
(*Anna has claimed, that the nieces the aunt welcomed have while ...*)
first noun singular, object before subject (OS)
Anna hat behauptet, dass die Tante die Nichten begrüsst haben während ...
(*Anna has claimed, that the aunt the nieces welcomed have while ...*)

Table 5.5: Example sentences for each of the two critical conditions in the two lists in Experiment 3

For the first list, I interchanged the two noun phrases in one half of the sentences and in the other half for the second list. The two sentence versions corresponded to the factor *word order* (subject-object (SO) vs. object-subject (OS)).

The sentences were pseudo-randomized with the same constraints as in Experiment 1.

Procedure, *EEG Recording* and *Data Analysis* were the same as in Experiment 1.

5.3.2 Results

Behavioral Data

	Ref. DP - SO	**Ref. DP - OS**
Error rates	8.3 %	16.3 %
Reaction times	413 ms	425 ms

Table 5.6: Error rates and reaction times for the two conditions

For the error rates, a repeated measures ANOVA revealed a significant effect of WORD ORDER ($F(1,19) = 11.49$, $p = .003$). Sentences with non-canonical word order (object-first) showed higher error rates than their canonical counterparts.
The analysis of reaction times evoked no effect of WORD ORDER ($F < 1$).

ERP Data

Figure 5.6 shows grand averages for the sentences with SO vs. OS word order, at the position of the disambiguating auxiliary (*hat/haben* vs. *haben/hat*, 1000 ms post onset). The sentences with non-canonical word order show a widely distributed negativity and a late positivity.

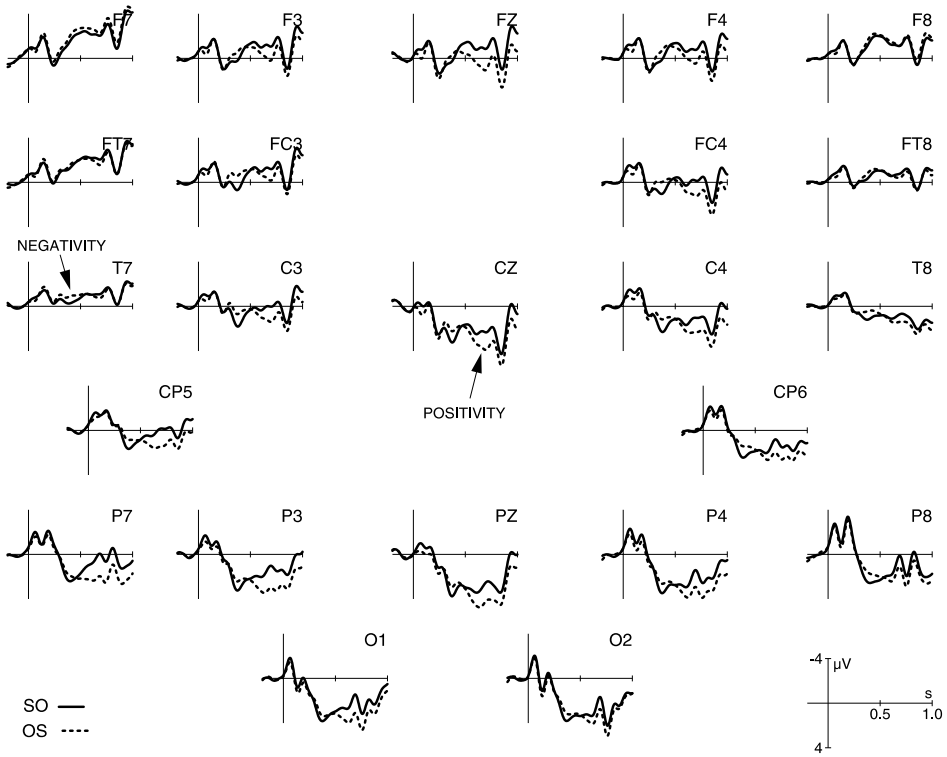

Figure 5.6: Grand Average ERPs elicited by the auxiliary for sentences with referential DPs, subject-first (SO) vs. object-first (OS).

For the statistical analysis, three different time windows were chosen on the basis of the previous experiments and visual inspection: 250-350 ms post onset of the auxiliary for the early positivity found in Experiment 1 and 2, 300-500 ms for the widely distributed negativity and 500-900 ms for the positivity found in previous studies for scrambled sentences in the same time window.

The early time window *250-350 ms* showed no significant effects.

300-500 ms

The global analysis of the lateral electrodes revealed a significant main effect of WORD ORDER ($F(1,19) = 4.46$, $p = .05$), but no interactions. The global analysis

of the midline electrodes showed no significant effect of WORD ORDER and no interactions ($F < 1$).

To sum up, a widely distributed negativity was found at lateral electrode sites for the sentences with non-canonical word order.

500-900 ms time window

The global analysis of the lateral electrodes revealed a significant main effect of WORD ORDER ($F(1,19) = 7.04$, $p = .02$) and a significant interaction of the factors WORD ORDER x REGION ($F(2,38) = 3.53$, $p = .04$) and a marginally significant three-way interaction of WORD ORDER x REGION x HEMISPHERE ($F(2,38) = 2.93$, $p = .08$). The analyses of each ROI showed an effect of WORD ORDER with a centro-parietal distribution: left central ($F(1,19) = 7.15$, $p = .02$), right central ($F(1,19) = 4.42$, $p = .05$), left posterior ($F(1,19) = 17.26$, $p = .0005$) and right posterior ($F(1,19) = 7.43$, $p = .01$).

The global analysis of the midline electrodes revealed a main effect of WORD ORDER ($F(1,19) = 8.92$, $p = .008$).

In sum, the results demonstrated a highly reliable centro-parietal late positivity for sentences with non-canonical word order.

5.3.3 Discussion

As in Experiment 1 and 2, the sentences with non-canonical word order showed higher error rates than the sentences with canonical word order. In the reaction times, the word order differences had no significant effect.

The ERP data revealed a widely distributed negativity in a similar time range as in Experiment 1, but with somewhat different topographic characteristics. The more locally restricted effect in Experiments 1 and 2 and the more widely distributed effect in Experiment 3 might be the result of an interaction of the negativity with the presence or absence of the early positivity. Therefore, this effect is interpreted like in Experiment 1 and 2 as the reflection of a morphosyntactic mismatch between the expected and the actual form of the auxiliary. As already mentioned in the

discussion of Experiment 2 (section 5.2.3), Kaan (2002) also found a bilaterally distributed negativity correlated with morphosyntactic processing.

Experiment 3 tried to answer the question why there is a clear difference in the latency and duration of the early positivity elicited in Experiment 1 and 2 and the later positivity reported for scrambled sentences by Friederici and Mecklinger (1996) and Friederici et al. (2001). Here, the hypothesis was formulated that these latency and duration differences between the two studies are caused by differences in the ease of diagnosing the syntactic problem and reanalysing the syntactic structure as a consequence of the differing sentence materials. This hypothesis was tested with the variation of the number of the first and second noun within the same sentence material as in Experiment 1.

The ERP data provide evidence for this hypothesis. The latency and the duration of the positivity correlated with diagnosing and reanalysing the syntactic structure clearly differ between Experiment 1 and Experiment 3. In Experiment 1, the positivity was significant between 250-350 ms. In Experiment 3, the positivity was present between 500-900 ms.

With Experiment 3, I also tried to answer the question why the previous studies did not find a correlate of focus structural revision for scrambled sentences. One reason for this could be the temporal overlap of the positivity and the negativity. The time window for the positivity that was found here includes the time window in which the negativity was found in Experiment 1 (500-600 ms).

To summarize, the difference in the onset of the positivities found in Experiments 1 and 3 depends on the number variation of the disambiguating auxiliary. Following Friederici (1998), this latency difference is correlated with the ease of diagnosing the 'symptom'. The difference in duration correlated with the ease of reanalyzing the syntactic structure seems to be the result of the more difficult reassignment of the syntactic functions if singular and plural DPs vary their structural positions in the sentence. In addition, the absence of the right-central negativity found in Experiment 1 in the present experiment and the previous studies is interpreted as an effect of the temporal overlap with the positivity.

5.4 Summary and Outlook

This study accrued evidence showing that in addition to syntactic information, different types of non-syntactic information influence the processing of word order variations in German.

All three experiments revealed a negativity in an early time window, which is interpreted to be the reflection between a mismatch of a morphosyntactic expectation and the actual word form.

The main result of Experiment 1 is that syntactic processing and focus structural processing can be differentiated during online sentence comprehension. We saw different ERP correlates of syntactic reanalysis (early positivity) and focus structural revision (right-central negativity).

No evidence could be found for a syntactic difference between sentences with scrambled DPs and moved pronominal objects. The correlates of syntactic reanalysis do not differ between scrambled sentences and sentences with moved pronouns.

But Experiment 1 also provides further evidence for the assumption that the processing of word order variations is influenced by the DP type of the moved constituents. The explanation offered by Bader and Meng (1999) concerning different effects corresponding to the processing of sentences with referential DPs in comparison to sentences with pronouns could be confirmed. Sentences with moved referential DPs require, besides syntactic reanalysis, an additional focus structural revision process. Further evidence for this interpretation comes from a study by Stolterfoht and Bader (2004) who observed no right-central negativity for scrambled sentences in which the focus of the sentence is assigned by a focus particle, and therefore no focus structural revision was necessary (see example in (9); effects of focus particles will be discussed in more detail in section 6.2 and in chapter 7).

(9) Anna hat behauptet, dass die Tante$_i$ **nur** [die Nichten]$_F$ t$_i$ begrüßt haben.
Anna has claimed that the aunt$_{acc/sg}$ only the nieces$_{nom/pl}$ welcomed have$_{pl}$.
'Anna has claimed that the aunt was welcomed by the nieces.'

Experiment 1 and Experiment 2 revealed a third ERP effect, a late positivity, for sentences with moved pronouns, which fits well with the results of Kaan (2001). The explanation of her findings relies on properties of pronouns related to information structure. Pronominal DPs, in comparison to referential DPs, have a stronger tendency to be the subject as they refer to discourse-salient entities or discourse topics which are more frequently encoded as subjects. Further research is necessary to demonstrate that this effect of information structural properties of DPs can be modulated by the manipulation of the topic-hood of the pronoun's antecedent.

The positivity found in Experiments 1 and 2 also goes along with the study of Friederici and Mecklinger (1996) demonstrating a similar effect for the processing of relative clauses. But note that Stolterfoht and Bader (2004) observed a late positivity also for scrambled sentences like (9). Therefore, the late positivity seems to be the reflection of a more general process, namely the mapping of different types of information, e.g. syntactic and information structural representations. I will come to this interpretation in chapter 8 where the data will be discussed in relation to Friederici's (1999, 2002) neurocognitive model of language comprehension (see section 4.3).

In Experiment 3, it could be shown that the time course of syntactic reanalysis depends on the ease of diagnosing a syntactic problem and reanalysing the syntactic representation built up to that point. Fodor and Inoue (1994, 2000) assume that the ease of diagnosis depends on the effectiveness of the 'symptom', that is, the element signaling an error in a particular structure. The ease of reanalysis seems to depend on the ease of reassigning syntactic functions. With regard to ERPs as correlates of sentence processing, Friederici (1998) suggested that the ease of diagnosis and reanalysis is reflected in the latency and the duration of the positivity. It could be

shown that the onset and duration of the positivity is sensitive to the variation of the number of the auxiliary and the two DPs contained in the complement clauses of the experimental sentences. Reanalysis starts very early and has a short duration if the misanalysis is signalled by the same word form in all cases and, consequently, singular and plural DPs have rigid structural positions in the sentences. If the number of the auxiliary and the position of singular and plural DPs are varied, reanalysis obviously starts later and continues much longer.

All in all, five different types of linguistic information could be differentiated, all of which play a crucial role in the processing of subject-object ambiguities: (1) morphosyntactic expectations, (2) the complexity of the syntactic representation, (3) focus structural characteristics, (4) the type of DP and (5) effectiveness of symptoms for diagnosis and reanalysis.

In the following, the right-central negativity, which was interpreted as a correlate of focus structural revision, will be considered in more detail. This is the first study which reported this component for the processing of word order variations. It has to be further clarified what kind of process is reflected by this ERP effect. As discussed in chapter 2, there are at least two different focus structural and prosodic representations for the scrambled sentence in (11).

(10) Anna hat behauptet, dass [die Tante die NICHten begrüßt hat]$_F$
Anna has claimed that the aunt$_{nom/sg}$ *the nieces*$_{acc/pl}$ *welcomed has*$_{sg}$
'Anna has claimed that the aunt welcomed the nieces.'

(11a) Anna hat behauptet, dass die Tante [die NICHten]$_F$ begrüßt haben]$_F$
Anna has claimed that the aunt$_{acc/sg}$ *the nieces*$_{nom/pl}$ *welcomed have*$_{pl}$.
'Anna has claimed that the aunt was welcomed by the nieces.'

(11b) Anna hat behauptet, dass die [TANte]$_{CF}$ die Nichten begrüßt haben.
Anna has claimed that the aunt$_{acc/sg}$ *the nieces*$_{nom/pl}$ *welcomed have*$_{pl}$.
'Anna has claimed that the aunt was welcomed by the nieces.'

In (11a), the moved DP *die Tante* ('the aunt') is background information, and therefore deaccented. The focus domain of the sentence can include the subject *die Nichten* ('the nieces') and the verb. In contrast, contrastive focus lies on the moved object DP in (11b). Stolterfoht & Bader (2004) discussed the possibility that the negativity observed in Experiment 1 reflects not only focus structural revision, but also an additional prosodic process[24]. In contrast to the default focus structural and prosodic representation for the preferred canonical word order in (10), the non-canonical sentence (11a) requires a focus structural revision whereas in (11b), the focus structure as well as the prosodic structure differs in comparison to the default assignment. At the moment, it could not be decided which of the two representations in (11) is the one that is assigned to scrambled sentences.

A first hint to the prosodic and focus structural representations built up for scrambled sentences gives us a post-experimental questioning in Experiment 3. Participants were asked to read aloud some of the experimental sentences. For the scrambled sentences, about 70 % of the participants realized a clear pitch accent on the scrambled object. First tentative results come from a small production study in which a female speaker read scrambled and non-scrambled sentences (embedded in filler sentences). In 6 of 10 cases, she stressed the first DP. In the remaining four sentences, she corrected herself and shifted the accent from the subject to the scrambled object. The question arises as to why participants should have a preference for assigning contrastive focus to the scrambled object. As discussed in section 2.2.2, the sentence in (10b) is more marked than the sentence in (10a), i.e., it imposes more restrictions on the context in which it can be uttered felicitously. Perhaps, it might be a disambiguation strategy. The sentences in (9) and (10a) are ambiguous with regard to focus structure and prosodic structure. The accent on the second DP can be interpreted as wide focus like in (9) and as narrow focus in (10a). In (10b), only a contrastive focus on the scrambled object is possible. Focusing the scrambled constituent might be a focus structural disambiguation process which could help the processing system to reanalyze scrambled sentences. Further research

[24] Evidence for prosodic processes during reading will be discussed in the following chapter.

is necessary to clarify whether the negativity is a correlate of focus structural revision only or whether this effect reflects additional costs for implicit prosodic processing.

To shed light on this question, I conducted a further experiment, which will be described in chapter 7. Before turning to this study, I will give an overview of studies that investigated the processing of focus structural and prosodic information, with a main emphasis on ERP studies.

CHAPTER 6

The Role of Focus Structure and Prosody in Language Comprehension

Many studies, using different methods, have investigated the role of prosody during language comprehension (for an overview, see e.g. Cutler, Dahan and van Donselaar, 1997; Nicol, 1996; Warren, 1996). In this chapter, I will focus on ERP studies investigating the processing of accent placement and/or focus structural characteristics and on behavioral studies showing effects of focus structural and prosodic information on the processing of syntactic ambiguities.

In section 6.1, studies on auditory language processing will be described. Section 6.2 discusses reading studies exploring the effects of focus and implicit prosody during reading. Section 6.3 provides a short summary of the results.

6.1 Prosody and Focus Structure in Auditory Language Processing

A series of behavioral experiments investigated effects of focus and accent placement in auditory language comprehension. As shown by Cutler and Fodor (1979), focusing leads to faster responses in phoneme monitoring in much the same way as accentuation does. Schafer, Carter, Clifton and Frazier (1996), Schafer, Carlson, Clifton and Frazier (2000) and Carlson (2001, 2002) could show that syntactic parsing is also influenced by focal pitch accents: the position of pitch accents influences ambiguity resolution. There are also information structural effects of focus and accent. Accents are taken as indicators of new information (Dahan, Tanenhaus and Chambers, 2002; Birch and Clifton, 1995, 2002). Birch and Clifton (1995) also showed that an accent on a specific constituent can project focus to the entire phrase.

There are only a few studies employing event-related brain potentials (ERPs) to investigate focus structural and prosodic effects. Johnson, Clifton, Breen and Morris (2003) investigated the processing of auditorially presented sentences embedded in

small contexts in English (see examples in (1) and (2)). The wh-questions in (1a) and (1b) request information regarding one constituent in the following answers. This answer either matched or did not match the information structural expectations with respect to the prosodic structure.

appropriate context

(1a) Rhonda kissed Jason. Who else was kissed by Rhonda?

inappropriate context

(1b) Evelyn kissed Jeremy. Who else was Jeremy kissed by?

target

(2) JERemy was kissed by Rhonda, too.

The results showed that focus on the one hand and prosodic pitch accenting on the other are associated with different ERP effects. The processing of focused (new) constituents compared to non-focused (given) material evoked a widely distributed late positivity (500-700 ms), irrespective of prosody, whereas the processing of prosodic information in terms of a missing pitch accent elicited an early anterior negativity (100 – 500 ms).

Hruska (2004) and Hruska and Alter (2004) presented question-answer pairs in German (see examples in (3) and (4)).

appropriate context

(3a) Wem verspricht Peter zu arbeiten und das Büro zu putzen?
'Whom does Peter promise to work and to clean the office?'

inappropriate context

(3b) Was verspricht Peter Anna zu tun?
What does Peter promise Anna to do?'

target

(4) Peter verspricht ANna zu arbeiten und das Büro zu putzen.
'Peter promises Anna to work and to clean the office.'

The authors found a similar positivity at parietal electrode sites for focused constituents, but only for prosodically matching question-answer pairs. Their results also showed a negativity (200-600 ms) with a centro-parietal distribution for a missing pitch accent in the answer. The authors interpreted this effect as a member of the N400-familiy. As described in section 4.2, the 'classical' N400 is elicited by semantic violations realized as sentences with one word that does not fit in the sentence context. The N400 can be interpreted as reflecting an integration problem: the upcoming word cannot be integrated in the (semantic) representation of the sentence. In parallel to this interpretation, Hruska (2004) correlated the observed negativity with integration problems due to the missing prosodic marking of the focused and expected constituent.

Toepel and Alter (2004) investigated similar sentence types in contexts requiring either contrastive focus or new information focus in the target sentences (see examples in (5) and (6).

appropriate context (new information focus)

(5a) Am Samstag hat Peter mir etwas versprochen.
'On Saturday, Peter promised me something.'
Was hat er Dir denn versprochen?
'What then did he promise you?'

inappropriate context (contrastive focus)

(5b) Am Samstag hat Peter mir etwas versprochen.
'On Saturday, Peter promised me something.'
Hat er Dir versprochen, Frauke zu entlasten?
'Did he promise you to relieve Frauke?'

target

(6) Er hat versprochen, Anna zu entlasten und das BÜro zu putzen.
'He has promised to relieve Anna and to clean the office.'

The results revealed a positivity at parietal electrode sites, similar to that found by Hruska (2004). In contrast to Hruska and similar to Johnson et al. (2003), this effect was independent of prosodic structure. For a missing contrastive accent on the critical word 'Anna' in (6), a negativity was observed when the sentence is preceded by a context asking for a contrastive focus (inappropriate context in (5b)). This effect seems to be similar to the negativity found by Hruska (2004).

All three studies showed that focus structural processing in auditory language comprehension elicits a late positive effect, whereas prosodic information in terms of a missing pitch accent evokes an earlier negativity. The studies described above were able to differentiate between effects of focus structure and those of prosody. Sentence material in both studies was presented auditorially; therefore, it was possible to create mismatches between a predicted focus structure and the realized prosodic structure. The question arises as to whether focus structure and accent placement have any effect on reading. Studies which investigated focus structural effects in reading will be discussed in the following section.

6.2 The Processing of Focus Structure and Implicit Prosody during Reading

Behavioral studies investigating the influence of focus structural restrictions have shown that focusing by means of it-clefts in English increases the salience of the focused constituent (see example (7), Birch, Albrecht and Myers, 2000).

context

(7) Betty was covering local and state races. She was at City Hall for a press conference. Minutes into the conference, an argument erupted.

target (focused)

(8a) <u>It was the mayor</u> who refused to answer a reporter's question.

target (non-focused)

(8b) <u>The mayor</u> refused to answer a reporter's question.

With a continuation task, the authors demonstrated that constituents introduced with a focusing it-cleft such as seen in example (8a) were more likely to be referred to in story continuations than constituents introduced with a definite determiner like in (8b). However, in a probe recognition experiment, the focus manipulation had no effect. Here, the position of the constituent was crucial. Responses were faster for constituents in the subject position than for constituents in object positions.

For similar sentences like the one in (8), an eye movement study could show that focused information is more carefully encoded by the reader (Birch and Rayner, 1997). Whereas the focus manipulation had no effect in first-pass parsing, participants were more likely to reread focused constituents in comparison to non-focused ones, and they spent a longer time doing so. The same was true when a constituent was narrowly focused by a preceding wh-question.

A specific context like a wh-question or a specific syntactic structure like it-clefts are not the only factor in determining the focus structural and prosodic characteristics of a sentence. Lexical elements like focus particles (*only*, *also* and *even*) also interact with the focus structure of a sentence. (9) shows one type of focus structural pattern for sentences with focus particles.

(9) Johnny bought *only* [a PREsent]$_F$

Here, the constituent to the right of the particle bears the nuclear accent of the sentence associated with narrow focus. This seems to be a typical pattern for sentences with focus particles in English and German (see e.g., Büring & Hartmann (2001)[25].

The semantic function of focus-sensitive operators is to signal that the focused element is being contrasted with a set of alternatives (see e.g., Krifka, 1991, Rooth, 1992). The sentence in (9) is only true if Johnny bought a present and nothing else,

[25] There are exceptions to this principle, e.g., the stressed additive particle AUCH ('also') has to appear to the right of the 'added' constituent (Reis & Rosengren, 1997):

(i) Ich glaube, dass Hans [Anna] AUCH besucht hat.

whereas the same sentence without the focus particle is also true if Johnny bought a present and any number of additional items.

Several studies that investigated focus structural effects on syntactic processing used focus particles for the manipulation of focus structure. Ni, Crain and Shankweiler (1996) investigated focus structural effects on the processing of reduced relatives (see section 3.1) like the examples in (10).

(10a) *The* businessmen loaned money at low interest were told to record their expenses.

(10b) *Only* businessmen loaned money at low interest were told to record their expenses.

The authors could show that a sentence-initial particle reduces reading times in the disambiguating region in reduced relatives (for similar results, see also Sedivy, 2002). Further results from an eye movement experiment indicated that the focus structural manipulation influences first-pass parsing. These effects are explained by the assumption that an element in focus is contrasted with a set of alternatives which favors the reduced relative analysis. However, using the identical sentence materials as in the Ni et al. study, Clifton, Bock and Radó (2000) failed to replicate this effect. In an eye movement study, Paterson, Liversedge and Underwood (1999) showed that focus particles do not influence first-pass parsing, but facilitate the reanalysis of the syntactic structure. Initial parsing seems to be influenced only in specific sentence types ("long" relative clause sentences, see Liversedge, Paterson and Clayes, 2002).

Effects of focus structural characteristics on processing were also investigated in two ERP studies. Wind Cowles (2003) investigated sentences in short contexts in English.

context

(11) A queen, an advisor and a banker were arguing over taxes. Who did the queen silence with a word, the banker or the advisor?

target (congruent)

(12a) It was the banker that the queen silenced.

target (incongruent)

(12a) It was the queen that silenced the banker.

The first sentence of the context introduces three referents. The second (and last) context sentence is a wh-question, which asks for a decision between two of the referents (see example (11)). In the congruent condition (12a), the suceeding sentence picks up one of the referents by a contrastive it-cleft. The it-cleft in the incongruent condition picks up an entity, which was mentioned already, but was not included in the alternative set given by the question. Her results showed a right lateralised negativity (200 – 500 ms) for the congruent condition compared to the incongruent condition. Similar to Hruska (2004), she interpreted this effect as a "kind of N400" (p. 135) and argues that prior context causes the participants to form expectations about which of the referents can appear in the contrastively focusing it-cleft.

Bornkessel, Schlesewsky and Friederici (2003b) investigated question-answer pairs in German. As shown in the examples in (14), the answers were either canonical sentences (subject-object) or non-canonical sentences (object-subject).

neural context

(13a) Klaus fragt sich, was am Sonntag passiert ist.

'Klaus wonders what happened on Sunday.'

subject focusing context

(13b) Klaus fragt sich, wer am Sonntag den Lehrer besucht hat.

'Klaus wonders who visited the teacher on Sunday.'

object focusing context

(13c) Klaus fragt sich, wen der Gärtner am Sonntag besucht hat.
'Klaus wonders who the gardener visited on Sunday.'
target subject-object

(14a) Dann erfuhr er, dass <u>der Gärtner</u> den Lehrer besucht hat.
Then heard he that the$_{nom}$ gardener the$_{acc}$ teacher visited has.
'Then he heard that the gardener visited the teacher.'
target object-subject

(14b) Dann erfuhr er, dass <u>den Lehrer</u> der Gärtner besucht hat.
Then heard he that the$_{acc}$ teacher the $_{nom}$ gardener visited has.
'Then he heard that the teacher was visited by the gardener.'

If the sentences in (14) were preceded by a context in which one argument is asked for by the wh-question (see (13b) and (13c)), the focused constituents elicited a parietal positivity (280-480 ms), independent of word order. The authors interpreted this effect as a correlate of focus structural processing. In contrast, the scrambled constituent in (14b) elicited a negativity (350-550 ms) when preceded by the neutral context in (13a) or the subject-focusing context in (13b). This negativity resembles the *scrambling negativity* found by Schlesewsky et al. (2003, see section 4.4) for scrambled constituents in isolated sentences. It seems that the givenness of the scrambled constituent by a context like (13b), which is assumed to license the movement of a DP (see section 2.2.2), does not help the parser to integrate the moved DP into the current phrase structure. However, the latency of the negativity in the scrambled sentences was shorter in context (13b) compared to the neutral context in (13a). According to the authors, this result indicates that the processing conflict may be more visible when a scrambled sentence appears in a licensing context. It is remarkable that the negativity does not appear when the scrambled constituent was focused. As mentioned above, a positivity was found for all focused constituents (I will come back to this result in the general discussion in chapter 8).

In comparison to the auditory ERP studies, the results of the reading studies showed a rather inconsistent pattern of results. A negativity as well as a positivity were found for focus structural processing. A reason for this inconsistency might be the different structures (focusing by it-clefts vs. focusing by wh-questions) and different languages (English vs. German) used across studies. Another problem for all studies described in this section is the fact that the focus structural manipulations are confounded with the prosodic structure of the sentences. The focus exponent of the sentence always coincided with the constituent bearing the nuclear accent (see examples (7) – (13)). Whereas the described studies show that a focus structural manipulation can have an effect on reading, they cannot distinguish between the influence of focus structure and/or prosody.

It has been shown that a phonological or prosodic representation (*implicit prosody*, see Fodor, 1998, 2002) is not only built up in auditory language comprehension, but also in reading. This process is called *phonological coding* (see e.g., Rayner and Pollatsek, 1989; Pollatsek, Rayner and Lee, 2000). As proposed by Slowiaczek and Clifton (1980), phonological coding in reading compensates for the lack of prosodic information in written language, since prosody is needed for successful understanding.

A number of recent studies have demonstrated that prosodic representations constructed during reading influence syntactic processing (e.g., Fodor, 2002; Steinhauer and Friederici, 2001; Steinhauer, 2003, see also section 4.2). These studies investigated effects of intonational phrasing during reading. The role of accent placement in reading has been almost entirely disregarded in the past. To my knowledge, the only study which investigated accent placement during reading was conducted by Bader (1998). He assumes that implicit prosody is one crucial factor for differences in garden-path strength (see section 3.3). This assumption is formulated in (15), (Bader, 1998, p. 8)[26].

[26] A similar constraint is formulated by Fodor (2002):

(15) *Prosodic Constraint on Reanalysis*

Revising a syntactic structure is difficult if it necessitates a concomitant reanalysis of the associated prosodic structure.

Evidence for this assumption comes from a study that investigated locally ambiguous sentences like the examples in (16) and (17), (see Bader, 1996, 1998).

(16a) Zu mir hat Maria gesagt, dass man ihr Geld anvertraut hat.
To me has Maria said that one (her)$_{dat}$ (money)$_{acc}$ entrusted has

(16b) Zu mir hat Maria gesagt, dass man *sogar* ihr Geld anvertraut hat.
To me has Maria said that one even (her)$_{dat}$ (money)$_{acc}$ entrusted has
'Maria said to me that someone entrusted money (even) to her.'

(17a) Zu mir hat Maria gesagt, dass man ihr Geld beschlagnahmt hat.
To me has Maria said that one (her$_{poss}$ money)$_{acc}$ confiscated has

(17b) Zu mir hat Maria gesagt, dass man *sogar* ihr Geld beschlagnahmt hat.
To me has Maria said that one even (her$_{poss}$ money)$_{acc}$ confiscated has
'Maria said to me that someone confiscated (even) her money.'

The ambiguous part of these sentences, namely *ihr Geld* ('her money') is resolved by the subcategorization of the two different verbs. In (16), the pronoun *ihr* is the dative object of the ditransitive verb *anvertraut* ('entrusted') whereas in (17), *ihr* is a possessive pronoun which is part of the accusative object *ihr Geld* of the verb *beschlagnahmt* ('confiscated'). There is no difference in reading times at the final verb in (16a) and (17a). In the sentences (16b) and (17b) in which a focus particle preceded the ambiguous pronoun, Bader found longer reading times for

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(i) *Implicit Prosody Hypothesis* (IPH)

In silent reading, a default prosodic contour is projected onto the stimulus, and it may influence syntactic ambiguity resolution. Other things being equal, the parser favors the syntactic analysis associated with the most natural (default) prosodic contour for the construction.

disambiguation of *ihr* as a dative object in (16b). He explains this difference by the different prosodic structures of (16b) and (17b).

(16b') Zu mir hat Maria gesagt, dass man sogar $[\text{IHR}]_F$ Geld anvertraut hat.
(17b') Zu mir hat Maria gesagt, dass man sogar $[\text{ihr GELD}]_F$ beschlagnahmt hat.

In (16b'), the pronoun bears the nuclear accent whereas in (17b'), the noun following the pronoun is accented. He assumes that the prosodic pattern in (17b') is the preferred one for the ambiguous string because of the prosodic difference between function words like *ihr* and content words like *Geld*. The former are prosodically less prominent than the latter. Function words also tend to be phonetically reduced in spoken language (Selkirk, 1984, 1995). As in the other studies described in this section, there is not only a prosodic difference between the two sentences types but also a focus structural one. In (16b'), only the pronoun is narrowly focused whereas in (17b') the pronoun and the noun are in focus. Evidence against a focus structural explanation comes from a further experiment by Bader (1998) in which the preferred prosodic pattern was shown to be sensitive to rhythmic alternations (Selkirk, 1984; see also section 2.3.2). When the focus particle *sogar* was replaced by a longer particle with two word-final unstressed syllables like *ausschließlich* ('exclusively'), the preference changed. Participants were more likely to stress the pronoun. This seems to be evidence for a pure prosodic preference and further supports the assumption that implicit prosody plays a crucial role.

6.3 Summary and Outlook

The auditory ERP studies described in section 6.1 were able to differentiate between prosodic processing on the one hand, and the processing of focus structure on the other. Focus structural processing elicits a positive effect, whereas prosodic processing was correlated with a negativity. For the processing of focus structure and implicit prosody in reading, all studies described in section 6.2, which showed

focus structural influences on syntactic processing, are faced with the problem of confounding focus structure and prosodic structure, as the focus exponent of the sentence was always the place of the nuclear accent as well. In section 7.2 of the following chapter, I will describe an experiment which tried to disentangle these two types of representations, i.e. focus structure and implicit prosody. In this study, I investigated the processing of *contrastive ellipses*. The characteristics of this sentence type will be described in section 7.1

CHAPTER 7

Contrastive Ellipses: The Processing of Focus Structure and Implicit Prosody

7.1 Contrastive Ellipses

As seen in the preceding chapter, the focus structure of a sentence can be determined by a preceding context, such as wh-questions or by a sentence-internal construction such as it-clefts. Another structure which highly depends on information structural characteristics and, therefore, interacts with focus structure and prosodic structure, is *contrastive ellipsis* like the examples in (1).

(1a) Am Dienstag hat der Direktor [den SCHÜler]$_{CF}$ getadelt, und nicht [den LEHrer]$_{CF}$
On Tuesday has the$_{nom}$ *principal the*$_{acc}$ *pupil criticized, and not the*$_{acc}$ *teacher*

(1b) Am Dienstag hat [der DiREKtor]$_{CF}$ den Schüler getadelt, und nicht [der LEHrer]$_{CF}$
On Tuesday has the$_{nom}$ *principal the* $_{acc}$ *pupil criticized, and not the*$_{nom}$ *teacher*
'On Tuesday, the principal criticized the pupil, and not the teacher.'

The German sentences in (1) illustrate that elliptic constructions like contrastive *replacives* also influence the focus structure of the related sentence. The term *replacive* is adopted from Carlson (2002) who refers to Drubig (1994). He labels this type of sentence in English as replacive negation, a type of negative-contrastive construction. This construction type, which appears in coordinate structures, leaves only one contrastively focused argument behind, is also called *bare argument conjunction* (Reinhart, 1991). This argument in the second conjunct is called the *contrastive remnant*. The remnant contrasts with one contrastively focused constituent in the related first conjunct, the *correlate* (see Winkler, 2003).

Replacives like the sentences in (1) are one type of contrastive focusing and appear in corrections, where (e.g.) one speaker uses grammatical entities against which another speaker protests with a sentence nearly identical except for a prosodically

marked corrective element (Steube, 2001, see section 2.2.2). The remnants in the examples in (1) either contrast with the subject or the object of the related sentence. With regard to the syntactic structure of the ellipsis site, I assume that there is no difference in syntactic complexity between the sentences with an object remnant in (1a) and the sentences with a subject remnant in (1b). For English, Drubig (1994) suggested that replacives are not actually elliptical, but phrasal conjunctions in which the second conjunct can be displaced to the end of the sentence. Winkler (2003) suggested a syntactic analysis of sentences like (1) which assumes 'PF-deletion' (see e.g., Chomsky and Lasnik, 1993; Klein, 1993; Wilder, 1996)[27]. Very simplified, she assumes that in sentence (1a), the object, and in (1b) the subject, are moved to a specifier position of VP. After that, the VP is ellided at PF (see representations in (1')).

(1a') ..., und nicht [$_{VP}$ den LEHrer$_i$ [$_{VP}$ ~~der Direktor~~ [$_{V'}$ t$_i$ [$_{V°}$ ~~getadelt hat~~]]]]

(1b') ..., und nicht [$_{VP}$ der LEHrer$_i$ [$_{VP}$ t$_i$ [$_{V'}$ ~~den Schüler~~ [$_{V°}$ ~~getadelt hat~~]]]]

Nevertheless, neither analysis shows syntactic complexity differences between subject versus object remnants at the ellipsis site. This assumption is supported by evidence from sentence processing. Whereas other types of ellipses show clear complexity effects in processing (for an overview of ellipsis processing, see Frazier and Clifton, 2001), Carlson (2002) investigated replacives and found no evidence for a complexity difference. She used ambiguous sentences like the one in (2) (see Carlson, 2002, p. 107). In (2a), the remnant is lexically parallel to the subject, whereas (2b) shows a parallelism to the object.

(2a) Maude called a policemen for help, not Marjorie.

(2b) Maude called a policemen for help, not a fireman.

[27] Note that Winkler (2000, 2003) assumes a PF-deletion account only for contrastive ellipses. Other types of VP-ellipses are explained by a proform account (*Hybrid Focus Hypothesis of Ellipsis*; Winker, 2003, p. 270).

In a questionnaire study, she found a clear preference for subject interpretations of the remnant in sentences like (2a) and a clear object preference for (2b). In contrast to results for the processing of other types of ellipses (e.g., *gapping*) which showed an overall preference for object interpretations (see also Carlson, 2001), she interpreted her results for the processing of replacives as evidence for the assumption that subject- and object-replacives do not differ with regard to syntactic complexity. Beside lexical parallelism effects, Carlson (2003) could also show that focus structural and prosodic information influences the interpretation of replacives (see examples in (3)).

(3a) After dinner, *only* the JUDge joined the diplomat for coffee, not the senator.

(3b) After dinner, the judge joined *only* the DIplomat for coffee, not the senator.

In a visual as well as in an auditory study, she could show that the focus particle, as well as the accent, bias the interpretation of the ambiguous remnant. The auditory study, in which the factors accent and focus particle were crossed, also revealed that focus particle and accent had approximately equal and entirely non-interactive effects on the interpretation of the remnant.

These results suggest that the unambiguous German sentences in (1) are also qualified for the investigation of focus structural and implicit prosodic effects during sentence processing. These sentences were used for an ERP study which will be described in the following section. Before turning to the description of the experiment, specific hypotheses concerning the ERP correlates of processing focus structure and prosody will be formulated.

7.2 Experiment 4: Processing Contrastive Ellipses

To differentiate between focus structural processes on the one hand and accent placement on the other, elliptic constructions like the examples in (5) were used.

Default focus structure and prosodic structure

(4) [Am Dienstag hat der Direktor den SCHÜler getadelt]$_F$
On Tuesday has the$_{nom}$ *principal the*$_{acc}$ *pupil criticized*
'On Tuesday, the principal criticized the pupil:'

object contrast without focus particle (ON)

(5a) Am Dienstag hat der Direktor [den SCHÜler]$_{CF}$ getadelt, und nicht den LEHrer
On Tuesday has the$_{nom}$ *principal the*$_{acc}$ *pupil criticized, and not the*$_{acc}$ *teacher*
'On Tuesday, the principal criticized the pupil, and ~~the prinicipal did~~ not ~~criticize~~ the teacher.'

subject contrast without focus particle (SN)

(5b) Am Dienstag hat [der DiREKtor]$_{CF}$ den Schüler getadelt, und nicht der LEHrer.
On Tuesday has the$_{nom}$ *principal the*$_{acc}$ *pupil criticized, and not the*$_{nom}$ *teacher*
'On Tuesday, the principal criticized the pupil, and the teacher did not ~~criticize the pupil~~.'

object contrast with focus particle (OF)

(6a) Am Dienstag hat der Direktor nur [den SCHÜler]$_{CF}$ getadelt, und nicht den LEHrer.
On Tuesday has the$_{nom}$ *principal only the*$_{acc}$ *pupil criticized, and not the*$_{acc}$ *teacher*
'On Tuesday, the principal criticized only the pupil, and ~~the prinicipal did~~ not ~~criticize~~ the teacher.'

subject contrast with focus particle (SF)

(6b) Am Dienstag hat nur [der DiREKtor]$_{CF}$ den Schüler getadelt, und nicht der LEHrer.
On Tuesday has only the$_{nom}$ *principal the*$_{acc}$ *pupil criticized, and not the*$_{nom}$ *teacher*
'On Tuesday, only the principal criticized the pupil, and the teacher did not ~~criticize the pupil~~.'

Without a preceding context, a sentence like (4), which is identical to the first conjunct of the coordinate sentences, has a wide focus reading. The whole sentence consists of new information. According to the *Null Theory of Phrase Stress* (Cinque, 1993, see section 2.2.2), the sentence accent lies on the most deeply embedded phrase, the accusative object (*den Schüler*, 'the pupil'). It is assumed that during sentence comprehension, the language processor assigns this *default*

prosodic and focus structure to sentences like (5) until the contrastive remnant is encountered. When the sentence in (4) is continued by a contrastive ellipsis which assigns narrow focus and accent to the object of the related clause, there is a focus structural difference between the default assignment in (4) and the representation in (5a). The processing system has to revise the focus structural representation (wide focus → narrow focus). When (4) is compared to (5b), a focus structural revision has to be accomplished, too (wide focus → narrow focus). In addition, the nuclear accent has to be reassigned to the subject, i.e., an additional prosodic revision has to take place (nuclear accent object → nuclear accent subject). In contrast, the control sentences in (6) require no prosodic or focus structural revision. The focus particle *nur* ('only') assigns narrow focus and accent independently to its adjacent constituent, i.e. the default assignment cannot apply. With the assumption of a default focus structure and prosodic structure in reading, the following hypotheses can be formulated.

Hypothesis (1)

If the remnants of (5a) and (6a) are compared, **ON vs. OF**, a focus structural revision has to be undertaken only for (5a). We should see the correlate of **focus structural revision** for sentence (5a): *wide focus → narrow focus.* According to the auditory studies described in section 6.1, which were able to differentiate between focus structural and prosodic processing, a positive deflection is expected.

Hypothesis (2)

For the comparison of (5a) and (5b), **ON vs. SN,** a focus structural revision has to be done for both sentences. Only for sentence (5b) is an additional prosodic revision necessary. Therefore, the correlate of **prosodic revision** for sentence (5b) should be seen: *nuclear accent object → nuclear accent subject.* According to the auditory studies, a negative-going ERP signal is expected.

Hypothesis (3)

Comparing (5b) and (6b), **SN vs. SF**, a focus structural and prosodic revision have to be done only for (5b). The correlate of **focus structural and prosodic revision** for this comparison should be seen: *wide focus → narrow focus* and *nuclear accent object → nuclear accent subject.* In principle, a positivity and a negativity are predicted. These effects, however, may overlap in time and may therefore not be as clear as in the single revision comparisons.

Hypothesis (4)

For the behavioral data (error rates and reaction times for answering comprehension questions), I predict higher error rates and reaction times for sentences requiring focus structural and/or prosodic revisions (sentences without focus particles) than for sentences for which no revision processes are necessary (sentences with focus particles): **ON, SN** vs. **OF, SF.**

These hypotheses were tested in Experiment 4.

7.2.1 Method

Participants

20 students of the University of Leipzig (mean age 24.0, age range 20-30, 10 female) participated in the experiment. All participants were right-handed native speakers of German and had normal or corrected-to-normal vision.

Materials

The experimental sentences were constructed on the basis of a verb list consisting of 100 transitive verbs. The participles of the verbs were combined with two masculine nouns (nominative and accusative) to form the VP. The first position in the sentences (*Vorfeld*, position in front of the finite verb) was filled by temporal adverbials. Together with the VP and the finite verb (auxiliary) in V2-position, the

first clause of the sentence (correlate) results in an unmarked argument order in German: *temporal adverbial* > *auxiliary* > *subject* > *object* > *lexical verb*. The second clause of the sentence (contrastive remnant) consists of a negation particle (*nicht,* 'not') and a further masculine noun, which was marked either for nominative or accusative case. This results in two versions of each sentence. Two further versions were constructed by the insertion of a focus particle (*nur*, 'only') either before the subject or the object of the first clause. For a comparison of the sentences with focus particles (OF vs. SF), no ERP differences were expected because no revision processes are necessary. This comparison also controls for the fact that the comparisons involve morphologically identical constituents as well as morphologically different constituents. If different case marking (nominative vs. accusative) plays a role, similar effects should be found for the comparison of constituents with different case marking, in sentences without focus particles (ON-SN) and in sentences with focus particles (OF-SF).

The four sentence versions corresponded to the full crossing of the factor *contrast* (subject vs. object) and *focus particle* (with vs. without) (see examples in (5) and (6)).

The final set of experimental sentences presented to participants consisted of 50 sentences for each of the four critical conditions, resulting in a total of 200 experimental sentences per participant. Each participant saw two versions of one quadruple. The two versions differed with regard to the presence of a focus particle and the type of contrastive remnant. Additionally, each participant saw 150 filler sentences. To avoid strategies of contrastive accent placement in the first part of the sentences, the filler sentences contained no contrastive ellipsis. In 50 of the filler sentences, a focus particle appeared in front of the first DP, and 50 fillers in front of the second DP. 50 fillers contained no particle (see Table 7.1).

without focus particle
Am Montag hat die Mutter die Kinder beschäftigt.
On Monday has the mother the children occupied
'On Monday, the mother occupied the children.'
focus particle in front of the second DP
Am Montag hat die Tante nur die Nichten begrüßt.
On Monday has the aunt only the nieces welcomed
'On Monday, the aunt welcomed only the nieces.'
focus particle in front of the first DP
Am Dienstag hat nur die Sängerin die Zuschauer beschimpft.
On Tuesday has only the singer the audience insulted
'On Tuesday, only the singer insulted the audience.'

Table 7.1: Different versions of filler sentences

After the presentation of each experimental sentence, participants were required to answer a comprehension question. The questions asked for the relation of agent and patient of the sentences. The comprehension task required the answer 'yes' equally as often as the answer 'no'. To keep the length of the experiment acceptable for the participants, only 80 of the filler sentences were followed by a question.

The sentences were presented in 10 blocks of 63 trials (sentences + questions). The frequency of questions, fillers and experimental sentences was balanced across blocks. The sentences were pseudo-randomized with the following constraints: Trials of one quadruple were separated by at least one block. Trials with or without focus particles and sentences with subject or object contrast were not presented in more than three consecutive trials. No more than three experimental or filler trials were presented in succession. Questions that required the same answer or trials without a question were not presented in more than three successive trials. Additionally, it was ensured that each condition occurred approximately equally often in each block.

Two experimental lists were created which were pseudo-randomized in parallel twice. The resulting four experimental lists were presented five times across the twenty participants.

Procedure

The sentences were presented word by word except for the DPs and PPs: determiner/preposition and noun were presented as a whole. The words and phrases were presented in the center of a computer screen. The presentation of a sentence was preceded by a fixation point, which appeared for 550 ms followed by a pause of 100 ms. Words were presented for 450 ms. Determiner and noun were presented together for 550 ms. The duration of the inter-stimulus interval was 100 ms. The presentation of a sentence was followed by a 1500 ms pause, after which a question mark was presented for 450 ms to signal the beginning of the comprehension question. Then, the whole comprehension question appeared on the screen for 2000 ms. After a pause of 200 ms, 'yes' and 'no' appeared on the screen to signal the value assignment of the two hand-held push-buttons. Participants were given maximally 2500 ms to give the answer. When an answer had been given or after 2500 ms, the fixation point of the next trial appeared after a pause of 1000 ms. Participants were asked to avoid blinks and other movements during the presentation of the sentences and to restrict blinks and movements to the presentation and answering of the comprehension question.

The assignment of the values 'yes' and 'no' to the left and right push-buttons was varied between participants. Prior to the experimental session, 25 practice trials were presented. The whole experiment lasted approximately 1.25 hours. Including electrode preparation, an entire session lasted no longer than 2.5 hours.

EEG Recording

The EEG was recorded with 26 AgAgCL-electrodes, which were fixed at the scalp by means of an elastic cap (Electro Cap International) and placed in the following electrode sites (labelled according to the nomenclature proposed by the American

Encephalographic Society (Sharbourgh et al., 1991)): FP1, FPZ, FP2, F7, F3, FZ, F4, F8, FT7, FC3, FC4, FT8, T7, C3, CZ, C4, T8, CP5, CP6, P7, P3, PZ, P4, P8, O1, O2. The ground electrode was positioned above the sternum. The recordings were referenced against the left mastoid. The activity over the right mastoid was actively recorded and did not reveal any condition specific variation. All recordings were re-referenced to linked mastoids offline. The vertical electrooculogram (EOGV) was recorded bipolar from electrodes placed above and below the right eye. The horizontal EOG (EOGH) was recorded bipolar from positions of the outer canthus of each eye. Electrode impedances were kept below 5 kΩ. All EEG and EOG channels were amplified using a Twente Medical System DC amplifier and recorded continuously with a digitization rate of 250 Hz. The ERPs were filtered off-line with 8 Hz low pass for the plots, but all statistical analyses were computed on non-filtered data.

Data Analysis

For the behavioral data, error rates and reaction times for the comprehension questions were analyzed. Incorrectly answered trials were excluded from the reaction time analysis. Reaction times and error percentages per condition and subject were used as data entries in a repeated measures analyses of variance (ANOVAs), with the factors CONTRAST and FOCUS PARTICLE.

For the ERP data, only correct responded trials entered the analysis. Trials containing occular, amplifier-saturation or other artefacts were also excluded (EOG rejection above 40 μV).

The EEG data per participant and condition were averaged from the onset of the contrastive remnant to 1500 ms post onset, before grand-averages were computed over all participants. The averages were aligned to a 200 ms pre-stimulus baseline.

For the statistical analyses of the ERP data, ANOVAs were calculated for mean amplitude values per time window per condition. Time windows were chosen on the basis of previous studies and visual inspection of the data. To allow for a quantification of hemispheric differences, the three midline electrodes and the

lateral positions were analysed separately. For the midline electrodes, the analysis included the variables CONTRAST (object vs. subject), FOCUS PARTICLE (with vs. without) and ELECTRODE (FZ, CZ, PZ). Instead of the variable ELECTRODE, the analyses for the lateral electrodes included two topographical variables: REGION (anterior vs. central vs. posterior) and HEMISPHERE (left vs. right).

Crossing the two factors for the lateral electrodes resulted in six regions of interest (ROIs). Regions of interest were defined as for Experiment 1-3. The data analysis also proceeded in accordance with the procedure outlined for Experiment 1-3.

7.2.2 Results

Behavioral Data

	ON	**OF**	**SN**	**SF**
Error rates	7.2 %	6.4 %	7.3 %	4.3 %
Reaction times	373 ms	372 ms	371 ms	368 ms

Table 7.2: Error rates and reaction times for all four conditions

With regard to error rates, a repeated measures ANOVA revealed a highly significant effect of FOCUS PARTICLE ($F(1,19) = 14.39$, $p = .001$). Error rates were higher for sentences without focus particles than for sentences with focus particles.

The analysis of the reaction times revealed no significant effects ($Fs < 1$).

ERP Data

Figure 7.1 shows the grand averages for the sentences with object contrast, with vs. without focus particle, at the ellipsis site (1500 ms post onset of the final DP). The sentences without a focus particle show a widely distributed positivity (350-1300 ms).

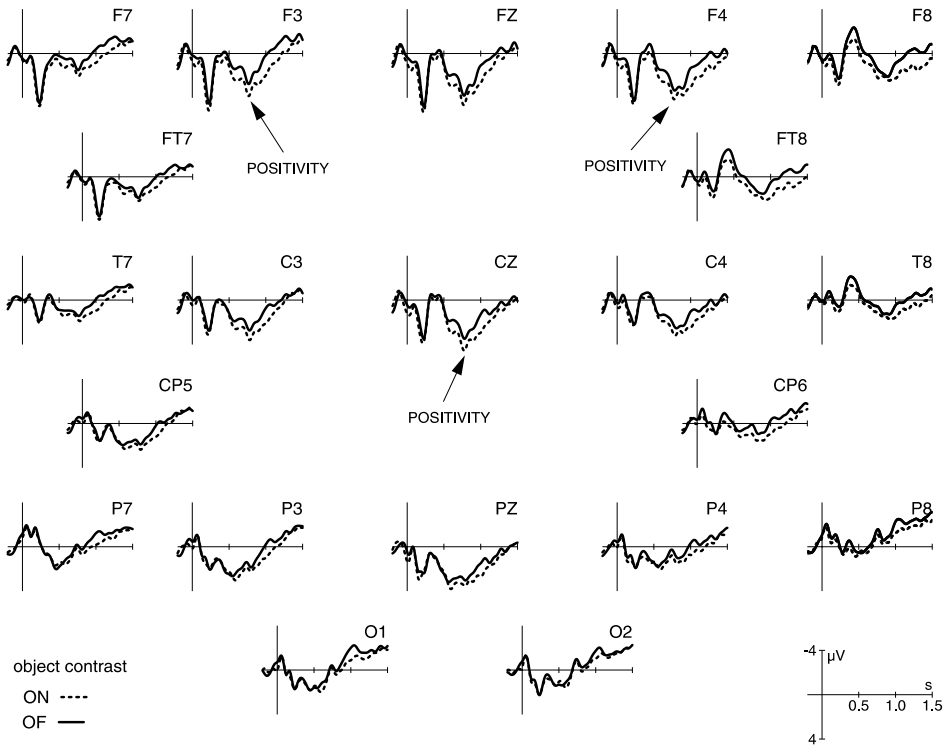

Figure 7.1: Grand average ERPs elicited by the contrastive remnant (onset at the vertical line) for the sentences with object contrast, with vs. without focus particle at the ellipsis site. Negativity is plotted upwards.

Figure 7.2 shows the grand averages at the final DP for the sentences without focus particles, object contrast vs. subject contrast. Here, the sentences without focus particle show a widely distributed negativity (450-650 ms).

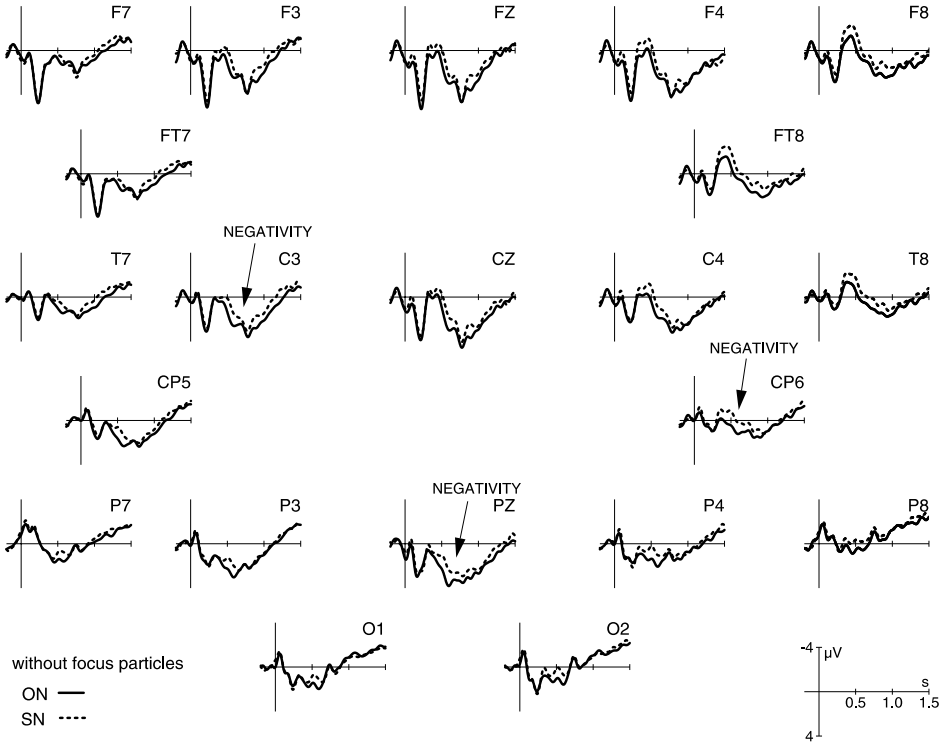

Figure 7.2: Grand average ERPs elicited by the contrastive remnant for the sentences without focus particles, object contrast vs. subject contrast.

Figure 7.3 shows the grand averages at the final DP for the sentences with subject contrast, with vs. without focus particle. For the sentences without focus particle, a right-central negativity (450-650 ms) was found.

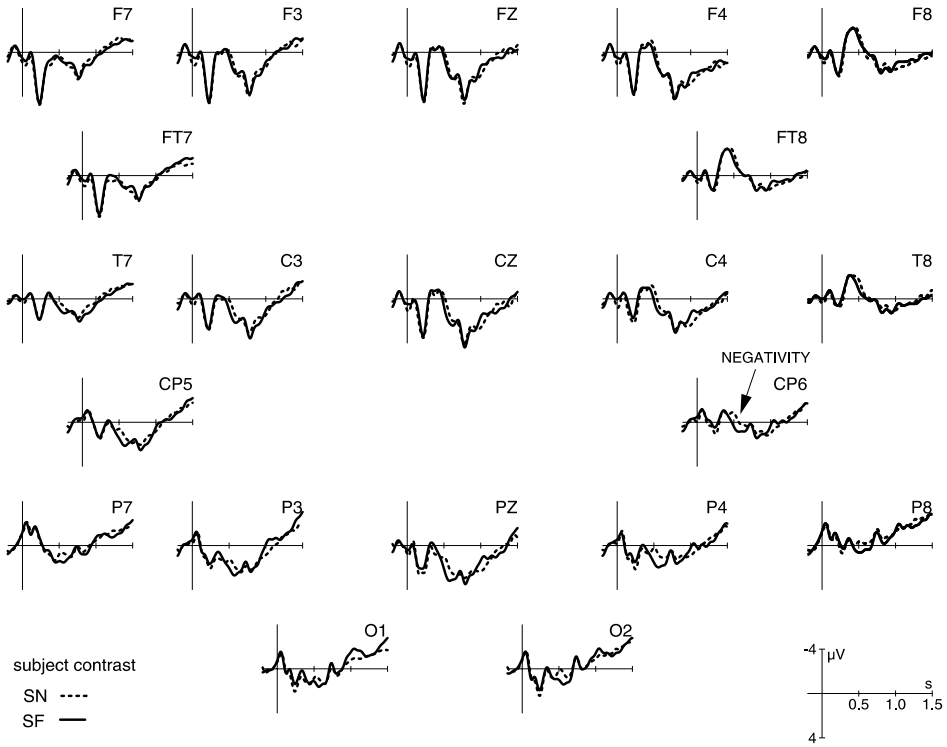

Figure 7.3: Grand average ERPs elicited by the contrastive remnant for the sentences with subject contrast, with vs. without focus particle.

The grand average waveforms at the final DP for the sentences with focus particles, subject contrast vs. object contrast, did not reveal any significant effect in the relevant time windows, and are, therefore, not displayed separately.

For the statistical analysis of the effects seen in the grand averages, two different time windows were chosen: 350 – 1300 ms post onset of the final DP for the positivity, a 450-650 time window for the negativities and a 1100-1500 ms time window for the late negativity.

350 – 1300 ms

The global analysis of the lateral electrodes revealed no significant main effects, but a significant interaction FOCUS PARTICLE x CONTRAST ($F(1,19) = 4.27$, $p =$

.05). In resolving the interaction, only the comparison of sentences with object contrast, with vs. without focus particle, showed a significant effect of FOCUS PARTICLE ($F(1,19) = 9.93$, $p = .005$) with a more positive going waveform for sentences without a focus particle.

The global analysis of the midline electrodes revealed no significant main effects or interactions.

In sum, the results of the first analysis covering a long time range demonstrated a highly reliable widely distributed positivity for the sentences with object contrast without focus particle in comparison to sentences with object contrast and focus particle (see Figure 7.1). This is the comparison for which a correlate of focus structural revision was predicted.

450 – 650 ms

The global analysis of the lateral electrodes revealed a significant main effect of FOCUS PARTICLE ($F (1,19) = 6.52$, $p = .02$) and significant interactions of FOCUS PARTICLE x CONTRAST ($F(1,19) = 6.65$, $p = .02$) and FOCUS PARTICLE x REGION ($F(2,38) = 3.29$, $p = .05$). Resolving the interaction FOCUS PARTICLE x REGION, no significant effect of FOCUS PARTICLE in the different ROIs was found.

Resolving the interaction FOCUS PARTICLE x CONTRAST, a significant effect of FOCUS PARTICLE ($F(1,19) = 5.02$, $p = .04$) was found for the comparison of the sentences with object contrast, with vs. without focus particle. The comparison of sentences without focus particle, subject contrast vs. object contrast revealed a significant effect of CONTRAST ($F(1,19) = 8.71$, $p = .008$). The sentences with subject contrast, with vs. without focus particle, showed a marginally significant effect of FOCUS PARTICLE ($F1,19) = 2.83$, $p = .10$). Visual inspection of the data in this comparison showed a negativity similar to the negativity found in Experiment 1. Despite the fact that the interaction of FOCUS PARTICLE x REGION did not reach significance ($F(2,38) = 1.87$, $p = .18$), I analyzed each ROI

separately to compare these two negativities. The effect only reached significance in one ROI: right central ($F(1,19) = 5.03$, $p = .04$).

The analysis of the midline electrodes revealed a highly significant effect of CONTRAST ($F(1,19) = 8.55$, $p = .009$) and a significant interaction FOCUS PARTICLE x CONTRAST ($F(1,19) = 4.10$, $p = .05$). Resolving the interaction, a significant effect was only found in the comparison of sentences without focus particle, subject contrast vs. object contrast: CONTRAST ($F(1,19) = 7.49$, $p = .01$).

In sum, the results for the time window between 450-650 ms revealed a highly reliable widely distributed negativity for the sentences with subject contrast without focus particle compared to sentences with object contrast without focus particle (see Figure 7.2). For this comparison, a prosodic revision process was hypothesized. The same sentences compared to sentences with subject contrast with focus particle showed a marginally significant negativity which reaches significance only in the right central region (Figure 7.3). Here, processes of both focus structural and prosodic revision were predicted.

As for the long time window which temporally includes the one analyzed here, a widely distributed positivity for sentences with object contrast without focus particle in comparison to sentences with object contrast with focus particle were found (see Figure 7.1).

In both time windows, no significant effects were found for the comparison of the sentences with focus particle, subject contrast vs. object contrast.

7.2.3 Discussion

The behavioral data indicate that the presence of a focus particle has an effect, and therefore, confirm Hypothesis (4). As expected, error rates were significantly higher for sentences without focus particles, as for these sentences, focus structural and prosodic revision processes were predicted. These processes were assumed not to be necessary in the presence of focus particles assigning prosodic structure and focus structure of the sentence. The reaction times revealed no significant effects. It is

arguable, however, as to how meaningful the reaction time data are, as participants were not asked to make a speeded decision.

For the comparison of the sentences with focus particles, no significant effects were found. This result confirms the assumption that revision processes were not necessary for these sentences. This result further indicates that the morphological difference between nominative and accusative case marking plays no important role for the processing of contrastive ellipses.

According to Hypotheses (1) and (2), two different ERP correlates were predicted on the basis of previous auditory studies: A positivity for focus structural revision on the one hand, and a negativity for implicit prosodic revision on the other. Overall, the ERP results are in agreement with the hypotheses. A bilateral sustained positivity (350-1100 ms) as a correlate of focus structural revision was found. A widely distributed negativity (450-650 ms) was observed for the revision of the implicit prosodic representation.

First of all, these results show that it was possible to differentiate between focus structural and implicit prosodic processing during reading. Furthermore, the outcome of this experiment supports the assumption that implicit prosodic representations play a crucial role in sentence processing. This seems to be true not only for intonational phrasing but also for accent placement. The results fit well with the results of the auditory studies described above (Johnson et al., 2003; Hruska, 2004; Hruska and Alter, 2004, Toepel, 2004): A negativity was found for prosodic processing, whereas focus structural processing elicited a positive deflection. Although similarities in the polarity of the effects compared to those in the auditory domain were found, differences between auditory language comprehension and reading were also observed. The onset of the negativity appeared much earlier in the auditory studies, whereas the positivity appeared clearly later. This might be an effect of the modality. Possibly, prosodic information is in the foreground in auditory language comprehension, while in reading, focus structure is more highlighted. The explicit acoustic information realized as a missing pitch accent available in the auditory stimulus is presumably more salient

than a missing accent in an implicit prosodic representation and can be processed immediately. A further difference between the two modalities seems to be the feasibility of revision processes. It was argued that the effects observed in the present study reflect revision processes, i.e. a change in the prosodic and focus structural representations built during sentence comprehension. It seems unlikely that the effects found in the auditory domain, where explicit focus structural and prosodic information were given, are correlates of revision processes. However, further research is necessary to clarify these modality-specific differences and the exact time-course of prosodic and focus structural processes.

In the comparison for which correlates of both prosodic and focus structural revision were predicted (see Hypothesis (3)), only a small locally restricted right-central negativity (450-650 ms) was found. This could be the result of an overlap of the ERP components. The correlates of focus structural and prosodic processing are reversed in their polarity and overlap temporally. Another reason for this finding might be an interaction between focus structural and implicit prosodic processing. Further experiments have to explore the (in)dependency of the processing of implicit prosodic structure and focus structure.

The observed right-central negativity resembles the negative component (500-600 ms) that was found in Experiment 1 (see section 5.1.2) for the processing of non-canonical word order. This seems to support the speculation in the discussion of Experiment 1 (see section 5.1.3) that during the processing of scrambled sentences, focus structure and prosodic structure have to be revised (I will further discuss this point in the general discussion in the following chapter).

In conclusion, the results show that implicit prosodic and focus structural processing in reading have different ERP correlates each comparable to those found in auditory language comprehension. These results strengthen the assumption that, beside morphological, syntactic and semantic information, focus structure and implicit prosody play a crucial role in reading.

CHAPTER 8

General Discussion and Outlook

This final chapter has the following objectives: I will give a summary of the results from Experiments 1-4 and discuss these in light of the theoretical considerations in chapter 2 and the findings of the psycholinguistic studies described in chapters 3, 4 and 6. In addition, the implications of the present findings for models of sentence processing (which were introduced in chapter 3 and 4) will be highlighted. An outlook on possible future research will also be given.

8.1 Summary of the Results

Chapter 2 described the syntactic and focus structural characteristics of scrambling and pronoun movement in German. In section 2.2.1, I argued for a movement account of scrambling and pronoun fronting. Under this assumption, sentences with canonical word order (subject-before-object) and sentences with non-canonical word order (object-before-subject) differ with regard to their syntactic representations: A moved constituent adjoins to the extended projection of VP and leaves a trace in its base position. Therefore, canonical and non-canonical word orders differ with regard to the complexity of the syntactic structure. Evidence for this complexity difference comes from psycholinguistic studies using behavioral methods (see section 3.2) as well as from studies using neurophysiological measures, in particular event-related brain potentials (ERPs, see section 4.4). These studies revealed that the parser highly prefers the canonical word order subject-before-object.

In addition to syntactic differences, chapter 2 also described information structural differences dependent on word order. Contextual information in terms of the given-new distinction determines the focus structure of the following sentence. Conversely, syntactic and prosodic characteristics determine the contexts with

which a given sentence is compatible (see section 2.2.2). It has been shown that non-canonical sentences are more marked than canonical ones, i.e. non-canonical word order imposes more restrictions on the context in which it can be uttered felicitously (see also Höhle, 1982; Weskott, 2002). Consequently, different word order variations not only vary in terms of their syntactic representations, but also with regard to focus structure: Without a preceding context, sentences with canonical word order are assumed to have a wide focus reading, whereas in scrambled sentences, one or more constituents have to be interpreted as narrowly focused. Chapter 2 also showed that these focus structural differences depend on the type of nominal expression. In contrast to referential DPs, pronouns have no referential potential. As anaphoric expressions, pronouns refer to background information, which generally has to precede new information (see section 2.2.1). Pronouns are typically used to refer to discourse-salient entities or discourse topics. These differences also result in different focus structural characteristics for sentences with pronouns on the one hand, and sentences with referential DPs on the other. As described above, the movement of referential DPs leads to a focus structural representation that differs from that of canonical word order. This is not the case for pronoun movement. The movement of a subject pronoun and the movement of an object pronoun have the same focus structural effects. Apart from the focus structural differences, I argued that scrambling and pronoun fronting are syntactically the same. Section 2.3.1 showed that there is no reason to assume different landing positions or different movement types for referential DPs in contrast to pronouns. Both DP types are XPs that adjoin to the extended verbal projection (see e.g., Haider and Rosengren, 1998; Lenerz, 1992).

These considerations lead to the assumption of the following syntactic and focus structural representations for ambiguous canonical and non-canonical sentences with referential DPs and pronouns (see examples in (1) and (2)).

Scrambling

(1a) Anna hat behauptet, dass [die Tante die Nichten begrüßt hat]$_F$
Anna has claimed that the aunt$_{nom/sg}$ *the nieces*$_{acc/pl}$ *welcomed has*$_{sg}$
'Anna claimed that the aunt welcomed the nieces.'

(1b) Anna hat behauptet, dass die Tante$_i$ [die Nichten]$_F$ t_i begrüßt haben
Anna has claimed that the aunt$_{acc/sg}$ *the nieces*$_{nom/pl}$ *welcomed have*$_{pl}$.
'Anna claimed that the aunt was welcomed by the nieces.'

Pronoun movement

(2a) Anna hat behauptet, dass sie [die Nichten begrüßt hat]$_F$
Anna has claimed that she$_{nom/sg}$ *the nieces*$_{acc/pl}$ *welcomed has*$_{sg}$
'Anna claimed that she welcomed the nieces.'

(2b) Anna hat behauptet, dass sie$_i$ [die Nichten t_i begrüßt haben]$_F$
Anna has claimed that she$_{acc/sg}$ *the nieces*$_{nom/pl}$ *welcomed have*$_{pl}$.
'Anna claimed that she was welcomed the nieces.'

The question that motivated the experimental part of my thesis was the following: Is it possible to differentiate between syntactic and focus structural representations for sentences with word order variations during processing? First evidence for a positive answer to this question came from a study by Bader and Meng (1999), who investigated sentences similar to the examples in (1) and (2). Sentences with pronouns were judged as grammatical more frequently than sentences with referential DPs. Bader and Meng interpreted the observed difference as a result of the focus structural difference between (1b) and (2b). For both sentences, a syntactic reanalysis is necessary because of the preference for the subject-before-object order in ambiguous sentences. For the non-canonical sentences with referential DPs, an additional focus structural revision is required. This additional process is not necessary for sentences with pronouns. Further evidence for differences between the processing of word order variations with referential DPs and with pronouns comes from a study by Kaan (2001). She investigated the

processing of relative clauses in Dutch and was able to show that the referential status of DPs modulates the subject-first preference. She explains the more pronounced subject-preference for pronouns with the observation that, compared to referential DPs, pronouns have a stronger tendency to refer to discourse-salient entities or discourse topics which are more frequently encoded as subjects than non-subjects (Ariel, 1990; Givón, 1983).

The aforementioned studies on DP type effects showed rather inconclusive results. They reported evidence for two different processing preferences dependent on DP type. Bader and Meng (1999) found a penalty for the processing of non-canonical sentences with referential DPs in comparison to pronouns whereas the results of Kaan (2001) show the reverse pattern: She found that pronouns are more likely to be the subject than referential DPs. With the present study on the processing of word order variations, I aimed to find evidence for these two different information structural factors influencing the processing of word order variations, i.e., focus structural characteristics and the discourse status of DPs. A second question which could not be answered on the basis of the behavioral results of the two studies can be formulated as follows: Do the referential and focus structural characteristics of different DP types influence syntactic processing or are they processed independently? I addressed these two questions by using event-related brain potentials (ERPs), a fine-grained online measurement with high temporal resolution, which allows for the differentiation of distinct processes in a multi-dimensional fashion.

Experiment 1, which investigated sentences like (1) and (2), revealed four different ERP effects on the disambiguating auxiliary for the non-canonical word order compared to the canonical order (see section 5.1).

(1) A left-anterior negativity (350-500 ms) was found for non-canonical sentences. This effect was interpreted as an instantiation of an LAN effect. In previous studies, the LAN was observed for morphosyntactic violations like subject-verb agreement errors (e.g., Kutas and Hillyard, 1993; Osterhout and Mobley, 1995, see also section 4.2). In the context of the present study, this effect was interpreted as a reflection of

a morphosyntactic mismatch between the expected and the actual form of the auxiliary. On the basis of the preferred subject-before-object order, the parser expects the singular form of the auxiliary (see examples in (1) and (2)). The plural auxiliary in the sentences with non-canonical word order violates this morphosyntactic expectation. This effect was also observed in Experiments 2 and 3.

(2) The fronto-central positivity (250-350 ms) was interpreted as a reflection of the diagnosis and reanalysis of the syntactic structure. This effect was not modulated by DP type, a result that is compatible with the syntactic analyses for non-canonical sentences with referential DPs and pronouns given in chapter 2 and which can be interpreted as evidence for the assumption that scrambled sentences do not differ syntactically from sentences with moved pronouns.

The positivity elicited in the present study clearly differs in latency and duration from the results of previous studies. Whereas the positivity in the present study was significant between 250 and 350 ms, Friederici and Mecklinger (1996) and Friederici et al. (2001) found a positivity between 500-900 ms. This can be accounted for with reference to the different sentence materials used in these studies. In Experiment 1, the first noun phrase of the complement clause was always singular and the second one was plural. Therefore, the diagnosis of the syntactic problem was very easy: the auxiliary *haben* ('to have') signaled the non-canonical word order in all cases. The previous studies varied the number of the first and second noun phrase. As a consequence, the diagnosis of the syntactic problem and the reanalysis should be more difficult. Evidence for this explanation was found in Experiment 3, which also varied the number of the first and the second noun phrase in scrambled sentences. Here, the sentences with non-canonical word order revealed a positivity between 500-900 ms which was very similar to the positivities found in the previous studies. This result supports the assumption that the ease of diagnosis and reanalysis is reflected by the onset and the duration of this positive ERP component (see Friederici, 1998).

(3) An additional positive ERP deflection that was not observable for the scrambled sentences was found for non-canonical sentences with pronouns. This widely

distributed positivity (600-800 ms) was correlated with a process triggered by the discourse status of pronouns. In accordance with Kaan (2001), this effect could be interpreted as reflecting the more pronounced subject-preference for pronouns which, compared to referential DPs, have a stronger tendency to refer to discourse-salient entities or discourse topics which are more frequently encoded as subjects than as non-subjects.

An alternative explanation of the late positivity was tested in Experiment 2. The pronoun *sie* ('she') used in Experiment 1 is not only case ambiguous (nominative vs. accusative), but also ambiguous with respect to number (singular vs. plural). With the plural interpretation of the pronoun, object-first sentences can in principle also be analyzed as subject-first sentences, even if this analysis is pragmatically inadequate. With this analysis, the pronoun has no explicit antecedent in the matrix clause, which contained an unambiguous singular DP. According to the alternative explanation, the late positivity could be a reflection of a rechecking process of the pronoun's reference. In Experiment 2, the sentences in (2) were compared to sentences in which the matrix clause excludes the plural interpretation of the pronoun. No modulation of the late positivity was found with this manipulation. This result was interpreted as evidence against the rechecking explanation. Nevertheless, it remains to be seen whether the late positivity that was interpreted as a discourse-driven effect can be modulated by the information structural characteristics of the pronoun's antecedent in a preceding context.

(4) Instead of the late positivity found for non-canonical sentences with pronouns, sentences with moved referential DPs revealed a right-central negativity (500-600 ms). This ERP effect was interpreted as the correlate of focus structural revision. This was the first study which reported this component. Previous studies on the processing of scrambled sentences did not find this effect. Additionally, the negativity was also absent in Experiment 3. This was interpreted as the result of a temporal overlap of the later positivity, found with the number variation in the sentence material, and the negativity. Nonetheless, this ERP effect was investigated in more detail. As discussed in chapter 2, there are at least two different focus

structural and prosodic representations for scrambled sentences (see examples in (3)).

(3a) Anna hat behauptet, dass die Tante [die NICHten]$_{F}$ begrüßt haben]$_{F}$

(3b) Anna hat behauptet, dass die [TANte]$_{CF}$ die Nichten begrüßt haben.
Anna has claimed that the aunt$_{acc/sg}$ the nieces$_{nom/pl}$ welcomed have.
'Anna claimed that the aunt was welcomed by the nieces.'

In (3a), in contrast to (1a), only a focus structural revision has to take place. The sentence accent in (1a) and (3a) lies on the same constituent. In contrast, the representation illustrated in (3b) with contrastive focus and accent on the scrambled element requires a focus structural and a prosodic revision compared to (1a). A number of studies have demonstrated that prosodic representations are not only constructed in auditory language comprehension, but also in reading (see e.g., Rayner and Pollatsek, 1989; Pollatsek et al., 2000). It has also been demonstrated that these representations influence syntactic processing (see e.g., Fodor, 2002; Steinhauer 2003; Steinhauer and Friederici, 2001). Therefore, we cannot determine which of the two representations in (3) is assigned to the scrambled sentences. Consequently, the right-central negativity could either be a correlate of focus structural revision only or it could reflect two different processes: a focus structural as well as a prosodic revision. To differentiate between these two possibilities, a further experiment was conducted.

In Experiment 4 (see chapter 7), the processing of contrastive ellipses was investigated. By using these constructions, it was possible to distinguish between the revision of focus structure and the revision of the prosodic representation (*implicit prosody*). For the comparison for which a correlate of focus structural revision was predicted, a widely distributed positivity (350-1300 ms) was found. The revision of implicit prosody elicited a widely distributed negativity (450-650 ms). These results are comparable to the outcome of auditory ERP studies for the processing of focus and accent (see section 6.1). Sentences for which revision

processes of both focus structure and prosodic structure were predicted revealed a right-central negativity (450-650 ms). This component resembles the right-central negativity found for scrambled sentences in Experiment 1. Therefore, this result was interpreted as evidence for the assumption that the reanalysis of scrambled sentences requires three different types of changes, namely the reanalysis of the syntactic structure and revisions of the prosodic and of the focus structural representation. At this point, the question arises as to whether participants should assign contrastive focus to the scrambled constituent. As discussed in section 2.2.2, the sentence in (3b) is more marked than the sentence in (3a). A reason for this could be the focus structural ambiguity between (3a) and the canonical word order (see example (1a)). Whereas the accent on the most deeply embedded phrase in (3a) is ambiguous with regard to focus structure (wide or narrow), (3b) is unambiguous. This disambiguation process might help the parser to reanalyze scrambled sentences. Further evidence for a preference for a narrowly focused scrambled constituent stems from the study of Bornkessel et al. (2003b, see section 6.2) who investigated word order variations in context. For sentences with non-canonical word order, the authors found a negativity on the scrambled constituent when the sentences were embedded in neutral contexts or in contexts in which a wh-question focused the subject. This effect disappeared when the scrambled object was narrowly focused by the context question. In this case, the results revealed a positivity which was also found on focused constituents in canonical sentences. I thus conclude that the preferred focus structural and prosodic representations for scrambled sentences contain a contrastively focused object as illustrated in (3b). I will return to this issue in the next section.

All in all, the following six factors could be differentiated for the processing of word order variations by the use of ERP measures: (1) morphosyntactic expectations, (2) syntactic complexity, (3) ease of diagnosis, (4) referential status of DPs, (5) focus structural characteristics and, (6) prosodic characteristics. In the following section, I will discuss the processing of these different types of information in light of models of sentence comprehension.

8.2 Implications for Models of Sentence Processing

Serial and modular models of sentence processing like the garden-path model (Frazier, 1987a, 1990) assume that syntactic processing in first-pass parsing is independent of other types of linguistic information (see section 3.1.1). The results of the present study on word order variations could show that syntactic reanalysis is also not influenced by other types of revision processes in second-pass parsing. The ERP correlate of focus structural and prosodic revision did not interact with the correlate of syntactic reanalysis. Furthermore, the syntactic reanalysis was not influenced by the discourse status of different DP types. These results can be interpreted as evidence against constraint-based accounts which assume that all sources of information (linguistic and non-linguistic) interact at the same time during parsing (e.g., MacDonald, 1997; Tanenhaus, Spivey-Knowlton and Hanna, 2002, see also section 3.1).

The data also support models of sentence processing which take differences in garden-path strength into account, such as the diagnosis model (Fodor and Inoue, 1994, 2000; see also section 3.3.1). This model, which is also serial and modular like the garden-path model, explains garden-path strength for non-preferred structures at the cost of deducing which structural alterations are needed. The ease of diagnosis depends on the effectiveness or informativeness of the *symptom*, that is, the element signaling an error in a particular structure. Experiment 3 demonstrated that the time-course of syntactic reanalysis is sensitive to a variation of the symptom's effectiveness. The correlate of syntactic reanalysis started later and continued much longer when the number of the auxiliary and the two DPs contained in the experimental sentences was varied.

On the basis of the present experiments, which investigated isolated sentences, nothing can be said directly about contextual effects on sentence processing. Nevertheless, the results of Bornkessel et al. (2003b) described above seem to support models that assume contextual influences on first-pass parsing like the referential-support model (Crain and Steedman, 1985; Altmann and Steedman, 1988, see section 3.1.2). Independent of word order, Bornkessel et al. found a

positivity for constituents that were focused by wh-questions. The interpretation of this result highly depends on the interpretation of the *scrambling negativity* found for non-focused scrambled constituents (see also Rösler et al., 1998; Schlesewsky et al., 2003; section 4.4). Schlesewsky et al. (2003) interpreted this effect as a reflection of a syntactic processing difficulty for scrambled referential DPs. In light of the present experimental results, the scrambling negativity can also be interpreted as a reflection of focus structural and prosodic processes. A similar explanation was suggested by Rösler et al. (1998, see section 4.4) With this interpretation, the negativity is not correlated with syntactic processing, but with the assignment of narrow focus and accent to the scrambled constituent. This explanation also predicts the absence of the negativity for focused scrambled constituents found by Bornkessel et al. (2003b). With regard to contextual effects, this would mean that context does not influence first-pass syntactic processing, but prosodic and focus structural processing. An auditory experiment could give us information about that controversial point: the syntactic explanation of the negativity would predict the same negativity for scrambled constituents in comparison to non-scrambled ones both bearing a clear pitch accent, whereas the prosodic and focus structural explanation would predict that there is no difference between the two conditions. However, further research is necessary to decide whether contextual information influences first-pass parsing.

To a large extent, the data fit well with the neurocognitive model of sentence processing developed in Friederici (1999, 2002, see section 4.3). Similar to the garden-path theory (Frazier, 1987a, 1990), this model assumes different independent stages in language processing. After a very early stage of word category identification, a second phase of lexical integration (300-500 ms) follows. In this time window, semantic and morphosyntactic integration (N400, LAN) processes take place. The correlate of morphosyntactic processing (early negativity, 250-500 ms) which was found in Experiment 1-3 can be attributed to this phase. With regard to the time course of the correlate of prosodic and focus structural revisions, this might also be the phase of focus structural processing (Experiment 1:

right-central negativity, 500-600 ms; Experiment 4: right-central negativity and widely distributed negativity, 450-650 ms). However, it has to be noted that the correlate of focus structural revision (Experiment 4) differs with regard to duration. This effect was observed between 350-1300 ms and overlaps with the third and last phase assumed by the model. This phase, correlated with late positivities between ~500-1000 ms, attends to syntactic reanalysis and the mapping of different types of linguistic information. These assumptions fit well with the time-course and interpretation of the effect found for non-canonical sentences with pronouns. This positivity (600-800 ms) was correlated with a preference for pronouns to be the subject, driven by their referential status. This process is interpreted as the difficulty to map the syntactic representation to the information structural characteristics of a sentence.

The positivity (500-900 ms) correlated with syntactic reanalysis found in Experiment 3 can also be easily apportioned to the third processing phase. The time course of the early positivity (250-350 ms) found in Experiments 1 and 2, which was also correlated with the process of diagnosis and reanalysis, suggests that the time course of revision processes is more flexible and depends highly on effectiveness of symptoms and ease of reanalysis. Earlier positivities have been observed for the syntactic reanalysis of relative clauses (Friederici and Mecklinger, 1996; Mecklinger et al., 1995; see section 4.4), and thematic reanalysis (Bornkessel et al., 2003a, see section 4.4). These earlier positivities could be interpreted as the reanalysis of one specific type of structure, namely syntactic and thematic reanalysis, whereas the later positivities reflect the mapping of different types of representations. Stolterfoht and Bader (2004, see section 5.4) observed an early and a late positivity for scrambled sentences which did not require a focus structural revision. The authors interpreted the early positivity as a correlate of syntactic reanalysis and the late positivity as the mapping of the syntactic and focus structural representations.

All in all, the results of the present studies demonstrated that information structure plays an important role in sentence comprehension. Focus structure, implicit

prosody and the referential characteristics of nominal expressions are crucial factors in understanding language. So far, these different types of information structural processes and their interplay with syntactic processing are not implemented in the discussed models of sentences processing. The findings of this thesis are a good starting point for the integration of information structural processes into models of language comprehension. Further research on the temporal dynamics of these processes is needed, not only on the sentence level, but also in discourse processing.

REFERENCES

Abraham, W. (1992). Wortstellung und das Mittelfeld im Deutschen. In: W. Abraham (Ed.). *Erklärende Syntax des Deutschen*. Tübingen: Narr, 27-52.

Alter, K., Mleinek, I., Rohe, T., Steube, A., & Umbach, C. (2001). Kontrastprosodie in Sprachproduktion und -perzeption. *Linguistische Arbeitsberichte*, 77, 59-79.

Altmann, G., & Steedman, M. (1988). Interaction with context during human sentence processing. *Cognition*, 30, 191-238.

Ariel, M. (1990). *Accessing noun-phrase antecedents*. London: Routledge.

Aoun, J., & Li, Y.A. (1993). *The syntax of scope*. Cambridge, MA: MIT Press.

Bader, M. (1996). *Sprachverstehen: Syntax und Prosodie beim Lesen*. Opladen: Westdeutscher Verlag.

Bader, M. (1998). Prosodic influences on reading syntactically ambiguous sentences. In J. D. Fodor, & F. Ferreira (Eds.), *Reanalysis in sentence processing* (pp. 1-46). Dordrecht: Kluwer.

Bader, M., Bayer, J., & Häusler, J. (2003). Resolving number ambiguities – redoing lexical, syntactic, and interpretative decisions. Poster presented at the 16th Annual CUNY Conference on Human Sentence Processing, Boston, MA.

Bader, M., & Meng, M. (1999). Subject-object ambiguities in German embedded clauses: An across-the-board comparison. *Journal of Psycholinguistic Research*, 28, 121-143.

Bader, M., Meng, M., Bayer, J., & Hopf, J.-M. (2001). Syntaktische Funktionsambiguitäten im Deutschen – Eine Klarstellung. *Zeitschrift für Sprachwissenschaft* 20, 266-279.

Bayer, J., & Kornfilt, J. (1994). In N. Corver, & H. van Riemsdijk (Eds.), *Studies on scrambling – movement and non-movement approaches to free word-order phenomena*. Berlin: de Gruyter, 17-60.

Bayer, J., & Marslen-Wilson, W. (1992). Configurationality in the light of language comprehension: the order of arguments in German. Ms., University of Aachen, University of Vienna, Birbeck College, London.

Behagel, O. (1909). Beziehung zwischen Umfang und Reihenfolge von Satzgliedern. *Indogermanische Forschungen*, 25, 110-142.

van Berkum, J. J. A., Hagoort, P., & Brown, C. M. (1999). Semantic integration in sentences and discourse: evidence from the N400. *Journal of Cognitive Neuroscience*, 11, 657-671.

Bever, T. G. (1970). The cognitive basis for linguistic structures. In J. R. Hayes (Ed.), *Cognition and the development of language* (pp. 279-362). New York: Wiley.

Bierwisch, M. (1988). On the grammar of local prepositions. In M. Bierwisch, W. Motsch, & I. Zimmermann (Eds.), *Syntax, Semantik und Lexikon* (pp. 1-65), Studia Grammatica XXIX.

Birch, C., Albrecht, J. E., & Myers, J. L. (2000). Syntactic focusing structures influence discourse processing. *Discourse Processes*, 30, 285-304.

Birch, S., & Clifton, C. (1995). Focus, accent, and argument structure: Effects on language comprehension. *Language and Speech*, 38, 365-391.

Birch, S., & Clifton, C. (2000). Effects of varying focus and accenting of adjuncts on the comprehension of utterances. *Journal of Memory and Language*, 47, 571-588.

Birch, S., & Rayner, K. (1997). Linguistic focus affects eye movements during reading. *Memory and Cognition*, 25, 653-660.

Bolinger, D. L. (1961). Contrastive accent and contrastive stress. *Language*, 37, 83-96.

Bornkessel, I. (2002). *The argument dependency model: A neurocognitive approach to incremental interpretation*. MPI Series in Cognitive Neuroscience, 28.

Bornkessel, I., Schlesewsky, M., & Friederici, A. D. (2002). Grammar overrides frequency: Evidence from the online processing of flexible word order. *Cognition*, 85, B21-B30.

Bornkessel, I., Schlesewsky, M., & Friederici, A. D. (2003a). Eliciting thematic reanalysis effects: On the importance of structure-independent order information during parsing. *Language and Cognitive Processes*, 18, 269-298.

Bornkessel, I., Schlesewsky, M., & Friederici, A. D. (2003b). Contextual information modulates initial processes of syntactic integration: The role of inter- versus intrasentential predictions. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 29 (5), 971-882.

Bosch, P., & van der Sandt, R. (1999). *Focus. Linguistic, cognitive, and computational perspectives.* Cambridge: Cambridge University Press.

Brennan, S. E. (1995). Centering attention in discourse. *Language and Cognitive Processes*, 10, 137-168.

Büring, D. (1997). *The meaning of topic and focus - The 59th Street bridge accent*. London: Routledge.

Büring, D., & Hartmann, K. (2001). The syntax and semantics of focus-sensitive particles in German. *Natural Language, & Linguistic Theory*, 19, 229-281.

Cardinaletti, A., & Starke, M. (1995). The typology of structural deficiency: On the three grammatical classes. *University of Venice Working Papers in Linguistics*, 4, 41-109.

Carlson, K. (2001). The effects of parallelism and prosody in the processing of gapping structures. *Language and Speech*, 44 (1), 1-26.

Carlson, K. (2002). *Parallelism and prosody in the processing of ellipsis sentences*. New York, London: Routledge.

Carlson, K. (2003). Prosodic and syntactic focus effects in parsing. Paper at "Syntax and Beyond" – International workshop on syntactic processing and its relation to the processing of discourse, information structure, semantics and prosody. Leipzig.

Chafe, W. (1974). Language and consciousness. *Language*, 50, 111-133.

Chomsky, N. (1965). *Aspects of the theory of syntax*. Cambridge: MIT Press.

Chomsky, N. (1981). *Lectures on government and binding.* Dordrecht: Foris.

Chomsky, N. (1995). *The minimalist program.* Cambridge, Mass.: MIT Press.

Chomsky, N., & Lasnik, H. (1993). The theory of principle and parameters. In J. Jacobs, A. von Stechow, W. Sternefeld, & T. Vennemann (Eds.), *Syntax: Ein internationales Handbuch zeitgenössischer Forschung* (pp. 506-569). Berlin: de Gruyter.

Cinque, G. (1993). A null theory of phrase and compound stress. *Linguistic Inquiry*, 18, 239-297.

Clifton, C., Bock, J., & Radó, J. (2000). Effects of the focus particle *only* and intrinsic contrast on comprehension of reduced relative clauses. In A. Kennedy, R. Radach, D. Heller, & J. Pynte (Eds.), *Reading as a perceptual process*. Amsterdam: Elsevier.

Clifton, C., & Frazier, L. (1989). Comprehending sentences with long-distance dependencies. In G. N. Carlson, & M. K. Tanenhaus (Eds.), *Linguistic structure in language processing* (pp. 273-317). Dordrecht: Kluwer.

Coles, M. G. H., & Rugg, M. D. (1995). Event-related brain potentials: an introduction. In M. D. Rugg, & M. G. H. Coles (Eds.), *Electrophysiology of mind: event-related brain potentials and cognition* (pp. 1-26). Oxford: Oxford University Press.

Corver, N., & van Riemsdijk, H. (1994, Eds.). *Studies on scrambling – movement and non-movement approaches to free word-order phenomena*. Berlin: de Gruyter.

Coulson, S., King, J., & Kutas, M. (1998). Expect the unexpected: event-related brain response to morphosyntactic violations. *Language and Cognitive Processes*, 13, 21-58.

Couper-Kuhlen, E. (1984). A new look at contrastive intonation. In R. Watts, & U. Weidman (Eds.), *Modes of interpretation* (pp. 137-158). Tübingen: Narr.

Crain, S., & Steedman, M. (1985). On not being led up the garden path: The use of context by the psychological processor. In: D. R. Dowty, L. Karttunen, & A. Zwicky (Eds.), *Natural language parsing. Psychological, computational and theoretical perspectives* (pp. 320-358). Cambridge: Cambridge University Press.

Crocker, M. W. (1994). On the nature of the principle-based sentence processor. In C. Clifton, L. Frazier, & K. Rayner (Eds.), *Perspectives on sentence processing* (pp. 245-266). Hillsdale: Erlbaum,.

Cutler, A., Dahan, D., & van Donselaar (1997). Prosody in the comprehension of spoken language: A literature review. *Language and Speech*, 40, 141-201.

Cutler, A., & Fodor, J.A. (1979). Semantic focus and sentence comprehension. *Cognition*, 7, 49-59.

Dahan, D., Tanenhaus, M. K., & Chambers, C. G. (2002). Accent and reference resolution in spoken-language comprehension. *Journal of Memory and Language*, 47, 292-314.

De Vincenzi, M. (1991). *Syntactic parsing strategies in Italian*. Dordrecht: Kluwer.

De Vincenzi, M., Job, R., Di Matteo, R., Angrilli, A., Penolazzi, B., Ciccarelli, L., & Vespignan, F. (2003). Differences in the perception and time course of syntactic and semantic violations. *Brain and Language*, 85, 280-296.

Dretske, F. J. (1972). Contrastive statements. *Philosophical Review*, 1972, 411-437.

Drubig, H. B. (1994). Island constraints and the syntactic nature of focus and association with focus. Arbeitsbericht #51, University of Tübingen.

Drubig, H. B (to appear). Towards a typology of focus and focus constructions. In E. Göbbel, & C. Meier (Eds.), Focus constructions: Grammatical and typological aspects of information structure. *Linguistics*. Special Issue.

Fanselow, G. (2001). Features, Θ-roles, and free constituent order. *Linguistic Inquiry*, 32, 405-437.

Farke, H. (1994). *Grammatik und Sprachverarbeitung*. Opladen: Westdeutscher Verlag.

Féry, C. (1993). *German intonational patterns*. Tübingen: Niemeyer.

Fiebach, C., Schlesewsky, M. and Friederici, A. D. (2001). Syntactic working memory and the establishment of filler-gap dependencies: insights from ERPs and fMRI. *Journal of Psycholinguistic Research*, 30, 321-338.

Fodor, J.D. (1998). Learning to parse? *Journal of Psycholinguistic Research*, 27, 285-319.

Fodor, J.D. (2002). Prosodic disambiguation in silent reading. In M. Hirotani (Ed.), *Proceedings of the 32nd Annual Meeting of the North East Linguistic Society (NELS)*, *32*. New York City, NY.

Fodor, J. D., & Ferreira, F (eds., 1998). *Reanalysis in sentence processing*. Dordrecht: Kluwer.

Fodor, J. D., & Inoue, A. (1994). The diagnosis and cure of garden paths. *Journal of Psycholinguistic Research*, 23, 407-434.

Fodor, J. D., & Inoue, A. (2000). Syntactic features in reanalysis: Positive and negative symptoms. *Journal of Psycholinguistic Research*, 29, 25-36.

Frazier, L. (1979). *On comprehending sentences: Syntactic parsing strategies*. West Bend, IN: Indiana University Linguistics Club.

Frazier, L. (1987a). Sentence processing: A tutorial review. In M. Coltheart. (Ed.), *Attention and performance XII. The psychology of reading* (pp. 559-586). Hillsdale: Erlbaum.

Frazier, L. (1987b). Syntactic processing: Evidence from Dutch. *Natural Language and Linguistic Theory*, 5, 519-559.

Frazier, Lyn (1990). Exploring the architecture of the language processing system. In G. Altmann (Eds.), *Cognitive models of speech processing. Psycholinguistic and computational perspectives* (pp. 409-433). Cambridge, MA: MIT Press.

Frazier, L., & Clifton, C. (2001). Parsing coordinates and ellipsis: copy α. *Syntax* 4, 1-22.

Frazier, L., & Flores d'Arcais, G. (1989). Filler-driven parsing: A study of gap-filling in Dutch. *Journal of Memory and Language*, 28, 331-344.

Frazier, L., & Rayner, K. (1982). Making and correcting errors during sentence comprehension: Eye movements in the analysis of structurally ambiguous sentences. *Cognitive Psychology*, 14, 178-210.

Frazier, L., & Rayner, K. (1988). Parameterizing the language processing system: left- vs. right-branching within and across languages. In J.A. Hawkins (Ed.), *Explaining language universals* (pp. 247-279). Oxford: Blackwell.

Frey, W. (2000). Über die syntaktische Position der Satztopiks im Deutschen. *ZAS Papers in Linguistics*, 20, 137-172.

Friederici, A. D. (1998). Diagnosis and reanalysis: Two processing aspects the brain may differentiate. In J. D. Fodor, & F. Ferreira (Eds.), *Reanalysis in sentence processing* (pp. 177-200). Dordrecht: Kluwer.

Friederici, A. D. (1999). The neurobiology of language processing. In: A. D. Friederici (Ed.), *Language comprehension: A biological perspective* (pp. 263-301). Berlin: Springer.

Friederici, A. D. (2002). Towards a neural basis of auditory sentence processing. *Trends in Cognitive Sciences*, 6, 78-84.

Friederici, A. D. (to appear). The neural basis of sentence processing: Inferior frontal and temporal contributions. In Y. Grodzinsky, & K. Amunts (Eds.), *Broca's region*. Oxford: Oxford University Press.

Friederici, A. D., & Frisch, S. (2000). Verb argument structure processing: the role of verb-specific and argument-specific information. *Journal of Memory and Language*, 43, 476-507.

Friederici, A. D., Gunter, T. C., Hahne, A., & Mauth, K. (2004). The relative timing of syntactic and semantic processes in sentence comprehension. *Neuroreport*, 15, 165-169.

Friederici, A. D., Hahne, A. and Saddy, D. (2002). Distinct neurophysiological patterns reflecting aspects of syntactic complexity and syntactic repair. *Journal of Psycholinguistic Research*, 31, 45-63.

Friederici, A. D., & Mecklinger, A. (1996). Syntactic parsing as revealed by brain responses: first-pass and second-pass parsing processes. *Journal of Psycholinguistic Research*, 25, 157-176.

Friederici, A. D., Mecklinger, A., Spencer, K. M., Steinhauer, K., & Donchin, E. (2001). Syntactic parsing preferences and their on-line revisions: A spatio-temporal analysis of event-related brain potentials. *Cognitive Brain Research*, 11, 305-323.

Friederici, A. D., Pfeifer, E., & Hahne, A. (1993). Event-related potentials in natural speech processing: effects of semantic, morphological and syntactic violations. *Cognitive Bain Research*, 1, 183-192.

Friederici, A. D., Steinhauer, K., & Frisch, S. (1999). Lexical integration: Sequential effects of syntactic and semantic information. *Memory and Cognition*, 27, 438-453.

Frisch, S., Hahne, A., & Friederici, A. D. (2004). Word category and verb-argument structure information in the dynamics of parsing. *Cognition*, 91, 191-219.

Frisch, S., Schlesewsky, M., Saddy, D., & Alpermann, A. (2002). The P600 as an indicator of syntactic ambiguity. *Cognition*, 85, B83-B92.

Fukui, N., & Speas, M. (1986). Specifiers and projections. *MIT Working Papers in Linguistics*, 8, 128-172.

Givón, T. (1983). Topic continuity in spoken English. In T. Givón (Ed.), *Topic continuity in discourse: A quantitative cross-language study* (pp. 343-363). Amsterdam: Benjamins.

Gorrell, P. (1995). *Syntax and Parsing*. Cambridge: Cambridge University Press.

Gunter, T. C., Friederici, A. D., & Schriefers, H. (2000). Syntactic gender and semantic expectancy: ERPs reveal early autonomy and late interaction. *Journal of Cognitive Neuroscience*, 12, 556-568.

Grabe, E., & Warren, P. (1995). Stress shift: do speakers do it or do listeners hear it? In B. Connell, & A. Arvaniti (Eds.), *Phonology and phonetic evidence. Papers in Laboratory Phonology IV*. Cambridge: CUP.

Hahne, A. (1998). *Charakteristika syntaktischer und semantischer Prozesse bei der auditiven Sprachverarbeitung*. MPI Series in Cognitive Neuroscience, 1.

Hahne, A., & Friederici, A. D. (2002). Differential task effects on semantic and syntactic processes as revealed by ERPs. *Cognitive Brain Research*, 13, 339-356.

Hahne, A., & Jescheniak, J. D. (2001). What's left if the Jabberwock gets the semantics? An ERP investigation into semantic and syntactic comprehension. *Cognitive Brain Research*, 11, 199-212.

Haider, H. (1993). *Deutsche Syntax – Generativ*. Tübingen: Narr.

Haider, H. (2000). Scrambling – what's the state of the art. In S. Powers, & C. Hamann (Eds.), *The acquisition of scrambling and cliticization* (pp. 19-40). Dordrecht: Kluwer.

Haider, H., & Rosengren, I. (1998). Scrambling. *Sprache und Pragmatik*, 49, 1-104.

Haider, H., & Rosengren, I (2003). Scrambling – Non-triggered chain formation in OV-languages. *Journal of Germanic Linguistics*, 15, 203-267.

Haftka, B. (1995). Syntactic positions for topic and contrastive focus in the German middlefield. In I. Kohlhof (Ed.), *Proceedings of the Göttingen focus workshop* (Arbeitsberichte des Sonderforschungsbereichs 340 Nr. 69, pp. 1-24). University of Tübingen.

Haftka, B. (2004). Topic constraints in the German middlefield. In A. Steube (Ed.), *Information structure: theoretical and empirical aspects.* Berlin: de Gruyter.

Hagoort, P. (2003). Interplay between syntax and semantics during sentence compehension: ERP effects of combining syntactic and semantic violations. *Journal of Cognitive Neuroscience*, 15, 882-899.

Hemforth, B. (1993). *Kognitives Parsing: Repräsentationen und Verarbeitung grammatischen Wissens*. Sankt Augustin: Infix.

Hemforth, B., & Konieczny, L. (2002). Where pronouns and relative clauses differ: Information structure and binding preferences. Paper presented at the 15th annual CUNY conference on human sentence processing. New York, NY.

Höhle, T. (1982). Explikationen für "normale Betonung" und "normale Wortstellung". In W. Abraham (Ed.), *Satzglieder im Deutschen* (pp. 75-153). Tübingen: Narr.

Hruska, C. (2004). *Einflüsse kontextueller und prosodischer Informationen in der auditorischen Satzverarbeitung: Untersuchungen mit ereigniskorrelierten Hirnpotentialen.* Doctoral Dissertation: University of Leipzig.

Hruska, C., & Alter, K. (2004). How prosody can influence sentence perception. In A. Steube (Eds.), *Information structure: theoretical and empirical aspects.* Berlin: de Gruyter.

Huynh, H., & Feldt, L.S. (1970). Conditions under which the mean square ratios in repeated measurement designs have exact F-distributions. *Journal of the American Statistical Association*, 65, 1582-1589.

Inoue, A., & Fodor, J. D. (1995). Information-paced parsing of Japanese. In R. Mazuka, & N. Nagai (Eds.), *Japanese sentence processing* (pp. 9-63). Hillsdale: Erlbaum.

Jackendoff, R. (1977). *Xbar syntax: A study of phrase structure.* Cambridge: MIT Press.

Jacobs, J. (1988). Probleme der freien Wortstellung. *Sprache und Pragmatik*, 1, 8-37.

Jacobs, J. (2001). The dimension of topic-comment. *Linguistics*, 39, 641-681.

Johnson, S.M., Clifton, C., Breen, M., & Morris, J. (2003). An ERP investigation of prosodic and semantic focus. 10th Annual Meeting of the Cognitive Neuroscience Society, New York City, USA, March/April 2003. *Journal of Cognitive Neuroscience*, Supplement, 174.

Just, M. A., & Carpenter, P. A. (1980). A theory of reading: From eye fixations to comprehension. *Psychological Review*, 87, 329-354.

Kaan, E. (1997). *Processing subject-object ambiguities in Dutch*. Ph.D. thesis, University of Groningen.

Kaan, E. (2001). Effects of NP type on the resolution of word-order ambiguities. *Journal of Psycholinguistic Research*, 5, 529-547.

Kaan, E. (2002). Investigating the effects of distance and number interference in processing subject-verb dependencies: an ERP study. *Journal of Psycholinguistic Research*, 31, 165-193.

Kaan, E., Harris, A., Gibson, E., & Holcomb, P. (2000). The P600 as an index of syntactic integration difficulty. *Language and Cognitive Processes*, 15, 159-201.

Kaplan, R. M., & Bresnan, J. (1982). Lexical-Functional Grammar: A formal system for grammatical representation. In J. Bresnan (Ed.), *The mental representation of grammatical relations* (pp. 173-281). Cambridge: MIT Press.

Kadmon, N. (2000). *Formal pragmatics. Semantics, pragmatics, presupposition, and focus*. Oxford: Blackwell.

King, J. W., & Kutas, M. (1995). Who did what when? Using word- and clause-level ERPs to monitor working memory usage in reading. *Journal of Cognitive Neuroscience*, 7, 376-395.

Klein, W. (1993). Ellipse. In J. Jacobs, A. von Stechow, W. Sternefeld, & T. Vennemann (Eds.), *Syntax: An international handbook of contemporary research* Vol.1 (pp. 763-799). Berlin: de Gruyter,.

Kluender, R., & Kutas, M. (1993). Bridging the gap: evidence from ERPs on the processing of unbounded dependencies. *Journal of Cognitive Neuroscience*, 5, 196-214.

Krahmer, E., & Swerts, M. (2001). On the alleged existence of contrastive accents. *Speech and Communication*, 34, 391-405.

Krifka, M. (1991). A compositional semantics for multiple focus constructions. In J. Jacobs (Ed.), Informationsstruktur und Grammatik. *Linguistische Arbeitsberichte*. Special Issue.

Kutas, M., & Hillyard, S. A. (1980). Reading senseless sentences: Brain potentials reflect semantic incongruity. *Science*, 207, 203-205.

Kutas, M., & Hillyard, S. A. (1983). Event-related potentials to grammatical errors and semantic anomalies. *Memory and Cognition*, 11, 539-550.

Kutas, M., & Hillyard, S. A. (1984). Brain potentials during reading reflect word expectancy and semantic association. *Nature*, 307, 161-163.

Ladd, D.R. (1983). Phonological features of intonational peaks. *Language*, 59, 721-759.

Lenerz, J. (1977). *Zur Abfolge nominaler Satzglieder im Deutschen*. Tübingen: Narr.

Lenerz, J.(1992). Zur Syntax der Pronomina im Deutschen. *Sprache und Pragmatik,* 1-54.

Liberman, M., & Prince, A. (1977). On stress and linguistic rhythm. *Linguistic Inquiry*, 8, 249-336.

Lipka, S., Kopp, F., & Pechmann, T. (2000). Referential context effects for subject/object relative clause ambiguities: the role of the reading span. In E. Schröger, A. Mecklinger, & A. D. Friederici (Eds.), *Working on working memory* (pp. 121-138). Leipzig: Leipziger Universitätsverlag.

Liversedge, S. P., Paterson, K. B., & Clayes, E. L. (2002). The influence of *only* on syntactic processing of "long" relative clause sentences. *The Quarterly Journal of Experimental Psychology*, 55A, 225-240.

Mak, W. M. (2001). *Processing relative clauses: Effects of pragmatic, semantic, and syntactic variables*. Doctoral dissertation, University of Nijmegen.

MacDonald, M. E. (1997). Representation and activation in syntactic processing. In T. Inui, & J. L. McClelland (Eds.), *Attention and performance XVI: Information integration in perception and communication* (pp. 433-456). Cambridge, MA: MIT Press.

Matzke, M., Mai, H., Nager, W., Rüsseler, J., & Münte, T. (2002). The cost of freedom: An ERP study of non-canonical sentences. *Clinical Neurophysiology*, 113, 844-852.

McClelland, J. L. (1987). The case of interactionism in language processing. In M. Coltheart. (Ed.), *Attention and performance XII: The psychology of reading* (pp. 3-35). Hillsdale: Erlbaum.

Mecklinger, A., Schriefers, H., Steinhauer, K., & Friederici, A. D. (1995). The processing of relative clauses varying in syntactic complexity and semantic

plausibility: An analysis with event related potentials. *Memory and Cognition*, 23, 477-494.

Meng, M. (1995). *Grammatik und Sprachverarbeitung: Psycholinguistische Untersuchungen zur Berechnung syntaktischer Strukturen.* Doctoral dissertation, University of Jena.

Meng, M., & Bader, M. (2000a). Ungrammaticality detection and garden-path strength.: Evidence for serial parsing. *Language and Cognitive Processes*, 15, 615-666.

Meng, M., & Bader, M. (2000b). Mode of disambiguation and garden-path strength: An investigation of subject-object ambiguities in German. *Language and Speech*, 43, 43-74.

Meng, M., Bader, M., & Bayer, J. (1999). Die Verarbeitung von Subjekt-Objekt Ambiguitäten im Kontext. In I. Wachsmuth, & B. Jung (Eds.), *Proceedings der 4. Fachtung der Gesellschaft für Kognitionswissenschaft* (pp. 244-249). St. Augustin: Infix.

Muckel, S. (2002). *Wortstellungseffekte beim Satzverstehen – Zur Rolle syntaktischer, verbspezifischer und prosodischer Information.* Wiesbaden: Deutscher Universitäts-Verlag.

Näätänen, R. (1992). *Attention and brain function*. Hillsdale: Erlbaum.

Neeleman, A. (1994). *Complex predicates*. OTS Dissertation Series: Utrecht.

Neeleman, A., & Reinhart, T. (1998). Scrambling and the PF interface. In M. Butt, & W. Geuder (Eds.), *The projection of arguments* (pp. 309-353). Stanford: CSLI.

Neville, H. J., Nicol, J., Barss, A., Forster, K., & Garrett, M. F. (1991). Syntactically based sentence processing classes: Evidence from event-related potentials. *Journal of Cognitive Neuroscience*, 6, 233-255.

Ni, W., Crain, S., & Shankweiler, D. (1996). Sidestepping garden paths: assessing the contributions of syntax, semantics and plausibility in resolving ambiguities. *Language and Cognitive* Processes, 11 (3), 283-334.

Nicol, J. D. (1996, Ed.). Sentence processing – Part 3. *Journal of Psycholinguistic Research,* 25. Special Issue.

Nobre, A. C., & McCarthy, G. (1994). Language-related ERPs: scalp distribution and modulation by word type and semantic priming. *Journal of Cognitive Neuroscience*, 6, 233-255.

Osterhout, L., & Holcomb, P.J. (1992). Event-related potentials and syntactic anomaly. *Journal of Memory and Language*, 31, 785-804.

Osterhout, L., & Holcomb, P.J. (1993). Event-related brain potentials and syntactic anomaly: evidence of anomaly detection during the perception of continuous speech. *Language and Cognitive Processes*, 8, 413-437.

Osterhout, L., & Mobley, L.A. (1995). Event-related brain potentials elicited by failure to agree. *Journal of Memory and Language*, 34, 739-773.

Paterson, K. B., Liversedge, S. P., & Underwood, G. (1999). The influence of focus operators on syntactic processing of short relative clause sentences. *The Quarterly Journal of Experimental Psychology*, 52A, 717-737.

Pechmann, T., Uszkoreit, H., Engelkamp, H., & Zerbst, D. (1994). Word order in the German middle field: Linguistic theory and psycholinguistic evidence. *Computational Linguistics at the University of the Saarland*, 43, 1-52.

Pechmann, T., Uszkoreit, H., Engelkamp, H., & Zerbst, D. (1996). Wortstellung im Deutschen Mittelfeld: Linguistische Theorie und psycholinguistische Evidenz. In C. Habel, S. Kanngießer, & G. Rickheit (Eds.), *Perspektiven der kognitiven Linguistik* (pp. 257-299). Wiesbaden: Westdeutscher Verlag.

Pickering, M. J., Clifton, C. and Crocker, M. W. (2000). Architectures and mechanisms in sentence comprehension. In M. W. Crocker, M. J. Pickering and C. Clifton (Eds.), *Architectures and mechanisms in language processing* (pp. 1-28). Cambridge: Cambridge University Press.

Pierrehumbert, J., & Hirschberg, J. (1990). The meaning of intonational contours in the interpretation of discourse. In P. Cohan, J. Morgan, & M. Pollack (Eds.), *Intentions in communication* (pp. 271-311). Cambridge, MA: MIT Press.

Pollard, C., & Sag, I. A. (1994). *Head-driven Phrase Structure Grammar.* Chicago: The University of Chicago Press.

Pollatsek, A., Rayner, K., & Lee, H.-W. (2000). Phonological coding in word perception and reading. In A. Kennedy, R. Radach, D. Heller, & J. Pynte (Eds.), *Reading as a perceptual process* (pp. 399-425). Oxford: Elsevier.

Primus, B. (1999). *Case and thematic roles.* Tübingen: Niemeyer.

Prince, E. F. (1992). The ZPG letter: Subjects, definiteness, and information status. In S. Thompson, & W. Mann (Eds.), *Discourse description: Diverse analyses of a fund raising text* (pp. 295-325). Philadelphia: Benjamins.

Rayner, K., Carlson, M., & Frazier, L. (1983). The interaction of syntax and semantics during sentence processing: Eye movements in the analysis of semantically biased sentences. *Journal of Verbal Learning and Verbal Behavior*, 22, 358-374.

Rayner, K., Garrod, S., & Perfetti, C. A. (1992). Discourse influences during parsing are delayed. *Cognition*, 45, 109-139.

Rayner, K., & Pollatsek, A (1989). *The Psychology of Reading*. Englewood Cliffs, NJ: Prentice Hall.

Regan, D. (1989). *Human brain electrophysiology: Evoked potentials and evoked magnetic fields in science and medicine.* New York: Elsevier.

Reinhart, T. (1981). Pragmatics and linguistics: an analysis of sentence topics. *Philosophica*, 27, 53-94.

Reinhart, T. (1995). Interface strategies. *OTS Working Papers in Linguistics*. Utrecht: UiL-OTS.

Reinhart, T. (1991). Elliptical conjunctions – non-quantificational LF. In A. Kasher (Ed.), *The Chomskian turn* (pp. 360-384). Oxford: Blackwell.

Reinhart, T., & Reuland, E. J. (1991). Anaphors and logophors: An argument structure perspective. In J. Kosta, & E. J. Reuland (Eds.), *Long distance anaphora* (283-321). Cambridge: Cambridge University Press.

Reis, M., & Rosengren, I. (1997). A modular approach to the grammar of additive particles: The case of German 'auch'. *Journal of Semantics*, 14, 237-309.

Rochemont, M. S. (1986). *Focus in generative grammar.* Amsterdam: Benjamins.

Rooth, M. (1992). A theory of focus interpretation. *Natural Language Semantics*, 1, 75-116.

Rösler, F., Pechmann, T., Streb, J., Röder, B., & Hennighausen, E. (1998). Parsing of sentences in a language with varying word order. *Journal of Memory and Language*, 38, 150-176.

Ross, J. R. (1967). *Constraints on variables in syntax*. Doctoral Dissertation, Massachusetts Institute of Technology.

Salmon, N., & Pratt, H. (2002). A comparison of sentence- and discourse-level semantic processing: An ERP study. *Brain and Language*, 83, 367-383.

Schafer, A., Carter, J., Clifton, C., & Frazier, L. (1996). Focus in relative clause construal. *Language and Cognitive Processes*, 11, 135-163.

Schafer, A., Carlson, K., Clifton, C., & Frazier, L. (2000). Focus and the interpretation of pitch accents: disambiguating embedded questions. *Language and Speech*, 43 (1), 75-105.

Sedivy, J. C. (2002). Invoking discourse-based contrast sets and resolving syntactic ambiguities. *Journal of Memory and Language*, 46, 341-370.

Schriefers, H., Friederici, A. D., & Kühn, K. (1995). The processing of locally ambiguous clauses in German. *Journal of Memory and Language*, 34, 499-520.

Scheepers, C. (1998). Menschliche Satzverarbeitung: Syntaktische und thematische Aspekte der Wortstellung im Deutschen. In G. Müller, B. Schinzel, & G. Strube (Eds.), *IIG-Berichte* 1/98, Freiburg: Institut für Informatik und Gesellschaft.

Scheepers, C., Hemforth, B., & Konieczny, L. (2000). Linking syntactic functions with thematic roles: psych-verbs and the resolution of subject-object

ambiguity. In B. Hemforth, & L. Konieczny (Eds.), *German sentence processing* (pp. 95-135). Dordrecht: Kluwer.

Schlesewsky, M., Fanselow, G., Kliegl, R., & Krems, J. (2000). The subject preference in the processing of locally ambiguous wh-questions in German. In B. Hemforth, & L. Konieczny (Eds.), *German sentence processing* (pp. 65-93). Dordrecht: Kluwer.

Schlesewsky, M., & Bornkessel, I. (2004). On incremental interpretation: degrees of meaning accessed during sentence comprehension. *Lingua*, 114, 1213-1234.

Schlesewsky, M., Bornkessel, I., & Frisch, S. (2003). The neurophysiological basis of word order variations in German. *Brain and Language,* 86, 116-128.

Schmidt, C. M. (1992). Eine mediale Klitikposition. Ms., University of Cologne.

Selkirk, E. O. (1984). *Phonology and syntax: the relation between sound and structure.* Cambridge, MA: MIT Press.

Selkirk, E. O. (1995). Sentence prosody: Intonation, stress and phrasing. In J. Goldsmith (Ed.), *Handbook of phonological theory* (pp. 550-569). Oxford: Blackwell.

Sharbrough, F., Chatrian, G.-E., Lesser, R .P., Lüders, H., Nuwer, M., & Picton, T. W. (1991). American Encephalographic Society for standard electrode position nomenclature. *Journal of Clinical Neurophysiology*, 8, 200-202.

Slowiaczek, M.L., & Clifton, C. (1980). Subvocalization and reading for meaning. *Journal of Verbal Learning and Verbal Behavior*, 19, 573-582.

Späth, A. (2003). *Determination im Satzkontext. Grammatische Voraussetzungen der Nominalreferenz in den artikellosen slawischen Sprachen im Vergleich zum Deutschen.* Habilitationsschrift, University of Leipzig.

Stechow, A. von (1991). Current issues in the theory of focus. In A. von Stechow, & D. Wunderlich (Eds.), *Semantik. Ein internationales Handbuch der zeitgenössischen Forschung.* Berlin: De Gruyter, 804-825.

Steinhauer, K. (2003). Electrophysiological correlates of prosody and punctuation. *Brain and Language*, 86, 142-164.

Steinhauer, K., Alter, K., & Friederici, A. D. (1999). Brain potentials indicate the immediate use of prosodic cues in natural speech processing. *Nature Neuroscience*, 2, 1991-196.

Steinhauer, K., & Friederici, A. D. (2001). Prosodic boundaries, comma rules, and brain responses: The Closure Positive Shift in ERPs as universal marker for prosodic phrasing in listeners and readers. *Journal of Psycholinguistic Research*, 30, 267-295.

Steinhauer, K., Mecklinger, A., Friederici, A. D., & Meyer, M. (1997). Wahrscheinlichkeit und Strategie: Eine EKP-Studie zur Verarbeitung syntaktischer Anomalien. *Zeitschrift für experimentelle Psychologie*, XLIV (2), 305-331.

Steube, A. (2000). Ein kognitionswissenschaftlich basiertes Modell für Informationsstrukturierung (in Anwendung auf das Deutsche. In J. Bayer, & C. Römer (Eds.), *Von der Philologie zur Grammatik* (pp. 213-238). Tübingen: Niemeyer.

Steube, A. (2001). Correction by contrastive focus. *Theoretical Linguistics*, 27, 215-249.

Steube, A., Alter, K., & Späth, A. (2004). Information structure and modular grammar. In A. Steube (Ed.), *Information structure: Theoretical and empirical aspects.* Berlin: de Gruyter.

Stolterfoht, B., & Bader, M. (2004.). Focus structure and the processing of word order variations in German. In A. Steube (Ed.), *Information structure: Theoretical and empirical aspects.* Berlin: de Gruyter.

Strohner, H. (2003). Parsing-Prozesse. In G. Rickheit, W. Deutsch, & T. Herrmann (Eds.), *Psycholinguistics : An international handbook* (pp. 524-532). Berlin: de Gruyter.

Tanenhaus, M. K., Spivey-Knowlton, M. J., & Hanna, J. E. (2000). Modeling thematic and discourse context effects within a multiple constraints framework: Implications for the architecture of the language comprehension system. In M. W

Crocker, M. J. Pickering and C. Clifton (Eds.), *Architectures and mechanisms in language processing* (pp. 90-118). Cambridge: Cambridge University Press.

Taylor, W. L. (1953). Cloze procedure: a new tool for measuring readability. *Journalism Quarterly*, 30, 415.

Toepel, U., & Alter, K. (2004). On the independence of information structural processing from prosody. In A. Steube (Ed.), *Information structure: Theoretical and empirical aspects.* Berlin: de Gruyter.

Tyler, L. K., & Marslen-Wilson, W. D. (1977). The on-line effects of semantic context on syntactic processing. *Journal of Verbal Learning and Verbal Behavior*, 16, 683-692.

Umbach, C. (2001). Restriktion der Alternativen. In A. Steube, & C. Umbach (Eds.), Kontrast: lexikalisch, semantisch, phonologisch (pp. 165-198). *Linguistische Arbeitsberichte*, 77, University of Leipzig,

Uszkoreit, H. (1986). Constraints on order. *Linguistics*, 24, 883-906.

Vallduvi, E., & Engdahl, E. (1996). The linguistic realization of information packaging. *Linguistics*, 36, 459-519.

Van Gompel, R.P.G. (1995). *The processing of subject and object relative clauses in Dutch.* MA thesis, University of Nijmegen.

Van Petten, C. K., & Kutas, M. (1990). Interactions between sentence context and word frequency in event-related potentials. *Memory and Cognition*, 18, 131-150.

Van Petten, C. K., Kutas, M., Kluender, R. Mitchiner, M., & McIsaac, H. K. (1991). Fractionating the word repetition effect with event-related brain potentials. *Journal of Cognitive Neuroscience*, 3, 131-150.

Warren, P. (1996, Ed.). Prosody and parsing. Language and Cognitive Processes, 11. Special Issue.

Weskott, T. (2002). Information Structure as a Processing Guide: The Left Periphery of German Verb-Second Sentences and Its Interpretation in Context. PhD dissertation, Leipzig University.

Wilder, C. (1996). V2-Effekte: Wortstellungen und Ellipsen. In E. Lang, & G. Zifonoun, *Deutsch-typologisch* (pp. 142-180). Berlin: de Gruyter.

Wind Cowles, H. (2003). *Processing information structure: Evidence from comprehension and production.* Doctoral Dissertation. University of California, San Diego, CA.

Winkler, S. (2000). Silent copy and polarity focus in VP ellipsis. In K. Schwabe, & N. Zhang (Eds.), *Ellipsis in Conjunction* (pp. 221-246). Tübingen: Niemeyer.

Winkler, S. (2003). Ellipsis at the interfaces: An information structural investigation of sentence-bound and discourse-bound ellipsis in English. Habilitation. University of Tübingen.

Woldorff, M., Hansen, J., & Hillyard, S. (1987). Evidence for effects of selective attention in the midlatency range of the human auditory event-related brain potential. In R. Johnson, R. Parasuraman, & J. Rohrbaugh (Eds.), *Current trends in event-related potential research* (pp. 146-154). Amsterdam: Elsevier.

Wunderlich, D. (1997). Cause and the structure of verbs. *Linguistic Inquiry*, 28, 27-68.

APPENDIX

A Materials for Experiments 1-3

The materials are listed here in the exact form used for Experiment 1. All modifications undertaken for different lists and for Experiment 2 and 3 are listed in the relevant Materials sections.

Erna hat behauptet, dass die Mutter die Kinder beschäftigt hat während das Fenster geputzt wurde.
Erna hat behauptet, dass die Mutter die Kinder beschäftigt haben während das Fenster geputzt wurde.
Erna hat behauptet, dass sie die Kinder beschäftigt hat während das Fenster geputzt wurde.
Erna hat behauptet, dass sie die Kinder beschäftigt haben während das Fenster geputzt wurde.

Gisela hat gesagt, dass die Patentante die Geschwister gefahren hat nachdem das Auto repariert war.
Gisela hat gesagt, dass die Patentante die Geschwister gefahren haben nachdem das Auto repariert war.
Gisela hat gesagt, dass sie die Geschwister gefahren hat nachdem das Auto repariert war.
Gisela hat gesagt, dass sie die Geschwister gefahren haben nachdem das Auto repariert war.

Hedwig hat gesagt, dass die Internistin die Chirurgen gerufen hat bevor die Diagnose gestellt wurde.
Hedwig hat gesagt, dass die Internistin die Chirurgen gerufen haben bevor die Diagnose gestellt wurde.
Hedwig hat gesagt, dass sie die Chirurgen gerufen hat bevor die Diagnose gestellt wurde.
Hedwig hat gesagt, dass sie die Chirurgen gerufen haben bevor die Diagnose gestellt wurde.

Katrin hat gesagt, dass die Pflegerin die Patienten gelobt hat nachdem die Visite vorbei war.
Katrin hat gesagt, dass die Pflegerin die Patienten gelobt haben nachdem die Visite vorbei war.
Katrin hat gesagt, dass sie die Patienten gelobt hat nachdem die Visite vorbei war.
Katrin hat gesagt, dass sie die Patienten gelobt haben nachdem die Visite vorbei war.

Barbara hat behauptet, dass die Architektin die Ingenieure beauftragt hat bevor die Planung abgeschlossen war.
Barbara hat behauptet, dass die Architektin die Ingenieure beauftragt haben bevor die Planung abgeschlossen war.
Barbara hat behauptet, dass sie die Ingenieure beauftragt hat bevor die Planung abgeschlossen war.
Barbara hat behauptet, dass sie die Ingenieure beauftragt haben bevor die Planung abgeschlossen war

Andrea hat behauptet, dass die Tante die Nichten begrüßt hat während die Rede gehalten wurde.
Andrea hat behauptet, dass die Tante die Nichten begrüßt haben während die Rede gehalten wurde.
Andrea hat behauptet, dass sie die Nichten begrüßt hat während die Rede gehalten wurde.
Andrea hat behauptet, dass sie die Nichten begrüßt haben während die Rede gehalten wurde.

Theresa hat gesagt, dass die Braut die Schwiegereltern gemocht hat nachdem das Fest zuende war.
Theresa hat gesagt, dass die Braut die Schwiegereltern gemocht haben nachdem das Fest zuende war.
Theresa hat gesagt, dass sie die Schwiegereltern gemocht hat nachdem das Fest zuende war.
Theresa hat gesagt, dass sie die Schwiegereltern gemocht haben nachdem das Fest zuende war.

Sylvia hat berichtet, dass die Touristin die Animateure gefilmt hat während die Aufführung geprobt wurde.
Sylvia hat berichtet, dass die Touristin die Animateure gefilmt haben während die Aufführung geprobt wurde.
Sylvia hat berichtet, dass sie die Animateure gefilmt hat während die Aufführung geprobt wurde.
Sylvia hat berichtet, dass sie die Animateure gefilmt haben während die Aufführung geprobt wurde.

Brunhilde hat berichtet, dass die Königin die Ritter befreit hat bevor die Burg zerstört wurde.
Brunhilde hat berichtet, dass die Königin die Ritter befreit haben bevor die Burg zerstört wurde.
Brunhilde hat berichtet, dass sie die Ritter befreit hat bevor die Burg zerstört wurde.
Brunhilde hat berichtet, dass sie die Ritter befreit haben bevor die Burg zerstört wurde.

Clara hat behauptet, dass die Dame die Herren begleitet hat nachdem das Treffen beendet war.
Clara hat behauptet, dass die Dame die Herren begleitet haben nachdem das Treffen beendet war.

Clara hat behauptet, dass sie die Herren begleitet hat nachdem das Treffen beendet war.
Clara hat behauptet, dass sie die Herren begleitet haben nachdem das Treffen beendet war.

Doris hat berichtet, dass die Fußgängerin die Radfahrer behindert hat bevor die Strasse gesperrt war.
Doris hat berichtet, dass die Fußgängerin die Radfahrer behindert haben bevor die Strasse gesperrt war.
Doris hat berichtet, dass sie die Radfahrer behindert hat bevor die Strasse gesperrt war.
Doris hat berichtet, dass sie die Radfahrer behindert haben bevor die Strasse gesperrt war.
Sabine hat erzählt, dass die Gastgeberin die Eingeladenen zurückgefahren hat nachdem die Party zuende war.
Sabine hat erzählt, dass die Gastgeberin die Eingeladenen zurückgefahren haben nachdem die Party zuende war.
Sabine hat erzählt, dass sie die Eingeladenen zurückgefahren hat nachdem die Party zuende war.
Sabine hat erzählt, dass sie die Eingeladenen zurückgefahren haben nachdem die Party zuende war.

Vera hat gesagt, dass die Fürsorgerin die Obdachlosen beäugt hat während das Essen verteilt wurde.
Vera hat gesagt, dass die Fürsorgerin die Obdachlosen beäugt haben während das Essen verteilt wurde.
Vera hat gesagt, dass sie die Obdachlosen beäugt hat während das Essen verteilt wurde.
Vera hat gesagt, dass sie die Obdachlosen beäugt haben während das Essen verteilt wurde.

Dagmar hat gesagt, dass die Managerin die Hausfrauen beneidet hat während das Gespräch geführt wurde.
Dagmar hat gesagt, dass die Managerin die Hausfrauen beneidet haben während das Gespräch geführt wurde.
Dagmar hat gesagt, dass sie die Hausfrauen beneidet hat während das Gespräch geführt wurde.
Dagmar hat gesagt, dass sie die Hausfrauen beneidet haben während das Gespräch geführt wurde.

Simone hat behauptet, dass die Verurteilte die Geschworenen gemustert hat bevor die Verhandlung begonnen wurde.
Simone hat behauptet, dass die Verurteilte die Geschworenen gemustert haben bevor die Verhandlung begonnen wurde.
Simone hat behauptet, dass sie die Geschworenen gemustert hat bevor die Verhandlung begonnen wurde.
Simone hat behauptet, dass sie die Geschworenen gemustert haben bevor die Verhandlung begonnen wurde.

Lisa hat berichtet, dass die Malerin die Mitbewohner gestört hat nachdem die Ausstellung genehmigt war.
Lisa hat berichtet, dass die Malerin die Mitbewohner gestört haben nachdem die Ausstellung genehmigt war.
Lisa hat berichtet, dass sie die Mitbewohner gestört hat nachdem die Ausstellung genehmigt war.
Lisa hat berichtet, dass sie die Mitbewohner gestört haben nachdem die Ausstellung genehmigt war.

Emma hat berichtet, dass die Sängerin die Zuschauer beschimpft hat nachdem der Applaus verweigert wurde.
Emma hat berichtet, dass die Sängerin die Zuschauer beschimpft haben nachdem der Applaus verweigert wurde.
Emma hat berichtet, dass sie die Zuschauer beschimpft hat nachdem der Applaus verweigert wurde.
Emma hat berichtet, dass sie die Zuschauer beschimpft haben nachdem der Applaus verweigert wurde.

Anna hat gesagt, dass die Dichterin die Kritiker beschrieben hat bevor der Text erschienen war.
Anna hat gesagt, dass die Dichterin die Kritiker beschrieben haben bevor der Text erschienen war.
Anna hat gesagt, dass sie die Kritiker beschrieben hat bevor der Text erschienen war.
Anna hat gesagt, dass sie die Kritiker beschrieben haben bevor der Text erschienen war.

Elke hat gesagt, dass die Hausmeisterin die Nachbarn beschuldigt hat bevor der Diebstahl geklärt wurde.
Elke hat gesagt, dass die Hausmeisterin die Nachbarn beschuldigt haben bevor der Diebstahl geklärt wurde.
Elke hat gesagt, dass sie die Nachbarn beschuldigt hat bevor der Diebstahl geklärt wurde.
Elke hat gesagt, dass sie die Nachbarn beschuldigt haben bevor der Diebstahl geklärt wurde.

Nora hat berichtet, dass die Diebin die Polizisten belauscht hat während der Einsatz geplant wurde.
Nora hat berichtet, dass die Diebin die Polizisten belauscht haben während der Einsatz geplant wurde.
Nora hat berichtet, dass sie die Polizisten belauscht hat während der Einsatz geplant wurde.
Nora hat berichtet, dass sie die Polizisten belauscht haben während der Einsatz geplant wurde.

Ella hat gesagt, dass die Tochter die Eltern bedauert hat nachdem die Miete erhöht wurde.
Ella hat gesagt, dass die Tochter die Eltern bedauert haben nachdem die Miete erhöht wurde.
Ella hat gesagt, dass sie die Eltern bedauert hat nachdem die Miete erhöht wurde.

Ella hat gesagt, dass sie die Eltern bedauert haben nachdem die Miete erhöht wurde.

Friederike hat erzählt, dass die Witwe die Erben betrogen hat bevor der Besitz verteilt wurde.
Friederike hat erzählt, dass die Witwe die Erben betrogen haben bevor der Besitz verteilt wurde.
Friederike hat erzählt, dass sie die Erben betrogen hat bevor der Besitz verteilt wurde.
Friederike hat erzählt, dass sie die Erben betrogen haben bevor der Besitz verteilt wurde.

Dora hat erzählt, dass die Kaiserin die Rebellen bekämpft hat nachdem der Aufstand eskaliert war.
Dora hat erzählt, dass die Kaiserin die Rebellen bekämpft haben nachdem der Aufstand eskaliert war.
Dora hat erzählt, dass sie die Rebellen bekämpft hat nachdem der Aufstand eskaliert war.
Dora hat erzählt, dass sie die Rebellen bekämpft haben nachdem der Aufstand eskaliert war.

Berta hat behauptet, dass die Polizistin die Diebe bedroht hat bevor die Verstärkung eingetroffen war.
Berta hat behauptet, dass die Polizistin die Diebe bedroht haben bevor die Verstärkung eingetroffen war.
Berta hat behauptet, dass sie die Diebe bedroht hat bevor die Verstärkung eingetroffen war.
Berta hat behauptet, dass sie die Diebe bedroht haben bevor die Verstärkung eingetroffen war.

Laura hat behauptet, dass die Unternehmerin die Teilhaber bestochen hat bevor der Auftrag angenommen wurde.
Laura hat behauptet, dass die Unternehmerin die Teilhaber bestochen haben bevor der Auftrag angenommen wurde.
Laura hat behauptet, dass sie die Teilhaber bestochen hat bevor der Auftrag angenommen wurde.
Laura hat behauptet, dass sie die Teilhaber bestochen haben bevor der Auftrag angenommen wurde.

Michaela hat gesagt, dass die Anwältin die Notare beraten hat während die Pfändung ausgesetzt wurde.
Michaela hat gesagt, dass die Anwältin die Notare beraten haben während die Pfändung ausgesetzt wurde.
Michaela hat gesagt, dass sie die Notare beraten hat während die Pfändung ausgesetzt wurde.
Michaela hat gesagt, dass sie die Notare beraten haben während die Pfändung ausgesetzt wurde.

Gesa hat behauptet, dass die Richterin die Juristen gefragt hat während die Verhandlung unterbrochen war.
Gesa hat behauptet, dass die Richterin die Juristen gefragt haben während die Verhandlung unterbrochen war.
Gesa hat behauptet, dass sie die Juristen gefragt hat während die Verhandlung unterbrochen war.
Gesa hat behauptet, dass sie die Juristen gefragt haben während die Verhandlung unterbrochen war.

Gunda hat erzählt, dass die Professorin die Studenten beachtet hat nachdem das Argument hinterfragt wurde.
Gunda hat erzählt, dass die Professorin die Studenten beachtet haben nachdem das Argument hinterfragt wurde.
Gunda hat erzählt, dass sie die Studenten beachtet hat nachdem das Argument hinterfragt wurde.
Gunda hat erzählt, dass sie die Studenten beachtet haben nachdem das Argument hinterfragt wurde.

Sandra hat gesagt, dass die Ehefrau die Schwägerinnen getröstet hat nachdem die Scheidung beschlossen war.
Sandra hat gesagt, dass die Ehefrau die Schwägerinnen getröstet haben nachdem die Scheidung beschlossen war.
Sandra hat gesagt, dass sie die Schwägerinnen getröstet hat nachdem die Scheidung beschlossen war.
Sandra hat gesagt, dass sie die Schwägerinnen getröstet haben nachdem die Scheidung beschlossen war.

Hannah hat berichtet, dass die Wächterin die Eindringlinge gehört hat während das Schloss aufgebrochen wurde.
Hannah hat berichtet, dass die Wächterin die Eindringlinge gehört haben während das Schloss aufgebrochen wurde.
Hannah hat berichtet, dass sie die Eindringlinge gehört hat während das Schloss aufgebrochen wurde.
Hannah hat berichtet, dass sie die Eindringlinge gehört haben während das Schloss aufgebrochen wurde.

Brigitte hat erzählt, dass die Chefin die Mitarbeiter bedrängt hat während die Firma geschlossen war.
Brigitte hat erzählt, dass die Chefin die Mitarbeiter bedrängt haben während die Firma geschlossen war.
Brigitte hat erzählt, dass sie die Mitarbeiter bedrängt hat während die Firma geschlossen war.
Brigitte hat erzählt, dass sie die Mitarbeiter bedrängt haben während die Firma geschlossen war.

Frieda hat berichtet, dass die Pilotin die Lotsen beunruhigt hat während das Flugzeug gelandet wurde.
Frieda hat berichtet, dass die Pilotin die Lotsen beunruhigt haben während das Flugzeug gelandet wurde.
Frieda hat berichtet, dass sie die Lotsen beunruhigt hat während das Flugzeug gelandet wurde.
Frieda hat berichtet, dass sie die Lotsen beunruhigt haben während das Flugzeug gelandet wurde.

Henriette hat gesagt, dass die Großtante die Verwandten gehasst hat nachdem das Haus verkauft war.
Henriette hat gesagt, dass die Großtante die Verwandten gehasst haben nachdem das Haus verkauft war.
Henriette hat gesagt, dass sie die Verwandten gehasst hat nachdem das Haus verkauft war.
Henriette hat gesagt, dass sie die Verwandten gehasst haben nachdem das Haus verkauft war.

Iris hat erzählt, dass die Schwester die Brüder gekämmt hat bevor das Haar getrocknet war.
Iris hat erzählt, dass die Schwester die Brüder gekämmt haben bevor das Haar getrocknet war.
Iris hat erzählt, dass sie die Brüder gekämmt hat bevor das Haar getrocknet war.
Iris hat erzählt, dass sie die Brüder gekämmt haben bevor das Haar getrocknet war.

Ida hat berichtet, dass die Frau die Männer gekannt hat bevor das Treffen geplant war.
Ida hat berichtet, dass die Frau die Männer gekannt haben bevor das Treffen geplant war.
Ida hat berichtet, dass sie die Männer gekannt hat bevor das Treffen geplant war.
Ida hat berichtet, dass sie die Männer gekannt haben bevor das Treffen geplant war.

Julia hat gesagt, dass die Direktorin die Förderer gekränkt hat nachdem die Summe bezahlt war.
Julia hat gesagt, dass die Direktorin die Förderer gekränkt haben nachdem die Summe bezahlt war.
Julia hat gesagt, dass sie die Förderer gekränkt hat nachdem die Summe bezahlt war.
Julia hat gesagt, dass sie die Förderer gekränkt haben nachdem die Summe bezahlt war.

Judith hat erzählt, dass die Freundin die Kommilitonen gelangweilt hat nachdem der Urlaub gebucht war.
Judith hat erzählt, dass die Freundin die Kommilitonen gelangweilt haben nachdem der Urlaub gebucht war.
Judith hat erzählt, dass sie die Kommilitonen gelangweilt hat nachdem der Urlaub gebucht war.
Judith hat erzählt, dass sie die Kommilitonen gelangweilt haben nachdem der Urlaub gebucht war.

Nathalie hat gesagt, dass die Ärztin die Krankenschwestern kontaktiert hat während die Visite unterbrochen wurde.
Nathalie hat gesagt, dass die Ärztin die Krankenschwestern kontaktiert haben während die Visite unterbrochen wurde.
Nathalie hat gesagt, dass sie die Krankenschwestern kontaktiert hat während die Visite unterbrochen wurde.
Nathalie hat gesagt, dass sie die Krankenschwestern kontaktiert haben während die Visite unterbrochen wurde.

Sissi hat erzählt, dass die Schriftstellerin die Bildhauer beeinflusst hat bevor der Erfolg hereingebrochen war.
Sissi hat erzählt, dass die Schriftstellerin die Bildhauer beeinflusst haben bevor der Erfolg hereingebrochen war.
Sissi hat erzählt, dass sie die Bildhauer beeinflusst hat bevor der Erfolg hereingebrochen war.
Sissi hat erzählt, dass sie die Bildhauer beeinflusst haben bevor der Erfolg hereingebrochen war.

Lilo hat behauptet, dass die Schülerin die Klassenkameraden bestohlen hat während die Klausur geschrieben wurde.
Lilo hat behauptet, dass die Schülerin die Klassenkameraden bestohlen haben während die Klausur geschrieben wurde.
Lilo hat behauptet, dass sie die Klassenkameraden bestohlen hat während die Klausur geschrieben wurde.
Lilo hat behauptet, dass sie die Klassenkameraden bestohlen haben während die Klausur geschrieben wurde.

Katja hat behauptet, dass die Urlauberin die Mitreisenden gemieden hat bevor das Gerücht verbreitet wurde.
Katja hat behauptet, dass die Urlauberin die Mitreisenden gemieden haben bevor das Gerücht verbreitet wurde.
Katja hat behauptet, dass sie die Mitreisenden gemieden hat bevor das Gerücht verbreitet wurde.
Katja hat behauptet, dass sie die Mitreisenden gemieden haben bevor das Gerücht verbreitet wurde.

Jana hat gesagt, dass die Diva die Applaudierenden geliebt hat bevor das Konzert abgebrochen wurde.

Jana hat gesagt, dass die Diva die Applaudierenden geliebt haben bevor das Konzert abgebrochen wurde.
Jana hat gesagt, dass sie die Applaudierenden geliebt hat bevor das Konzert abgebrochen wurde.
Jana hat gesagt, dass sie die Applaudierenden geliebt haben bevor das Konzert abgebrochen wurde.

Christina hat berichtet, dass die Fahnderin die Schmuggler bemerkt hat während die Kontrolle durchgeführt wurde.
Christina hat berichtet, dass die Fahnderin die Schmuggler bemerkt haben während die Kontrolle durchgeführt wurde.
Christina hat berichtet, dass sie die Schmuggler bemerkt hat während die Kontrolle durchgeführt wurde.
Christina hat berichtet, dass sie die Schmuggler bemerkt haben während die Kontrolle durchgeführt wurde.

Ursula hat behauptet, dass die Kollegin die Abteilungsleiter beurlaubt hat nachdem der Konkurs angemeldet war.
Ursula hat behauptet, dass die Kollegin die Abteilungsleiter beurlaubt haben nachdem der Konkurs angemeldet war.
Ursula hat behauptet, dass sie die Abteilungsleiter beurlaubt hat nachdem der Konkurs angemeldet war.
Ursula hat behauptet, dass sie die Abteilungsleiter beurlaubt haben nachdem der Konkurs angemeldet war.

Bärbel hat berichtet, dass die Dirigentin die Musiker blamiert hat während das Klavier gestimmt wurde.
Bärbel hat berichtet, dass die Dirigentin die Musiker blamiert haben während das Klavier gestimmt wurde.
Bärbel hat berichtet, dass sie die Musiker blamiert hat während das Klavier gestimmt wurde.
Bärbel hat berichtet, dass sie die Musiker blamiert haben während das Klavier gestimmt wurde.

Martina hat erzählt, dass die Verkäuferin die Kunden beurteilt hat nachdem das Geschäft geschlossen war.
Martina hat erzählt, dass die Verkäuferin die Kunden beurteilt haben nachdem das Geschäft geschlossen war.
Martina hat erzählt, dass sie die Kunden beurteilt hat nachdem das Geschäft geschlossen war.
Martina hat erzählt, dass sie die Kunden beurteilt haben nachdem das Geschäft geschlossen war.

Linda hat berichtet, dass die Psychologin die Familien zermürbt hat während die Therapie beantragt wurde.
Linda hat berichtet, dass die Psychologin die Familien zermürbt haben während die Therapie beantragt wurde.
Linda hat berichtet, dass sie die Familien zermürbt hat während die Therapie beantragt wurde.
Linda hat berichtet, dass sie die Familien zermürbt haben während die Therapie beantragt wurde.

Paula hat behauptet, dass die Kameradin die Mitschüler geprügelt hat nachdem die Schule aus war.
Paula hat behauptet, dass die Kameradin die Mitschüler geprügelt haben nachdem die Schule aus war.
Paula hat behauptet, dass sie die Mitschüler geprügelt hat nachdem die Schule aus war.
Paula hat behauptet, dass sie die Mitschüler geprügelt haben nachdem die Schule aus war.

Lotte hat behauptet, dass die Cousine die Vettern beerbt hat bevor das Testament bestätigt war.
Lotte hat behauptet, dass die Cousine die Vettern beerbt haben bevor das Testament bestätigt war.
Lotte hat behauptet, dass sie die Vettern beerbt hat bevor das Testament bestätigt war.
Lotte hat behauptet, dass sie die Vettern beerbt haben bevor das Testament bestätigt war.

Adele hat berichtet, dass die Spionin die Polizeispitzel durchsucht hat während die Übergabe verhandelt wurde.
Adele hat berichtet, dass die Spionin die Polizeispitzel durchsucht haben während die Übergabe verhandelt wurde.
Adele hat berichtet, dass sie die Polizeispitzel durchsucht hat während die Übergabe verhandelt wurde.
Adele hat berichtet, dass sie die Polizeispitzel durchsucht haben während die Übergabe verhandelt wurde.

Anne hat gesagt, dass die Psychiaterin die Angehörigen benötigt hat bevor die Behandlung geplant wurde.
Anne hat gesagt, dass die Psychiaterin die Angehörigen benötigt haben bevor die Behandlung geplant wurde.
Anne hat gesagt, dass sie die Angehörigen benötigt hat bevor die Behandlung geplant wurde.
Anne hat gesagt, dass sie die Angehörigen benötigt haben bevor die Behandlung geplant wurde.

Maria hat gesagt, dass die Vertreterin die Bewohner belästigt hat bevor das Tor abgeschlossen war.
Maria hat gesagt, dass die Vertreterin die Bewohner belästigt haben bevor das Tor abgeschlossen war.
Maria hat gesagt, dass sie die Bewohner belästigt hat bevor das Tor abgeschlossen war.

Maria hat gesagt, dass sie die Bewohner belästigt haben bevor das Tor abgeschlossen war.

Britta hat gesagt, dass die Politikerin die Bürger befragt hat während der Wahlkampf forciert wurde.
Britta hat gesagt, dass die Politikerin die Bürger befragt haben während der Wahlkampf forciert wurde.
Britta hat gesagt, dass sie die Bürger befragt hat während der Wahlkampf forciert wurde.
Britta hat gesagt, dass sie die Bürger befragt haben während der Wahlkampf forciert wurde.

Miriam hat erzählt, dass die Wissenschaftlerin die Gutachter berücksichtigt hat nachdem der Druck erhöht wurde.
Miriam hat erzählt, dass die Wissenschaftlerin die Gutachter berücksichtigt haben nachdem der Druck erhöht wurde.
Miriam hat erzählt, dass sie die Gutachter berücksichtigt hat nachdem der Druck erhöht wurde.
Miriam hat erzählt, dass sie die Gutachter berücksichtigt haben nachdem der Druck erhöht wurde.

Heide hat behauptet, dass die Ministerin die Genossen benutzt hat bevor das Amt bestätigt war.
Heide hat behauptet, dass die Ministerin die Genossen benutzt haben bevor das Amt bestätigt war.
Heide hat behauptet, dass sie die Genossen benutzt hat bevor das Amt bestätigt war.
Heide hat behauptet, dass sie die Genossen benutzt haben bevor das Amt bestätigt war.

Angela hat behauptet, dass die Vorsitzende die Mitglieder beraubt hat nachdem die Kasse geleert war.
Angela hat behauptet, dass die Vorsitzende die Mitglieder beraubt haben nachdem die Kasse geleert war.
Angela hat behauptet, dass sie die Mitglieder beraubt hat nachdem die Kasse geleert war.
Angela hat behauptet, dass sie die Mitglieder beraubt haben nachdem die Kasse geleert war.

Sonja hat erzählt, dass die Herbergsmutter die Schulklassen geweckt hat bevor die Sonne aufgegangen war.
Sonja hat erzählt, dass die Herbergsmutter die Schulklassen geweckt haben bevor die Sonne aufgegangen war.
Sonja hat erzählt, dass sie die Schulklassen geweckt hat bevor die Sonne aufgegangen war.
Sonja hat erzählt, dass sie die Schulklassen geweckt haben bevor die Sonne aufgegangen war.

Manuela hat behauptet, dass die Trainerin die Spieler bewertet hat während das Training unterbrochen wurde.
Manuela hat behauptet, dass die Trainerin die Spieler bewertet haben während das Training unterbrochen wurde.
Manuela hat behauptet, dass sie die Spieler bewertet hat während das Training unterbrochen wurde.
Manuela hat behauptet, dass sie die Spieler bewertet haben während das Training unterbrochen wurde.

Regina hat berichtet, dass die Präsidentin die Verbündeten getäuscht hat nachdem die Wahl verloren war.
Regina hat berichtet, dass die Präsidentin die Verbündeten getäuscht haben nachdem die Wahl verloren war.
Regina hat berichtet, dass sie die Verbündeten getäuscht hat nachdem die Wahl verloren war.
Regina hat berichtet, dass sie die Verbündeten getäuscht haben nachdem die Wahl verloren war.

Martha hat gesagt, dass die Inhaberin die Freunde gereizt hat während der Laden gepfändet wurde.
Martha hat gesagt, dass die Inhaberin die Freunde gereizt haben während der Laden gepfändet wurde.
Martha hat gesagt, dass sie die Freunde gereizt hat während der Laden gepfändet wurde.
Martha hat gesagt, dass sie die Freunde gereizt haben während der Laden gepfändet wurde.

Gudrun hat behauptet, dass die Regisseurin die Schauspieler bewundert hat nachdem der Film angelaufen war.
Gudrun hat behauptet, dass die Regisseurin die Schauspieler bewundert haben nachdem der Film angelaufen war.
Gudrun hat behauptet, dass sie die Schauspieler bewundert hat nachdem der Film angelaufen war.
Gudrun hat behauptet, dass sie die Schauspieler bewundert haben nachdem der Film angelaufen war.

Nadja hat erzählt, dass die Großmutter die Tanten belogen hat bevor der Streit behoben war.
Nadja hat erzählt, dass die Großmutter die Tanten belogen haben bevor der Streit behoben war.
Nadja hat erzählt, dass sie die Tanten belogen hat bevor der Streit behoben war.
Nadja hat erzählt, dass sie die Tanten belogen haben bevor der Streit behoben war.

Petra hat erzählt, dass die Therapeutin die Oberärzte konsultiert hat nachdem die Krankheit diagnostiziert war.
Petra hat erzählt, dass die Therapeutin die Oberärzte konsultiert haben nachdem die Krankheit diagnostiziert war.
Petra hat erzählt, dass sie die Oberärzte konsultiert hat nachdem die Krankheit diagnostiziert war.
Petra hat erzählt, dass sie die Oberärzte konsultiert haben nachdem die Krankheit diagnostiziert war.

Heidi hat gesagt, dass die Hebamme die Ärzte geholt hat während die Geburt eingeleitet wurde.
Heidi hat gesagt, dass die Hebamme die Ärzte geholt haben während die Geburt eingeleitet wurde.
Heidi hat gesagt, dass sie die Ärzte geholt hat während die Geburt eingeleitet wurde.
Heidi hat gesagt, dass sie die Ärzte geholt haben während die Geburt eingeleitet wurde.

Sibylle hat berichtet, dass die Kritikerin die Schriftsteller porträtiert hat bevor das Treffen vereinbart wurde.
Sibylle hat berichtet, dass die Kritikerin die Schriftsteller porträtiert haben bevor das Treffen vereinbart wurde.
Sibylle hat berichtet, dass sie die Schriftsteller porträtiert hat bevor das Treffen vereinbart wurde.
Sibylle hat berichtet, dass sie die Schriftsteller porträtiert haben bevor das Treffen vereinbart wurde.

Tanja hat erzählt, dass die Rebellin die Abtrünnigen gehängt hat nachdem der Verrat entdeckt war.
Tanja hat erzählt, dass die Rebellin die Abtrünnigen gehängt haben nachdem der Verrat entdeckt war.
Tanja hat erzählt, dass sie die Abtrünnigen gehängt hat nachdem der Verrat entdeckt war.
Tanja hat erzählt, dass sie die Abtrünnigen gehängt haben nachdem der Verrat entdeckt war.

Ute hat erzählt, dass die Nachbarin die Asylbewerber bekocht hat während der Antrag verhandelt wurde.
Ute hat erzählt, dass die Nachbarin die Asylbewerber bekocht haben während der Antrag verhandelt wurde.
Ute hat erzählt, dass sie die Asylbewerber bekocht hat während der Antrag verhandelt wurde.
Ute hat erzählt, dass sie die Asylbewerber bekocht haben während der Antrag verhandelt wurde.

Nadine hat erzählt, dass die Reiseleiterin die Einheimischen belehrt hat während der Bus repariert wurde.
Nadine hat erzählt, dass die Reiseleiterin die Einheimischen belehrt haben während der Bus repariert wurde.
Nadine hat erzählt, dass sie die Einheimischen belehrt hat während der Bus repariert wurde.
Nadine hat erzählt, dass sie die Einheimischen belehrt haben während der Bus repariert wurde.

Olga hat behauptet, dass die Kandidatin die Mitbewerber benannt hat bevor das Quiz ausgestrahlt wurde.
Olga hat behauptet, dass die Kandidatin die Mitbewerber benannt haben bevor das Quiz ausgestrahlt wurde.
Olga hat behauptet, dass sie die Mitbewerber benannt hat bevor das Quiz ausgestrahlt wurde.
Olga hat behauptet, dass sie die Mitbewerber benannt haben bevor das Quiz ausgestrahlt wurde.

Sieglinde hat erzählt, dass die Anführerin die Kämpfer zurückgehalten hat nachdem die Schlacht verloren war.
Sieglinde hat erzählt, dass die Anführerin die Kämpfer zurückgehalten haben nachdem die Schlacht verloren war.
Sieglinde hat erzählt, dass sie die Kämpfer zurückgehalten hat nachdem die Schlacht verloren war.
Sieglinde hat erzählt, dass sie die Kämpfer zurückgehalten haben nachdem die Schlacht verloren war.

Uschi hat gesagt, dass die Schwimmerin die Herausforderer geschlagen hat nachdem der Wettkampf fortgesetzt wurde.
Uschi hat gesagt, dass die Schwimmerin die Herausforderer geschlagen haben nachdem der Wettkampf fortgesetzt wurde.
Uschi hat gesagt, dass sie die Herausforderer geschlagen hat nachdem der Wettkampf fortgesetzt wurde.
Uschi hat gesagt, dass sie die Herausforderer geschlagen haben nachdem der Wettkampf fortgesetzt wurde.

Sigrid hat behauptet, dass die Wärterin die Gefangenen gequält hat bevor der Aufstand eskaliert war.
Sigrid hat behauptet, dass die Wärterin die Gefangenen gequält haben bevor der Aufstand eskaliert war.
Sigrid hat behauptet, dass sie die Gefangenen gequält hat bevor der Aufstand eskaliert war.
Sigrid hat behauptet, dass sie die Gefangenen gequält haben bevor der Aufstand eskaliert war.

Pauline hat gesagt, dass die Graphikerin die Photographen geschickt hat nachdem das Design besprochen war.

Pauline hat gesagt, dass die Graphikerin die Photographen geschickt haben nachdem das Design besprochen war.
Pauline hat gesagt, dass sie die Photographen geschickt hat nachdem das Design besprochen war.
Pauline hat gesagt, dass sie die Photographen geschickt haben nachdem das Design besprochen war.

Pina hat erzählt, dass die Amazone die Krieger beschützt hat nachdem der Sieg errungen war.
Pina hat erzählt, dass die Amazone die Krieger beschützt haben nachdem der Sieg errungen war.
Pina hat erzählt, dass sie die Krieger beschützt hat nachdem der Sieg errungen war.
Pina hat erzählt, dass sie die Krieger beschützt haben nachdem der Sieg errungen war.

Katharina hat berichtet, dass die Tennisspielerin die Konkurrenten besiegt hat während der Regen stärker wurde.
Katharina hat berichtet, dass die Tennisspielerin die Konkurrenten besiegt haben während der Regen stärker wurde.
Katharina hat berichtet, dass sie die Konkurrenten besiegt hat während der Regen stärker wurde.
Katharina hat berichtet, dass sie die Konkurrenten besiegt haben während der Regen stärker wurde.

Rita hat gesagt, dass die Meisterin die Lehrlinge gesucht hat nachdem die Maschine geölt war.
Rita hat gesagt, dass die Meisterin die Lehrlinge gesucht haben nachdem die Maschine geölt war.
Rita hat gesagt, dass sie die Lehrlinge gesucht hat nachdem die Maschine geölt war.
Rita hat gesagt, dass sie die Lehrlinge gesucht haben nachdem die Maschine geölt war.

Marion hat gesagt, dass die Bademeisterin die Schwimmer betrachtet hat während das Sprungbrett installiert wurde.
Marion hat gesagt, dass die Bademeisterin die Schwimmer betrachtet haben während das Sprungbrett installiert wurde.
Marion hat gesagt, dass sie die Schwimmer betrachtet hat während das Sprungbrett installiert wurde.
Marion hat gesagt, dass sie die Schwimmer betrachtet haben während das Sprungbrett installiert wurde.

Ronja hat erzählt, dass die Produzentin die Regisseure getroffen hat bevor der Wettbewerb entschieden war.
Ronja hat erzählt, dass die Produzentin die Regisseure getroffen haben bevor der Wettbewerb entschieden war.
Ronja hat erzählt, dass sie die Regisseure getroffen hat bevor der Wettbewerb entschieden war.
Ronja hat erzählt, dass sie die Regisseure getroffen haben bevor der Wettbewerb entschieden war.

Arlett hat berichtet, dass die Konkurrentin die Mitstreiter belächelt hat nachdem die Entscheidung gefallen war.
Arlett hat berichtet, dass die Konkurrentin die Mitstreiter belächelt haben nachdem die Entscheidung gefallen war.
Arlett hat berichtet, dass sie die Mitstreiter belächelt hat nachdem die Entscheidung gefallen war.
Arlett hat berichtet, dass sie die Mitstreiter belächelt haben nachdem die Entscheidung gefallen war.

Anja hat berichtet, dass die Mitschülerin die Jungen geärgert hat bevor der Unterricht begonnen wurde.
Anja hat berichtet, dass die Mitschülerin die Jungen geärgert haben bevor der Unterricht begonnen wurde.
Anja hat berichtet, dass sie die Jungen geärgert hat bevor der Unterricht begonnen wurde.
Anja hat berichtet, dass sie die Jungen geärgert haben bevor der Unterricht begonnen wurde.

Gerhild hat berichtet, dass die Animateurin die Reiseleiter gefunden hat bevor der Ausflug beendet war.
Gerhild hat berichtet, dass die Animateurin die Reiseleiter gefunden haben bevor der Ausflug beendet war.
Gerhild hat berichtet, dass sie die Reiseleiter gefunden hat bevor der Ausflug beendet war.
Gerhild hat berichtet, dass sie die Reiseleiter gefunden haben bevor der Ausflug beendet war.

Milena hat berichtet, dass die Betreuerin die Jugendlichen getriezt hat bevor die Kontrolle verstärkt wurde.
Milena hat berichtet, dass die Betreuerin die Jugendlichen getriezt haben bevor die Kontrolle verstärkt wurde.
Milena hat berichtet, dass sie die Jugendlichen getriezt hat bevor die Kontrolle verstärkt wurde.
Milena hat berichtet, dass sie die Jugendlichen getriezt haben bevor die Kontrolle verstärkt wurde.

Nelly hat behauptet, dass die Passantin die Bekannten gegrüßt hat bevor die Ampel umgesprungen war.
Nelly hat behauptet, dass die Passantin die Bekannten gegrüßt haben bevor die Ampel umgesprungen war.

Nelly hat behauptet, dass sie die Bekannten gegrüßt hat bevor die Ampel umgesprungen war.
Nelly hat behauptet, dass sie die Bekannten gegrüßt haben bevor die Ampel umgesprungen war.

Grit hat behauptet, dass die Pförtnerin die Besucher gesehen hat während die Schranke geöffnet wurde.
Grit hat behauptet, dass die Pförtnerin die Besucher gesehen haben während die Schranke geöffnet wurde.
Grit hat behauptet, dass sie die Besucher gesehen hat während die Schranke geöffnet wurde.
Grit hat behauptet, dass sie die Besucher gesehen haben während die Schranke geöffnet wurde.

Silke hat erzählt, dass die Geliebte die Ehemänner gewarnt hat nachdem der Treffpunkt entdeckt war.
Silke hat erzählt, dass die Geliebte die Ehemänner gewarnt haben nachdem der Treffpunkt entdeckt war.
Silke hat erzählt, dass sie die Ehemänner gewarnt hat nachdem der Treffpunkt entdeckt war.
Silke hat erzählt, dass sie die Ehemänner gewarnt haben nachdem der Treffpunkt entdeckt war.

Nina hat berichtet, dass die Pianistin die Geiger getadelt hat während der Vorhang gehoben wurde.
Nina hat berichtet, dass die Pianistin die Geiger getadelt haben während der Vorhang gehoben wurde.
Nina hat berichtet, dass sie die Geiger getadelt hat während der Vorhang gehoben wurde.
Nina hat berichtet, dass sie die Geiger getadelt haben während der Vorhang gehoben wurde.

Edith hat berichtet, dass die Wirtin die Kellner beteiligt hat nachdem die Rechnung bezahlt wurde.
Edith hat berichtet, dass die Wirtin die Kellner beteiligt haben nachdem die Rechnung bezahlt wurde.
Edith hat berichtet, dass sie die Kellner beteiligt hat nachdem die Rechnung bezahlt wurde.
Edith hat berichtet, dass sie die Kellner beteiligt haben nachdem die Rechnung bezahlt wurde.

Susanne hat behauptet, dass die Homöopathin die Schulmediziner geheilt hat nachdem die Skepsis beseitigt war.
Susanne hat behauptet, dass die Homöopathin die Schulmediziner geheilt haben nachdem die Skepsis beseitigt war.
Susanne hat behauptet, dass sie die Schulmediziner geheilt hat nachdem die Skepsis beseitigt war.
Susanne hat behauptet, dass sie die Schulmediziner geheilt haben nachdem die Skepsis beseitigt war.

Nicole hat erzählt, dass die Informantin die Reporter getestet hat während das Interview geführt wurde.
Nicole hat erzählt, dass die Informantin die Reporter getestet haben während das Interview geführt wurde.
Nicole hat erzählt, dass sie die Reporter getestet hat während das Interview geführt wurde.
Nicole hat erzählt, dass sie die Reporter getestet haben während das Interview geführt wurde.

Sarah hat behauptet, dass die Juristin die Klienten beschenkt hat bevor das Urteil gesprochen war.
Sarah hat behauptet, dass die Juristin die Klienten beschenkt haben bevor das Urteil gesprochen war.
Sarah hat behauptet, dass sie die Klienten beschenkt hat bevor das Urteil gesprochen war.
Sarah hat behauptet, dass sie die Klienten beschenkt haben bevor das Urteil gesprochen war.

Tatjana hat erzählt, dass die Muse die Künstler beeindruckt hat während das Bild gemalt wurde.
Tatjana hat erzählt, dass die Muse die Künstler beeindruckt haben während das Bild gemalt wurde.
Tatjana hat erzählt, dass sie die Künstler beeindruckt hat während das Bild gemalt wurde.
Tatjana hat erzählt, dass sie die Künstler beeindruckt haben während das Bild gemalt wurde.

Tina hat berichtet, dass die Dekanin die Professoren gefördert hat bevor die Neuwahl anberaumt war.
Tina hat berichtet, dass die Dekanin die Professoren gefördert haben bevor die Neuwahl anberaumt war.
Tina hat berichtet, dass sie die Professoren gefördert hat bevor die Neuwahl anberaumt war.
Tina hat berichtet, dass sie die Professoren gefördert haben bevor die Neuwahl anberaumt war.

Doreen hat behauptet, dass die Künstlerin die Gäste beleidigt hat während die Ausstellung bestaunt wurde.
Doreen hat behauptet, dass die Künstlerin die Gäste beleidigt haben während die Ausstellung bestaunt wurde.
Doreen hat behauptet, dass sie die Gäste beleidigt hat während die Ausstellung bestaunt wurde.
Doreen hat behauptet, dass sie die Gäste beleidigt haben während die Ausstellung bestaunt wurde.

Vanessa hat erzählt, dass die Abenteurerin die Elefanten gejagt hat bevor das Verbot verhängt wurde.
Vanessa hat erzählt, dass die Abenteurerin die Elefanten gejagt haben bevor das Verbot verhängt wurde.
Vanessa hat erzählt, dass sie die Elefanten gejagt hat bevor das Verbot verhängt wurde.
Vanessa hat erzählt, dass sie die Elefanten gejagt haben bevor das Verbot verhängt wurde.

Ulrike hat erzählt, dass die Farmerin die Eingeborenen geachtet hat während die Ernte eingefahren wurde.
Ulrike hat erzählt, dass die Farmerin die Eingeborenen geachtet haben während die Ernte eingefahren wurde.
Ulrike hat erzählt, dass sie die Eingeborenen geachtet hat während die Ernte eingefahren wurde.
Ulrike hat erzählt, dass sie die Eingeborenen geachtet haben während die Ernte eingefahren wurde.

Ulla hat berichtet, dass die Sportlerin die Gegner bezwungen hat bevor der Skandal aufgeflogen war.
Ulla hat berichtet, dass die Sportlerin die Gegner bezwungen haben bevor der Skandal aufgeflogen war.
Ulla hat berichtet, dass sie die Gegner bezwungen hat bevor der Skandal aufgeflogen war.
Ulla hat berichtet, dass sie die Gegner bezwungen haben bevor der Skandal aufgeflogen war.

Agathe hat gesagt, dass die Oma die Enkel besucht hat während das Fest gefeiert wurde.
Agathe hat gesagt, dass die Oma die Enkel besucht haben während das Fest gefeiert wurde.
Agathe hat gesagt, dass sie die Enkel besucht hat während das Fest gefeiert wurde.
Agathe hat gesagt, dass sie die Enkel besucht haben während das Fest gefeiert wurde.

Christa hat erzählt, dass die Seglerin die Taucher gerettet hat nachdem der Sturm weitergezogen war.
Christa hat erzählt, dass die Seglerin die Taucher gerettet haben nachdem der Sturm weitergezogen war.
Christa hat erzählt, dass sie die Taucher gerettet hat nachdem der Sturm weitergezogen war.
Christa hat erzählt, dass sie die Taucher gerettet haben nachdem der Sturm weitergezogen war.

Adelheid hat behauptet, dass die Lehrerin die Schüler gefürchtet hat nachdem die Strafe verhängt war.
Adelheid hat behauptet, dass die Lehrerin die Schüler gefürchtet haben nachdem die Strafe verhängt war.
Adelheid hat behauptet, dass sie die Schüler gefürchtet hat nachdem die Strafe verhängt war.
Adelheid hat behauptet, dass sie die Schüler gefürchtet haben nachdem die Strafe verhängt war.

Eva hat berichtet, dass die Besitzerin die Einbrecher beobachtet hat bevor der Alarm ausgelöst war.
Eva hat berichtet, dass die Besitzerin die Einbrecher beobachtet haben bevor der Alarm ausgelöst war.
Eva hat berichtet, dass sie die Einbrecher beobachtet hat bevor der Alarm ausgelöst war.
Eva hat berichtet, dass sie die Einbrecher beobachtet haben bevor der Alarm ausgelöst war.

B Materials for Experiment 4

Am Montag hat der Informant den Neffen gesehen, und nicht den Onkel.
Am Montag hat der Informant den Neffen gesehen, und nicht der Onkel.
Am Montag hat der Informant nur den Neffen gesehen, und nicht den Onkel.
Am Montag hat nur der Informant den Neffen gesehen, und nicht der Onkel.

Am Dienstag hat der Pfleger den Therapeuten konsultiert, und nicht den Arzt.
Am Dienstag hat der Pfleger den Therapeuten konsultiert, und nicht der Arzt.
Am Dienstag hat der Pfleger nur den Therapeuten konsultiert, und nicht den Arzt.
Am Dienstag hat nur der Pfleger den Therapeuten konsultiert, und nicht der Arzt.

Am Mittwoch hat der Tourist den Animateur gefilmt, und nicht den Tänzer.
Am Mittwoch hat der Tourist den Animateur gefilmt, und nicht der Tänzer.
Am Mittwoch hat der Tourist nur den Animateur gefilmt, und nicht den Tänzer.
Am Mittwoch hat nur der Tourist den Animateur gefilmt, und nicht der Tänzer.

Am Donnerstag hat der Pfarrer den Mönch gerufen, und nicht den Priester.
Am Donnerstag hat der Pfarrer den Mönch gerufen, und nicht der Priester.
Am Donnerstag hat der Pfarrer nur den Mönch gerufen, und nicht den Priester.
Am Donnerstag hat nur der Pfarrer den Mönch gerufen, und nicht der Priester.

Am Freitag hat der Barkeeper den Zapfer gefeuert, und nicht den Kellner.
Am Freitag hat der Barkeeper den Zapfer gefeuert, und nicht der Kellner.
Am Freitag hat der Barkeeper nur den Zapfer gefeuert, und nicht den Kellner.
Am Freitag hat nur der Barkeeper den Zapfer gefeuert, und nicht der Kellner.

Am Montag hat der Bräutigam den Trauzeugen beschimpft, und nicht den Vetter.
Am Montag hat der Bräutigam den Trauzeugen beschimpft, und nicht der Vetter.
Am Montag hat der Bräutigam nur den Trauzeugen beschimpft, und nicht den Vetter.
Am Montag hat nur der Bräutigam den Trauzeugen beschimpft, und nicht der Vetter.

Am Dienstag hat der Architekt den Ingenieur beauftragt, und nicht den Maurer.
Am Dienstag hat der Architekt den Ingenieur beauftragt, und nicht der Maurer.
Am Dienstag hat der Architekt nur den Ingenieur beauftragt, und nicht den Maurer.
Am Dienstag hat nur der Architekt den Ingenieur beauftragt, und nicht der Maurer.

Am Mittwoch hat der Bekannte den Cousin festgehalten, und nicht den Bruder.
Am Mittwoch hat der Bekannte den Cousin festgehalten, und nicht der Bruder.
Am Mittwoch hat der Bekannte nur den Cousin festgehalten, und nicht den Bruder.
Am Mittwoch hat nur der Bekannte den Cousin festgehalten, und nicht der Bruder.

Am Donnerstag hat der Bildhauer den Kaiser portraitiert, und nicht den Maler .
Am Donnerstag hat der Bildhauer den Kaiser portraitiert, und nicht der Maler.
Am Donnerstag hat der Bildhauer nur den Kaiser portraitiert, und nicht den Maler.
Am Donnerstag hat nur der Bildhauer den Kaiser portraitiert, und nicht der Maler.

Am Freitag hat der Wachmann den Angestellten befragt, und nicht den Chef.
Am Freitag hat der Wachmann den Angestellten befragt, und nicht der Chef.
Am Freitag hat der Wachmann nur den Angestellten befragt, und nicht den Chef.
Am Freitag hat nur der Wachmann den Angestellten befragt, und nicht der Chef.

Am Montag hat der Hausmeister den Mitbewohner gesucht, und nicht den Mieter.
Am Montag hat der Hausmeister den Mitbewohner gesucht, und nicht der Mieter.
Am Montag hat der Hausmeister nur den Mitbewohner gesucht, und nicht den Mieter.
Am Montag hat nur der Hausmeister den Mitbewohner gesucht, und nicht der Mieter.

Am Dienstag hat der Direktor den Schüler getadelt, und nicht den Lehrer.
Am Dienstag hat der Direktor den Schüler getadelt, und nicht der Lehrer.

Am Dienstag hat der Direktor nur den Schüler getadelt, und nicht den Lehrer.
Am Dienstag hat nur der Direktor den Schüler getadelt, und nicht der Lehrer.

Am Mittwoch hat der Passant den Urlauber bestohlen, und nicht den Händler.
Am Mittwoch hat der Passant den Urlauber bestohlen, und nicht der Händler.
Am Mittwoch hat der Passant nur den Urlauber bestohlen, und nicht den Händler.
Am Mittwoch hat nur der Passant den Urlauber bestohlen, und nicht der Händler.

Am Donnerstag hat der Zauberer den Zwerg bestraft, und nicht den Troll.
Am Donnerstag hat der Zauberer den Zwerg bestraft, und nicht der Troll.
Am Donnerstag hat der Zauberer nur den Zwerg bestraft, und nicht den Troll.
Am Donnerstag hat nur der Zauberer den Zwerg bestraft, und nicht der Troll.

Am Freitag hat der Fremde den Wirt erkannt, und nicht den Kutscher.
Am Freitag hat der Fremde den Wirt erkannt, und nicht der Kutscher.
Am Freitag hat der Fremde nur den Wirt erkannt, und nicht den Kutscher.
Am Freitag hat nur der Fremde den Wirt erkannt, und nicht der Kutscher.

Am Montag hat der Ritter den Prinzen befreit, und nicht den König.
Am Montag hat der Ritter den Prinzen befreit, und nicht der König.
Am Montag hat der Ritter nur den Prinzen befreit, und nicht den König.
Am Montag hat nur der Ritter den Prinzen befreit, und nicht der König.

Am Dienstag hat der Seelsorger den Vater gepflegt, und nicht den Sohn.
Am Dienstag hat der Seelsorger den Vater gepflegt, und nicht der Sohn.
Am Dienstag hat der Seelsorger nur den Vater gepflegt, und nicht den Sohn.
Am Dienstag hat nur der Seelsorger den Vater gepflegt, und nicht der Sohn.

Am Mittwoch hat der Kritiker den Sänger bewertet, und nicht den Geiger.
Am Mittwoch hat der Kritiker den Sänger bewertet, und nicht der Geiger.
Am Mittwoch hat der Kritiker nur den Sänger bewertet, und nicht den Geiger.
Am Mittwoch hat nur der Kritiker den Sänger bewertet, und nicht der Geiger.

Am Donnerstag hat der Referendar den Klienten beraten, und nicht den Anwalt.
Am Donnerstag hat der Referendar den Klienten beraten, und nicht der Anwalt.
Am Donnerstag hat der Referendar nur den Klienten beraten, und nicht den Anwalt.
Am Donnerstag hat nur der Referendar den Klienten beraten, und nicht der Anwalt.

Am Freitag hat der Präsident den Kanzler belogen, und nicht den Minister.
Am Freitag hat der Präsident den Kanzler belogen, und nicht der Minister.
Am Freitag hat der Präsident nur den Kanzler belogen, und nicht den Minister.
Am Freitag hat nur der Präsident den Kanzler belogen, und nicht der Minister.

Am Montag hat der Kunde den Lehrling geholt, und nicht den Meister.
Am Montag hat der Kunde den Lehrling geholt, und nicht der Meister.
Am Montag hat der Kunde nur den Lehrling geholt, und nicht den Meister.
Am Montag hat nur der Kunde den Lehrling geholt, und nicht der Meister.

Am Dienstag hat der Fahnder den Komplizen beschattet, und nicht den Schmuggler.
Am Dienstag hat der Fahnder den Komplizen beschattet, und nicht der Schmuggler.
Am Dienstag hat der Fahnder nur den Komplizen beschattet, und nicht den Schmuggler.
Am Dienstag hat nur der Fahnder den Komplizen beschattet, und nicht der Schmuggler.

Am Mittwoch hat der Lotse den Piloten beachtet, und nicht den Techniker.
Am Mittwoch hat der Lotse den Piloten beachtet, und nicht der Techniker.
Am Mittwoch hat der Lotse nur den Piloten beachtet, und nicht den Techniker.
Am Mittwoch hat nur der Lotse den Piloten beachtet, und nicht der Techniker.

Am Donnerstag hat der Radfahrer den Konkurrenten geschlagen, und nicht den Jogger.

Am Donnerstag hat der Radfahrer den Konkurrenten geschlagen, und nicht der Jogger.
Am Donnerstag hat der Radfahrer nur den Konkurrenten geschlagen, und nicht den Jogger.
Am Donnerstag hat nur der Radfahrer den Konkurrenten geschlagen, und nicht der Jogger.

Am Freitag hat der Schöffe den Staatsanwalt beschenkt, und nicht den Richter.
Am Freitag hat der Schöffe den Staatsanwalt beschenkt, und nicht der Richter.
Am Freitag hat der Schöffe nur den Staatsanwalt beschenkt, und nicht den Richter.
Am Freitag hat nur der Schöffe den Staatsanwalt beschenkt, und nicht der Richter.

Am Freitag hat der Wächter den Beamten bezwungen, und nicht den Räuber.
Am Freitag hat der Wächter den Beamten bezwungen, und nicht der Räuber.
Am Freitag hat der Wächter nur den Beamten bezwungen, und nicht den Räuber.
Am Freitag hat nur der Wächter den Beamten bezwungen, und nicht der Räuber.

Am Dienstag hat der Mitstreiter den Langläufer beurteilt, und nicht den Trainer.
Am Dienstag hat der Mitstreiter den Langläufer beurteilt, und nicht der Trainer.
Am Dienstag hat der Mitstreiter nur den Langläufer beurteilt, und nicht den Trainer.
Am Dienstag hat nur der Mitstreiter den Langläufer beurteilt, und nicht der Trainer.

Am Mittwoch hat der Kurator den Galeristen beschämt, und nicht den Künstler.
Am Mittwoch hat der Kurator den Galeristen beschämt, und nicht der Künstler.
Am Mittwoch hat der Kurator nur den Galeristen beschämt, und nicht den Künstler.
Am Mittwoch hat nur der Kurator den Galeristen beschämt, und nicht der Künstler.

Am Donnerstag hat der Dirigent den Pianisten getriezt, und nicht den Trommler.
Am Donnerstag hat der Dirigent den Pianisten getriezt, und nicht der Trommler.
Am Donnerstag hat der Dirigent nur den Pianisten getriezt, und nicht den Trommler.
Am Donnerstag hat nur der Dirigent den Pianisten getriezt, und nicht der Trommler.

Am Montag hat der Taucher den Angler genervt, und nicht den Segler.
Am Montag hat der Taucher den Angler genervt, und nicht der Segler.
Am Montag hat der Taucher nur den Angler genervt, und nicht den Segler.
Am Montag hat nur der Taucher den Angler genervt, und nicht der Segler.

Am Montag hat der Afrikaner den Franzosen geküsst, und nicht den Spanier.
Am Montag hat der Afrikaner den Franzosen geküsst, und nicht der Spanier.
Am Montag hat der Afrikaner nur den Franzosen geküsst, und nicht den Spanier.
Am Montag hat nur der Afrikaner den Franzosen geküsst, und nicht der Spanier.

Am Dienstag hat der Bischof den Pilger gesegnet, und nicht den Abt.
Am Dienstag hat der Bischof den Pilger gesegnet, und nicht der Abt.
Am Dienstag hat der Bischof nur den Pilger gesegnet, und nicht den Abt.
Am Dienstag hat nur der Bischof den Pilger gesegnet, und nicht der Abt.

Am Mittwoch hat der Assistent den Studenten bekocht, und nicht den Professor.
Am Mittwoch hat der Assistent den Studenten bekocht, und nicht der Professor.
Am Mittwoch hat der Assistent nur den Studenten bekocht, und nicht den Professor.
Am Mittwoch hat nur der Assistent den Studenten bekocht, und nicht der Professor.

Am Donnerstag hat der Schauspieler den Photographen verprügelt, und nicht den Fan.
Am Donnerstag hat der Schauspieler den Photographen verprügelt, und nicht der Fan.
Am Donnerstag hat der Schauspieler nur den Photographen verprügelt, und nicht den Fan.
Am Donnerstag hat nur der Schauspieler den Photographen verprügelt, und nicht der Fan.

Am Freitag hat der Butler den Grafen begrüßt, und nicht den Baron.
Am Freitag hat der Butler den Grafen begrüßt, und nicht der Baron.
Am Freitag hat der Butler nur den Grafen begrüßt, und nicht den Baron.
Am Freitag hat nur der Butler den Grafen begrüßt, und nicht der Baron.

Am Montag hat der Diener den Fürsten gebadet, und nicht den Stiefsohn.
Am Montag hat der Diener den Fürsten gebadet, und nicht der Stiefsohn.
Am Montag hat der Diener nur den Fürsten gebadet, und nicht den Stiefsohn.
Am Montag hat nur der Diener den Fürsten gebadet, und nicht der Stiefsohn.

Am Dienstag hat der Enkel den Großvater beerbt, und nicht den Schwager.
Am Dienstag hat der Enkel den Großvater beerbt, und nicht der Schwager.
Am Dienstag hat der Enkel nur den Großvater beerbt, und nicht den Schwager.
Am Dienstag hat nur der Enkel den Großvater beerbt, und nicht der Schwager.

Am Mittwoch hat der Bauer den Kadetten gefürchtet, und nicht den Anführer.
Am Mittwoch hat der Bauer den Kadetten gefürchtet, und nicht der Anführer.
Am Mittwoch hat der Bauer nur den Kadetten gefürchtet, und nicht den Anführer.
Am Mittwoch hat nur der Bauer den Kadetten gefürchtet, und nicht der Anführer.

Am Donnerstag hat der Gauner den Besitzer beraubt, und nicht den Gast.
Am Donnerstag hat der Gauner den Besitzer beraubt, und nicht der Gast.
Am Donnerstag hat der Gauner nur den Besitzer beraubt, und nicht den Gast.
Am Donnerstag hat nur der Gauner den Besitzer beraubt, und nicht der Gast.

Am Freitag hat der Soldat den Zivilisten bekämpft, und nicht den Gegner.
Am Freitag hat der Soldat den Zivilisten bekämpft, und nicht der Gegner.
Am Freitag hat der Soldat nur den Zivilisten bekämpft, und nicht den Gegner.
Am Freitag hat nur der Soldat den Zivilisten bekämpft, und nicht der Gegner.

Am Montag hat der Verlierer den Teamchef beneidet, und nicht den Champion.
Am Montag hat der Verlierer den Teamchef beneidet, und nicht der Champion.
Am Montag hat der Verlierer nur den Teamchef beneidet, und nicht den Champion.
Am Montag hat nur der Verlierer den Teamchef beneidet, und nicht der Champion.

Am Dienstag hat der Läufer den Verletzten gestützt, und nicht den Rentner.
Am Dienstag hat der Läufer den Verletzten gestützt, und nicht der Rentner.
Am Dienstag hat der Läufer nur den Verletzten gestützt, und nicht den Rentner.
Am Dienstag hat nur der Läufer den Verletzten gestützt, und nicht der Rentner.

Am Mittwoch hat der Sportler den Nachbarn gegrüßt, und nicht den Postmann.
Am Mittwoch hat der Sportler den Nachbarn gegrüßt, und nicht der Postmann.
Am Mittwoch hat der Sportler nur den Nachbarn gegrüßt, und nicht den Postmann.
Am Mittwoch hat nur der Sportler den Nachbarn gegrüßt, und nicht der Postmann.

Am Donnerstag hat der Farmer den Züchter gehasst, und nicht den Käufer.
Am Donnerstag hat der Farmer den Züchter gehasst, und nicht der Käufer.
Am Donnerstag hat der Farmer nur den Züchter gehasst, und nicht den Käufer.
Am Donnerstag hat nur der Farmer den Züchter gehasst, und nicht der Käufer.

Am Freitag hat der Doktor den Kranken bedauert, und nicht den Freund.
Am Freitag hat der Doktor den Kranken bedauert, und nicht der Freund.
Am Freitag hat der Doktor nur den Kranken bedauert, und nicht den Freund.
Am Freitag hat nur der Doktor den Kranken bedauert, und nicht der Freund.

Am Montag hat der Ehemann den Geliebten beleidigt, und nicht den Masseur.
Am Montag hat der Ehemann den Geliebten beleidigt, und nicht der Masseur.
Am Montag hat der Ehemann nur den Geliebten beleidigt, und nicht den Masseur.
Am Montag hat nur der Ehemann den Geliebten beleidigt, und nicht der Masseur.

Am Dienstag hat der Gitarrist den Bassisten geachtet, und nicht den Drummer.
Am Dienstag hat der Gitarrist den Bassisten geachtet, und nicht der Drummer.
Am Dienstag hat der Gitarrist nur den Bassisten geachtet, und nicht den Drummer.
Am Dienstag hat nur der Gitarrist den Bassisten geachtet, und nicht der Drummer.

Am Mittwoch hat der Besucher den Pagen bestochen, und nicht den Portier.
Am Mittwoch hat der Besucher den Pagen bestochen, und nicht der Portier.
Am Mittwoch hat der Besucher nur den Pagen bestochen, und nicht den Portier.
Am Mittwoch hat nur der Besucher den Pagen bestochen, und nicht der Portier.

Am Donnerstag hat der Christ den Bekehrten geprüft, und nicht den Guru.
Am Donnerstag hat der Christ den Bekehrten geprüft, und nicht der Guru.
Am Donnerstag hat der Christ nur den Bekehrten geprüft, und nicht den Guru.
Am Donnerstag hat nur der Christ den Bekehrten geprüft, und nicht der Guru.

Am Freitag hat der Clown den Artisten behindert, und nicht den Dompteur.
Am Freitag hat der Clown den Artisten behindert, und nicht der Dompteur.
Am Freitag hat der Clown nur den Artisten behindert, und nicht den Dompteur.
Am Freitag hat nur der Clown den Artisten behindert, und nicht der Dompteur.

Am Montag hat der Matrose den Schiffsjungen gerettet, und nicht den Kapitän.
Am Montag hat der Matrose den Schiffsjungen gerettet, und nicht der Kapitän.
Am Montag hat der Matrose nur den Schiffsjungen gerettet, und nicht den Kapitän.
Am Montag hat nur der Matrose den Schiffsjungen gerettet, und nicht der Kapitän.

Am Dienstag hat der Reporter den Historiker besucht, und nicht den Dichter.
Am Dienstag hat der Reporter den Historiker besucht, und nicht der Dichter.
Am Dienstag hat der Reporter nur den Historiker besucht, und nicht den Dichter.
Am Dienstag hat nur der Reporter den Historiker besucht, und nicht der Dichter.

Am Mittwoch hat der Raucher den Bekannten verführt, und nicht den Säufer.
Am Mittwoch hat der Raucher den Bekannten verführt, und nicht der Säufer.
Am Mittwoch hat der Raucher nur den Bekannten verführt, und nicht den Säufer.
Am Mittwoch hat nur der Raucher den Bekannten verführt, und nicht der Säufer.

Am Donnerstag hat der Leiter den Praktikanten gefördert, und nicht den Forscher.
Am Donnerstag hat der Leiter den Praktikanten gefördert, und nicht der Forscher.
Am Donnerstag hat der Leiter nur den Praktikanten gefördert, und nicht den Forscher.
Am Donnerstag hat nur der Leiter den Praktikanten gefördert, und nicht der Forscher.

Am Freitag hat der Musiker den Produzenten beeindruckt, und nicht den Verleger.
Am Freitag hat der Musiker den Produzenten beeindruckt, und nicht der Verleger.
Am Freitag hat der Musiker nur den Produzenten beeindruckt, und nicht den Verleger.
Am Freitag hat nur der Musiker den Produzenten beeindruckt, und nicht der Verleger.

Am Montag hat der Gutachter den Manager getestet, und nicht den Boss.
Am Montag hat der Gutachter den Manager getestet, und nicht der Boss.
Am Montag hat der Gutachter nur den Manager getestet, und nicht den Boss.
Am Montag hat nur der Gutachter den Manager getestet, und nicht der Boss.

Am Dienstag hat der Deserteur den Rebellen gewarnt, und nicht den Hauptmann.
Am Dienstag hat der Deserteur den Rebellen gewarnt, und nicht der Hauptmann.
Am Dienstag hat der Deserteur nur den Rebellen gewarnt, und nicht den Hauptmann.
Am Dienstag hat nur der Deserteur den Rebellen gewarnt, und nicht der Hauptmann.

Am Mittwoch hat der Dilettant den Regisseur geärgert, und nicht den Filmstar.
Am Mittwoch hat der Dilettant den Regisseur geärgert, und nicht der Filmstar.
Am Mittwoch hat der Dilettant nur den Regisseur geärgert, und nicht den Filmstar.
Am Mittwoch hat nur der Dilettant den Regisseur geärgert, und nicht der Filmstar.

Am Donnerstag hat der Bademeister den Dicken belächelt, und nicht den Schwimmer.
Am Donnerstag hat der Bademeister den Dicken belächelt, und nicht der Schwimmer.
Am Donnerstag hat der Bademeister nur den Dicken belächelt, und nicht den Schwimmer.
Am Donnerstag hat nur der Bademeister den Dicken belächelt, und nicht der Schwimmer.

Am Freitag hat der Schütze den Soldaten besiegt, und nicht den Söldner.
Am Freitag hat der Schütze den Soldaten besiegt, und nicht der Söldner.
Am Freitag hat der Schütze nur den Soldaten besiegt, und nicht den Söldner.
Am Freitag hat nur der Schütze den Soldaten besiegt, und nicht der Söldner.

Am Montag hat der Seiltänzer den Komiker betrachtet, und nicht den Jongleur.
Am Montag hat der Seiltänzer den Komiker betrachtet, und nicht der Jongleur.
Am Montag hat der Seiltänzer nur den Komiker betrachtet, und nicht den Jongleur.
Am Montag hat nur der Seiltänzer den Komiker betrachtet, und nicht der Jongleur.

Am Dienstag hat der Bodyguard den Millionär beschützt, und nicht den Chauffeur.
Am Dienstag hat der Bodyguard den Millionär beschützt, und nicht der Chauffeur.
Am Dienstag hat der Bodyguard nur den Millionär beschützt, und nicht den Chauffeur.
Am Dienstag hat nur der Bodyguard den Millionär beschützt, und nicht der Chauffeur.

Am Mittwoch hat der Graphiker den Modedesigner bewundert, und nicht den Schneider.
Am Mittwoch hat der Graphiker den Modedesigner bewundert, und nicht der Schneider.
Am Mittwoch hat der Graphiker nur den Modedesigner bewundert, und nicht den Schneider.
Am Mittwoch hat nur der Graphiker den Modedesigner bewundert, und nicht der Schneider.

Am Donnerstag hat der Teilhaber den Boten geschickt, und nicht den Helfer.
Am Donnerstag hat der Teilhaber den Boten geschickt, und nicht der Helfer.
Am Donnerstag hat der Teilhaber nur den Boten geschickt, und nicht den Helfer.
Am Donnerstag hat nur der Teilhaber den Boten geschickt, und nicht der Helfer.

Am Montag hat der Cowboy den Indianer bemerkt, und nicht den Häuptling.
Am Montag hat der Cowboy den Indianer bemerkt, und nicht der Häuptling.
Am Montag hat der Cowboy nur den Indianer bemerkt, und nicht den Häuptling.
Am Montag hat nur der Cowboy den Indianer bemerkt, und nicht der Häuptling.

Am Freitag hat der Mafioso den Leibwächter erschossen, und nicht den Killer.
Am Freitag hat der Mafioso den Leibwächter erschossen, und nicht der Killer.
Am Freitag hat der Mafioso nur den Leibwächter erschossen, und nicht den Killer.
Am Freitag hat nur der Mafioso den Leibwächter erschossen, und nicht der Killer.

Am Dienstag hat der Teufel den Sünder gequält, und nicht den Engel.
Am Dienstag hat der Teufel den Sünder gequält, und nicht der Engel.
Am Dienstag hat der Teufel nur den Sünder gequält, und nicht den Engel.
Am Dienstag hat nur der Teufel den Sünder gequält, und nicht der Engel.

Am Mittwoch hat der Hausherr den Burschen entlassen, und nicht den Verwalter.
Am Mittwoch hat der Hausherr den Burschen entlassen, und nicht der Verwalter.
Am Mittwoch hat der Hausherr nur den Burschen entlassen, und nicht den Verwalter.
Am Mittwoch hat nur der Hausherr den Burschen entlassen, und nicht der Verwalter.

Am Donnerstag hat der Bergsteiger den Führer benötigt, und nicht den Träger.
Am Donnerstag hat der Bergsteiger den Führer benötigt, und nicht der Träger.
Am Donnerstag hat der Bergsteiger nur den Führer benötigt, und nicht den Träger.
Am Donnerstag hat nur der Bergsteiger den Führer benötigt, und nicht der Träger.

Am Freitag hat der Diplomand den Betreuer blamiert, und nicht den Dekan.
Am Freitag hat der Diplomand den Betreuer blamiert, und nicht der Dekan.
Am Freitag hat der Diplomand nur den Betreuer blamiert, und nicht den Dekan.
Am Freitag hat nur der Diplomand den Betreuer blamiert, und nicht der Dekan.

Am Montag hat der Kassierer den Vertreter gemieden, und nicht den Käufer.
Am Montag hat der Kassierer den Vertreter gemieden, und nicht der Käufer.
Am Montag hat der Kassierer nur den Vertreter gemieden, und nicht den Käufer.

Am Montag hat nur der Kassierer den Vertreter gemieden, und nicht der Käufer.

Am Dienstag hat der Verbrecher den Reichen bestohlen, und nicht den Bettler.
Am Dienstag hat der Verbrecher den Reichen bestohlen, und nicht der Bettler.
Am Dienstag hat der Verbrecher nur den Reichen bestohlen, und nicht den Bettler.
Am Dienstag hat nur der Verbrecher den Reichen bestohlen, und nicht der Bettler.

Am Mittwoch hat der Dachdecker den Bauherrn kontaktiert, und nicht den Sekretär.
Am Mittwoch hat der Dachdecker den Bauherrn kontaktiert, und nicht der Sekretär.
Am Mittwoch hat der Dachdecker nur den Bauherrn kontaktiert, und nicht den Sekretär.
Am Mittwoch hat nur der Dachdecker den Bauherrn kontaktiert, und nicht der Sekretär.

Am Donnerstag hat der Chirurg den Internisten beeinflusst, und nicht den Psychiater.
Am Donnerstag hat der Chirurg den Internisten beeinflusst, und nicht der Psychiater.
Am Donnerstag hat der Chirurg nur den Internisten beeinflusst, und nicht den Psychiater.
Am Donnerstag hat nur der Chirurg den Internisten beeinflusst, und nicht der Psychiater.

Am Freitag hat der Referent den Dozenten gelangweilt, und nicht den Prüfer.
Am Freitag hat der Referent den Dozenten gelangweilt, und nicht der Prüfer.
Am Freitag hat der Referent nur den Dozenten gelangweilt, und nicht den Prüfer.
Am Freitag hat nur der Referent den Dozenten gelangweilt, und nicht der Prüfer.

Am Montag hat der Geograph den Vermesser gekannt, und nicht den Zeichner.
Am Montag hat der Geograph den Vermesser gekannt, und nicht der Zeichner.
Am Montag hat der Geograph nur den Vermesser gekannt, und nicht den Zeichner.
Am Montag hat nur der Geograph den Vermesser gekannt, und nicht der Zeichner.

Am Dienstag hat der Friseur den Cellisten gekämmt, und nicht den Bläser.
Am Dienstag hat der Friseur den Cellisten gekämmt, und nicht der Bläser.
Am Dienstag hat der Friseur nur den Cellisten gekämmt, und nicht den Bläser.
Am Dienstag hat nur der Friseur den Cellisten gekämmt, und nicht der Bläser.

Am Mittwoch hat der Demonstrant den Polizisten beunruhigt, und nicht den Bürger.
Am Mittwoch hat der Demonstrant den Polizisten beunruhigt, und nicht der Bürger.
Am Mittwoch hat der Demonstrant nur den Polizisten beunruhigt, und nicht den Bürger.
Am Mittwoch hat nur der Demonstrant den Polizisten beunruhigt, und nicht der Bürger.

Am Donnerstag hat der Kopilot den Fluggast verscheucht, und nicht den Steward.
Am Donnerstag hat der Kopilot den Fluggast verscheucht, und nicht der Steward.
Am Donnerstag hat der Kopilot den Fluggast verscheucht, und nicht den Steward.
Am Donnerstag hat der Kopilot den Fluggast verscheucht, und nicht der Steward.

Am Freitag hat der Dramaturg den Visagisten gelobt, und nicht den Akteur.
Am Freitag hat der Dramaturg den Visagisten gelobt, und nicht der Akteur.
Am Freitag hat der Dramaturg nur den Visagisten gelobt, und nicht den Akteur.
Am Freitag hat nur der Dramaturg den Visagisten gelobt, und nicht der Akteur.

Am Montag hat der Camper den Jäger gehört, und nicht den Fischer.
Am Montag hat der Camper den Jäger gehört, und nicht der Fischer.
Am Montag hat der Camper nur den Jäger gehört, und nicht den Fischer.
Am Montag hat nur der Camper den Jäger gehört, und nicht der Fischer.

Am Dienstag hat der Gesandte den Kommandanten belauscht, und nicht den Leutnant.
Am Dienstag hat der Gesandte den Kommandanten belauscht, und nicht der Leutnant.
Am Dienstag hat der Gesandte nur den Kommandanten belauscht, und nicht den Leutnant.
Am Dienstag hat nur der Gesandte den Kommandanten belauscht, und nicht der Leutnant.

Am Mittwoch hat der Geselle den Lackierer betrogen, und nicht den Schweißer.
Am Mittwoch hat der Geselle den Lackierer betrogen, und nicht der Schweißer.

Am Mittwoch hat der Geselle nur den Lackierer betrogen, und nicht den Schweißer.
Am Mittwoch hat nur der Geselle den Lackierer betrogen, und nicht der Schweißer.

Am Donnerstag hat der Bäcker den Fleischer gemocht, und nicht den Koch.
Am Donnerstag hat der Bäcker den Fleischer gemocht, und nicht der Koch.
Am Donnerstag hat der Bäcker nur den Fleischer gemocht, und nicht den Koch.
Am Donnerstag hat nur der Bäcker den Fleischer gemocht, und nicht der Koch.

Am Freitag hat der Ansager den Kampfrichter verachtet, und nicht den Boxer.
Am Freitag hat der Ansager den Kampfrichter verachtet, und nicht der Boxer.
Am Freitag hat der Ansager nur den Kampfrichter verachtet, und nicht den Boxer.
Am Freitag hat nur der Ansager den Kampfrichter verachtet, und nicht der Boxer.

Am Montag hat der Inhaber den Bewerber beschäftigt, und nicht den Fachmann.
Am Montag hat der Inhaber den Bewerber beschäftigt, und nicht der Fachmann.
Am Montag hat der Inhaber nur den Bewerber beschäftigt, und nicht den Fachmann.
Am Montag hat nur der Inhaber den Bewerber beschäftigt, und nicht der Fachmann.

Am Dienstag hat der Chronist den Journalisten beschuldigt, und nicht den Redakteur.
Am Dienstag hat der Chronist den Journalisten beschuldigt, und nicht der Redakteur.
Am Dienstag hat der Chronist nur den Journalisten beschuldigt, und nicht den Redakteur.
Am Dienstag hat nur der Chronist den Journalisten beschuldigt, und nicht der Redakteur.

Am Mittwoch hat der Anwohner den Mörder beschrieben, und nicht den Gärtner.
Am Mittwoch hat der Anwohner den Mörder beschrieben, und nicht der Gärtner.
Am Mittwoch hat der Anwohner nur den Mörder beschrieben, und nicht den Gärtner.
Am Mittwoch hat nur der Anwohner den Mörder beschrieben, und nicht der Gärtner.

Am Donnerstag hat der Biertrinker den Prediger belästigt, und nicht den Spieler.
Am Donnerstag hat der Biertrinker den Prediger belästigt, und nicht der Spieler.
Am Donnerstag hat der Biertrinker nur den Prediger belästigt, und nicht den Spieler.
Am Donnerstag hat nur der Biertrinker den Prediger belästigt, und nicht der Spieler.

Am Freitag hat der Turner den Ringer gestört, und nicht den Fechter.
Am Freitag hat der Turner den Ringer gestört, und nicht der Fechter.
Am Freitag hat der Turner nur den Ringer gestört, und nicht den Fechter.
Am Freitag hat nur der Turner den Ringer gestört, und nicht der Fechter.

Am Montag hat der Kundschafter den Botschafter gemustert, und nicht den Konsul.
Am Montag hat der Kundschafter den Botschafter gemustert, und nicht der Konsul.
Am Montag hat der Kundschafter nur den Botschafter gemustert, und nicht den Konsul.
Am Montag hat nur der Kundschafter den Botschafter gemustert, und nicht der Konsul.

Am Dienstag hat der Notar den Diplomaten begleitet, und nicht den Staatsmann.
Am Dienstag hat der Notar den Diplomaten begleitet, und nicht der Staatsmann.
Am Dienstag hat der Notar nur den Diplomaten begleitet, und nicht den Staatsmann.
Am Dienstag hat nur der Notar den Diplomaten begleitet, und nicht der Staatsmann.

Am Mittwoch hat der Gastgeber den Buddhisten gekränkt, und nicht den Moslem.
Am Mittwoch hat der Gastgeber den Buddhisten gekränkt, und nicht der Moslem.
Am Mittwoch hat der Gastgeber nur den Buddhisten gekränkt, und nicht den Moslem.
Am Mittwoch hat nur der Gastgeber den Buddhisten gekränkt, und nicht der Moslem.

Am Donnerstag hat der Snowboarder den Skifahrer belehrt, und nicht den Rodler.
Am Donnerstag hat der Snowboarder den Skifahrer belehrt, und nicht der Rodler.
Am Donnerstag hat der Snowboarder nur den Skifahrer belehrt, und nicht den Rodler.
Am Donnerstag hat nur der Snowboarder den Skifahrer belehrt, und nicht der Rodler.

Am Freitag hat der Spion den Helden gejagt, und nicht den Gangster.

Am Freitag hat der Spion den Helden gejagt, und nicht der Gangster.
Am Freitag hat der Spion nur den Helden gejagt, und nicht den Gangster.
Am Freitag hat nur der Spion den Helden gejagt, und nicht der Gangster.

Am Montag hat der Kollege den Erben getröstet, und nicht den Witwer.
Am Montag hat der Kollege den Erben getröstet, und nicht der Witwer.
Am Montag hat der Kollege nur den Erben getröstet, und nicht den Witwer.
Am Montag hat nur der Kollege den Erben getröstet, und nicht der Witwer.

Am Dienstag hat der Banker den Politiker gefahren, und nicht den Kantor.
Am Dienstag hat der Banker den Politiker gefahren, und nicht der Kantor.
Am Dienstag hat der Banker nur den Politiker gefahren, und nicht den Kantor.
Am Dienstag hat nur der Banker den Politiker gefahren, und nicht der Kantor.

Am Mittwoch hat der Kamelreiter den Beduinen getroffen, und nicht den Scheich.
Am Mittwoch hat der Kamelreiter den Beduinen getroffen, und nicht der Scheich.
Am Mittwoch hat der Kamelreiter nur den Beduinen getroffen, und nicht den Scheich.
Am Mittwoch hat nur der Kamelreiter den Beduinen getroffen, und nicht der Scheich.

Am Donnerstag hat der Genosse den Bürokraten vertröstet, und nicht den Spitzel.
Am Donnerstag hat der Genosse den Bürokraten vertröstet, und nicht der Spitzel.
Am Donnerstag hat der Genosse nur den Bürokraten vertröstet, und nicht den Spitzel.
Am Donnerstag hat nur der Genosse den Bürokraten vertröstet, und nicht der Spitzel.

Am Freitag hat der Heuchler den Verbündeten getäuscht, und nicht den Feind.
Am Freitag hat der Heuchler den Verbündeten getäuscht, und nicht der Feind.
Am Freitag hat der Heuchler nur den Verbündeten getäuscht, und nicht den Feind.
Am Freitag hat nur der Heuchler den Verbündeten getäuscht, und nicht der Feind.

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