The time course of adverbial order processing

Psycholinguistic studies on incrementality in adjunct processing

Dissertation

zur

Erlangung des akademischen Grades

Doktor der Philosophie in der Philosophischen Fakultät

der Eberhard Karls Universität Tübingen

vorgelegt von

Larissa Specht

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Herzberg am Harz

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I believe that the road to hell is paved with adverbs[...]

(Stephen King[1])

[1] *King, Stephen. 2000. On Writing: A memoir of the craft. Simon and Schuster*

Frankly personally

Writing a dissertation is hard - spending almost half of this time in a global state of emergency is even more challenging. I am grateful that I have been enjoying the support of many people - some of them stuck by my side even in the most difficult of times.

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Table of Contents

List of Abbreviations

ACC - accusative

ART - article

ASP - aspect

AUX - auxiliary

CLMM - cumulative link mixed model

DAT - dative

delim - delimitator

epi - epistemic adverbial

evi - evidential adverbial

F - focus

LMEM - linear mixed effects model

NOM - nominative

loc.ext - external locative

loc.int - internal locative

PRT - particle

QUD - question under discussion

SAdv - sentence adverbial

SG - singular

temp - temporal adverbial

TopP - topic phrase

WH.INDEF - Question indefinites

List of Tables

List of Figures

1 Introduction

This dissertation has the aim to gain a better understanding of the time course of adverbial order processing. The global question that guided the experimental work conducted for this dissertation is:

• What determines the time course of adverbial order processing?

Adverbials, and in particular word order processing of adverbials, are highly understudied topics in psycholinguistic research. Psycholinguistic theory building has primarily focused on the processing of canonical and non-canonical complement order. For languages with a comparably flexible word order such as German, it has been shown that the processing of a non-canonical complement order leads to higher processing costs (Rösler, Pechmann, Streb, Röder, & Hennighausen, 1998; Bader & Meng, 1999; Bornkessel, Schlesewsky, & Friederici, 2002). Yet, it is hardly researched whether processing of adverbial linearizations, and deviations from the canonical adverbial order taxes the processing system in a similar way as it does for complements.

From a theoretical perspective, it is well-described that adverbial ordering follows constraints and that adverbials cannot appear in a random order. Accounts concerned with adverbial ordering differ primarily in what they consider the source of adverbial positioning. It has been proposed that adverbial order is purely determined by syntax (e.g., Cinque, 1993), mainly semantic in nature (e.g., Haider, 2000; Ernst, 2009), or an interplay of semantics and syntax (e.g., Frey & Pittner, 1998b; Frey, 2003). In this dissertation, I will follow the latter account and assume that adverbials are semantically classified and that each semantic class occupies a syntactic base position. Furthermore, I follow the authors of the base position

account and assume that adverbials can move out of their base positions, just like arguments. Proponents of the base position account successfully applied a battery of base position tests, originally designed for arguments, on adverbials and were able to show that adverbials reveal similar effects as arguments (e.g., Frey & Pittner, 1998b; Frey, 2003). Even though the three mentioned account families for adverbial order make very similar predictions regarding order preferences, I follow the base position account, as it is empirically well-attested and allows precise predictions for adverbial linearization. Furthermore, I assume that syntax is involved in adverbial ordering and that adverbials enter into c-command relations with the domain they modify, which is captured by the compositional working hypothesis developed by the project B8 of the Collaborative Research Center 833 given in (1).

(1) **Compositional working hypothesis:** The base (preferred) position of an adverbial minimally c-commands the domain it modifies.

I assume that syntax determines the adverbial position and that adverbials can be subject to syntactic movement operations. This raises the questions how adverbial movement is processed during language understanding.

For complements, it has been shown that their canonical order is processed faster and deviations from the base order lead to processing difficulties (e.g., Rösler et al., 1998; Bader & Meng, 1999; Bornkessel et al., 2002). An attempt to explain the observed attested costs for deviations from the canonical order refers to the assumption of traces that moved constituents leave behind at their place of origin. Frazier and Flores d'Arcais (1989) postulated the *Active Filler Strategy*, according to which the origin of a dislocated phrase has to be identified as fast as possible. It has been argued that unintegrated material must be held active in working memory until it can be interpreted and henceforth consumes processing resources (e.g., Gibson, 2000; Fiebach, Schlesewsky, & Friederici, 2001).

The case for adverbials is somewhat more complicated than for arguments for several reasons. First, adverbial order is not determined by the verb's thematic grid. Second, by assuming that different semantic adverbial types occupy distinct base positions in the middlefield, a semantic interpretation of the adverbial is required

in order to identify its base position. This process is exacerbated by the fact that several adverbials are semantically ambiguous. Consider Example (2) in which a locative adverbial fulfills three different functions: the first occurrence is a locative frame that restricts the validity of the proposition to hold true only in the location given, the second occurrence provides information about the location of the entire event and the third occurrence only locates parts of the branding event. All of the usages are assumed to occupy distinct base positions (Maienborn, 2001).

(2) a. [In den Anden]$_1$ werden Schafe vom Pfarrer [auf dem Marktplatz]$_2$
In the Andes are sheep from.the priest on the marketplace
[an den Ohren]$_3$ gebrandmarkt.
at the ears branded

(Maienborn, 2001, 199)

Furthermore, adverbials, like complements, have been shown to interact with information-structural parameters, which can affect order preferences and override syntactic preferences (e.g., Frey, 2004; Störzer, 2017; Störzer & Stolterfoht, 2018). Adverbials are an interface phenomenon in every sense, and all these intricacies must be considered when proposing a model about adverbial order processing. The global question that I am approaching is the following: What modulates the time course of adverbial order processing and how do all these types of linguistic information, i.e., semantics, syntax, and information structure interact while understanding a sentence that contains multiple adverbials.

1.1 Outline of the dissertation

This dissertation builds upon previous research conducted to gain insight into the processing of certain adverbial types. However, the pattern of results concerning the time course was rather heterogeneous. Order variations between adjacent frame and sentence adverbials seem to be processed highly incrementally, i.e, there is an immediate increase in reading times when the adverbials are not presented in their assumed base order (Störzer & Stolterfoht, 2013; Störzer, 2017). A similar experiment with manner adverbials that moved out of their assumed base position across the direct object did not cause effects in reading times, even though

the assumed base order was judged as more acceptable (Gauza, 2018). Given this mixed pattern of results, the goal of my experimental studies was to find the cause for these discrepancies.

The theoretical part of this dissertation is structured as follows: In Chapter 2, I will first introduce the concept of scrambling and word order variations in complements (in German). Furthermore, I will give an overview of the accounts for adverbial positioning mentioned above.

I will focus on a selection of five adverbial types that are investigated throughout this dissertation, namely: domain adverbials and sentence adverbials, on the one hand, and temporal, external locatives, manner adverbials, and internal locatives, on the other hand. I will define these adverbials in more detail in Chapter 3, which is dedicated to the semantics of adverbials. I will argue for a dichotomy of semantic adverbial categories, namely *propositional adverbials*, which subsume sentence adverbials and domain adverbials, and *event-modifying adverbials*, which comprise temporal, external locatives, manner adverbials, and internal locatives. I will motivate this distinction based on semantic features. Additionally, I will also discuss discourse structuring properties of domain adverbials and related notions of information structure since they are relevant for the processing of adverbials as will be shown in the light of Chapter 6. By the end of Chapter 3, I will bring together relevant aspects of the syntactic discussion in Chapter 2, and semantic aspects of Chapter 3. I will close Chapter 3 by arguing for specific base orders for the adverbials I investigated in the experimental part of this dissertation.

Chapter 4 is dedicated to psycholinguistic processing. I will discuss studies concerned with word order processing and parsing principles suggested by the influential *Garden-Path Model* of sentence processing (Frazier, 1987). This theory provides the foundation for *Construal* (Frazier & Clifton, 1995), which, so far, is the only processing theory that attempts to account for adjunct processing that I am aware of. Furthermore, I will evaluate previous studies on adverbial order processing. Nonetheless, I will conclude that the syntactic distinction between adjuncts and arguments is not sufficient to capture the mixed pattern of results attested for

adverbial order processing. Finally, I will discuss psycholinguistic studies focusing on semantic processing and processing of related semantic phenomena, which I argue to dovetail with adverbial processing.

To approach the global question, namely, what determines the time course of adverbial order processing, I derive three sub-questions that build upon the work mentioned above and got refined during the research conducted for this thesis. Each of the three experimental chapters is dedicated to one sub-question.

The first sub-question was derived out of an explanation put forward by Stolterfoht, Gauza, and Störzer (2019). They attempted to explain the heterogeneous pattern of results mentioned above by referring to the structural differences between the adverbials in question with recourse to their position at LF and their structural relation to their modified domain. Sentence and frame adverbials are assumed to be located outside of the LF domain they modify (the proposition mapped onto TP), and they modify the proposition as a whole without requiring access to a specific lexical element within the proposition. Manner adverbials, on the other hand, are located within the domain they modify (the event mapped onto VP) and modify the event. **Sub-question 1** thus is summarized as:

• Do the positions of the adverbials at LF and their relation to the modified domain determine the time course of adverbial order processing?

This question guided the experimental work conducted and reported in Chapter 5, which contains the article Specht and Stolterfoht (2022). For the experimental studies, we created materials with different types of adverbials that resembled the configuration of the adverbials used in the mentioned previous studies. We conducted a self-paced reading as well as an acceptability judgment experiment.

Chapter 6, consisting of a previous version of the article which was later published as Specht and Stolterfoht (2023), is dedicated to **sub-question 2**:

• How does information structure affect adverbial order preferences and the time course of processing?

It has been extensively shown that information structure affects the word order in complements (in German) and the time course of processing. However, most

studies reach the conclusion that information-structural processing does not interact with initial syntactic processing (e.g., Bader & Meng, 1999; Stolterfoht, 2005; Bornkessel & Schlesewsky, 2006). For adverbials, Störzer and Stolterfoht (2018) showed that the information-structural status of frame adverbial affects order preferences which is only visible in acceptability ratings but not reading times. In Chapter 7, the effect of the information-structural status of another type of adverbials, namely domain adverbials, is investigated. An additional aim of this experimental series was to eliminate some of the confounding factors of the experimental studies in Störzer and Stolterfoht (2018).

Chapter 7 has the purpose of bringing the findings of the previous chapters together and test these findings in an experiment. The findings of previous research and the experimental studies in Chapter 5 and Chapter 6 point towards the direction that the semantic adverbial category modulates incremental processing. Adverbial category is defined as a family of different adverbials which modify the same semantic entity (proposition or event) (cf. Table 1.1 and Chapter 3, respectively). **Sub-question 3** was answered in Chapter 7:

• Is the time course of adverbial order processing modulated by the adverbial category?

Finally, Chapter 8 summarizes the findings and provides a table with the experimental results collected throughout this thesis. Furthermore, I will evaluate the results in relation to one another and suggest a model of adverbial order processing based on the obtained results.

1.2 Experimental Methods

This thesis aims at broadening the understanding about the time course of adverbial order processing. More precisely, whether adverbial processing is affected by the syntactic position and whether adverbials are processed highly incrementally as it has been attested for complements (e.g., Rösler et al., 1998) or whether there is a delay in processing. The work conducted here builds upon previous work for adverbial order processing reported in Gauza (2018), Störzer (2017), and Stolterfoht

et al. (2019). These studies compared online and offline adverbial order processing and often found discrepancies between the online and offline studies. Thus, I will use online and offline methods to investigate adverbial order processing for two reasons. First, to keep the work maximally comparable to the previous work while investigating additional adverbial types. Second, it has been argued and shown for complements that their processing is guided by syntactic information, but other types of information such as information structure only affect later processing stages (e.g., Frazier, 1987; Bader & Meng, 1999; Bornkessel et al., 2002; Stolterfoht, 2005) and are thus only visible in offline studies. In order to understand processing fully, immediate processing but also post-interpretational processes have to be captured. In the following, I will describe the methods used in this dissertation.

1.2.1 Online Method: Self-paced reading

Self-paced reading has proven to be a useful behavioral method to get insight into real-time language processing. As a so-called online method, it has the aim to measure processing time without requiring the participant to conduct an explicit task such as evaluating a structure. Self-paced reading thus tries to capture processing time as direct as possible. I used the self-paced reading with moving window paradigm. This paradigm is a method that attempts to mimic the natural fixation and saccades of the pupil while reading text under natural circumstances (e.g., Rayner, 1998). It is, however, easier to handle and less cost-intensive than eye-tracking, as self-paced reading can be programmed and conducted on any computer. For self-paced reading experiments, an experimental item is divided into several segments. The segments are shown in subsequent order. The reading time, i.e., the time a participant spends on one segment, is measured as the independent variable of the experiment. Before the sentence unfolds, the entire item is presented on the screen but all characters are masked by dashes. By pressing a button, the participant unmasks the first segment from dashes into letters. An additional button press after having read the segment will re-mask the read segment and uncover the subsequent segment. The masking of the segments imitates the fovea, as the eye's

perception span is limited and information that is too far away from the fovea can not be processed. Given the comparably unnatural procedure that requires button presses, reading is slower in self-paced reading than in natural reading. Nevertheless, as the absolute reading time is not of interest but the relative differences between structures, this method is a valid way to investigate processing time. For an overview, consult Jegerski (2014).

In the experiments, reading times are measured on a region of interest. In this case it always comprised two adjacent adverbials (in the assumed base and in a reverse order), and on the subsequent region, the so-called spill-over region. After 50% of the sentences, a yes-no-comprehension question was presented, inquiring about the previous sentence. This was to ensure that participants attentively read the sentence and were distracted from the actual purpose of the experiments. Comprehension questions were designed to ask about information provided by any constituent of the sentence in order to prevent participants from developing a strategy to focus only on relevant segments of the sentence.

1.2.2 Offline Method: Acceptability judgment

Offline methods have the purpose to evaluate an already processed structure. This type of behavioral methods aims at evaluating an interpretation. I obtained perceived acceptability of the structures in question. Participants are presented with one experimental item. Their task is to judge the items' acceptability on a so-called Likert scale, in this case from 5 to 1, where 5 is highly acceptable and 1 completely unacceptable. The endpoints of the scale are labeled. In order to measure performance, participants are instructed to follow their linguistic intuition and not base their judgments on 'school grammar'. Häussler and Juzek (2017, 13) describe *acceptability* as reflecting language performance while grammaticality reflects competence. Thus acceptability judgments are a product of grammaticality, performance factors, and general decision making. Competence is not measurable in experiments.

1.3 Overview: Terminology, classification, and adverbials

In this dissertation, I will discuss several adverbial types from semantic and syntactic perspectives. I will discuss the syntactic side and classification in more detail in Chapter 2, and the semantic categorization and the adverbials in Chapter 3. Table 1.1 provides an overview of my terminology and exemplifies the adverbials under investigation. In the first column, I introduce the broadest dichotomy. It is based on semantic criteria and henceforth referred to as **semantic categories**. Column 2 represents the division based on syntactic base positions, referred to as **adjunct class**. The individual adverbials will be named **adverbial type**. Finally, I provide an example for each adverbial type I will investigate throughout this dissertation. The respective adverbial is underlined. Nevertheless, this table offers a first overview and a glossary. The divisions and the adverbials will be introduced and discussed in depth in the following chapters.

Semantic category	**Adjunct class (base position account)**	**Adverbial type**	**Example**
propositional adverbial	sentence adjunct	sentence adverbial	Sarah ist wahrscheinlich ein Organisitationstalent. 'Sarah is probably a talented organizer.'
	frame adjunct	frame adverbial	Im Fitnessstudio ist Edith unschlagbar. 'In the gym, Edith is unbeatable.'
		domain adverbial	Beruflich ist Annette erfolgreich. 'Professionally, Annette is successful.'
event-modifying adverbial	event-external adjunct	temporal adverbial	Hanna ist am Abend beim Handballtraining. 'In the evening, Hanna is at handball training.'
		external locative	Jamel macht Wahlkampf auf der Straße. 'Jamel is campaigning on the street.'
	event-internal	manner adverbial	Felix beschwert sich lauthals über den Amtsschimmel. 'Felix complains loudly about bureaucracy .'
	process-related	internal locative	Álvaro brät Tofu in der Pfanne an. 'Álvaro is frying tofu in the pan.'

Table 1.1: Overview adverbial classification and examples

2 | Adverbial order accounts and adverbial scrambling

This chapter aims to provide a brief overview of word order variations in German in general and on adverbial order variations in particular. I will introduce basic notions of word order variation with a primary focus on a phenomenon known as *scrambling*. I will discuss how the framework of Generative Grammar accounts for movement operations. Scrambling is limited to word order variations of DP-arguments and selected modifiers (Haider & Rosengren, 2003). The research on the processing of word order variation in German that I will discuss in Chapter 4 has mainly investigated the processing of complement order variation. For this reason, I will first discuss how theories account for complement order variations in German and introduce Haider and Rosengren's (2003) account for scrambling. In Section 2.2, I will present theories that account for the freedom of word order observed in adverbials, focusing mainly on the accounts proposed by Frey and Pittner (1998b) and Frey (2003) who assume that adverbials like complements have base positions.

Before predicting the base orders of the adverbials under investigation, I will zoom in on semantic aspects of adverbials. The predicted base linearizations of the adverbials under investigation will be discussed in Chapter 3.2 where I bring relevant syntactic and semantic characteristics together. I decided to argue for specific adverbial serializations only after I discussed both the syntactic accounts for adverbial order and semantic analyses of the adverbials under investigation, as insights from syntax and semantics are crucial to evaluate adverbial order. Again,

this shows the fundamental differences between free, i.e., non-selected adverbials and arguments. As for the latter, semantics play a minor role in a placement which is mainly determined by the verb's thematic grid.

2.1 Word order variation in German: Movement and scrambling

Psycholinguistic theories of sentence processing are still largely influenced by the Government and Binding Theory (GB) (e.g., Chomsky, 1993). For that reason, I will introduce concepts and notions from the GB frame work and will mainly ignore more recent stages proposed within the generative frame work such as the Minimalist Program (e.g., Chomsky, 1995, 2014). Within the framework of Generative Grammar, it is standardly assumed that sentences have a hierarchy of phrases, and that these phrases enter into certain grammatical relations (Chomsky, 1993). Furthermore, it is assumed that transformational rules form grammatical constructions based on abstract underlying forms. Moreover, it is assumed that distinct subcomponents interact with different types of linguistic representations: the Phonological Form (PF) and the Logical Form (LF). The former serves as input for the sensomotoric system and the latter as input to the conceptional-intentional system. It is assumed that sentence structures are derived from an underlying structure (*Deep-structure* or *D-Structure*) fed by input from the lexicon in the form of lexical entries. Lexical entries contain information about word category, argument structure information as well as semantic and phonological information. Phrase structure rules generate deep structures that represent hierarchies and relations among phrases. The D-structure is mapped by the operation *move* α onto the *Surface-Structure (S-Structure)*. This operation reorders constituents. Instances of this reordering are *topicalization* and *wh-movement*. According to the Binding Theory (Chomsky, 1993), moved elements leave traces, phonologically empty copies, at their places of origin. Traces are not visible at PF. However, they are interpretable at LF. It is assumed that the moved constituent (the antecedent) enters into a chain formation

with its trace, the antecedent has to c-command (3) its trace in order to bind it and to be interpreted (Chomsky, 1993).

(3) *c-command*
α c-commands β if β does not dominate α and every γ that dominates α dominates β.

Within the GB framework as well as in the more recent *Minimalist Program* (Chomsky, 1995), Chomsky stated that movement has to be triggered for example by case and agreement features. From the perspective of Generative Grammar, word order variations such as scrambling provide a problem due to their optionality. This will be discussed in the following section.

As described above, the syntactic status of scrambling is controversial. In Generative Grammar, scrambling was first described by Ross (1967) as a clause-bound stylistic reordering rule that accounts for the freedom of constituent order in certain languages. As a consequence Ross, like Chomsky (1995), argues that scrambling is not part of core syntax but merely a stylistic rule or 'bare output condition'. This assumption is one of the reasons why scrambling is still controversial within GB as well as in the Minimalist framework, since movement of a constituent has to be triggered. These triggers, however, are not present in scrambled formations.

Scrambling in German is limited to the so-called middlefield, which is the area between the head of the C domain that hosts either complementizers or the finite verb and the position that hosts the sentence-final verb (the head of the VP). Different approaches have been suggested for scrambling formations. *Base generation accounts* (e.g., Fanselow, 2001) assume that the order variation applies at D-Structure and constituents can be base-generated there in an arbitrary order, i.e., there is no underlying canonical word order. *Movement accounts* (e.g., Haider, 1993; Haider & Rosengren, 2003), on the other hand, propose that there is a base order of constituents at D-Structure, and scrambling is derived from the base order by overt movement of constituents and is thus visible at S-Structure. In the following, I will introduce an account of scrambling of the latter kind proposed by Haider and Rosengren (2003), who argue that scrambling is part of the grammati-

cal system. After introducing the account, I will discuss several tests that have been proposed to identify the base order of complements. Later, I will apply these tests to adverbials. The attested base linearizations for adverbials will then be tested and investigated in the experimental studies reported throughout this dissertation.

According to Haider and Rosengren (2003) scrambling is an optional reordering of DPs derived from an underlying base order. The base order is considered the least marked and neutral order. Any other linearization of constituents is derived by movement from the base order. The base order is semantically determined by the thematic grid of the verb, which tightly maps onto the syntactic structure. Example (4a) gives the base order of the DP arguments, whereas in (4b), the object DP has moved across the subject DP, leaving a trace at its place of origin.

(4) a. Eva sagt, dass der Hans den Peter küsst
Eva says that ART.NOM $\text{Hans}_{\text{Subject}}$ ART.ACC $\text{Peter}_{\text{Object}}$ kiss.3rd.SG

b. Eva sagt, dass den Hans_{i} der Peter t_{i} küsst
Eva says that ART.ACC $\text{Peter}_{\text{Object}}$ ART.NOM $\text{Hans}_{\text{Subject}}$ kiss.3rd.SG
'Eva says that Hans kisses Peter.'

The authors analyze scrambling as an instance of A-movement, where the moved element enters into a chain formation between the trace and the antecedent. Both the antecedent and the gap have to be in the identification domain of the verbal head[1]. They argue that movement operations are either licensed structurally like in V2 movement in German or wh-movement. Scrambling, however, is licensed when syntax does not forbid it, i.e,. when the foot and head of the chain are within the extended identification domain of the verbal head. Haider and Rosengren (2003, 206) argue that scrambling is systematic exploitation of the syntax interfaces i.e., can reveal information-structural or pragmatic effects. They defend the claim that scrambling is syntactically not triggered by arguing that any interpretation that is available in the base order has to be available in the scrambled order as well.

[1] This implies that scrambling is only possible in OV languages where the head licenses to the left. In VO languages, where the licensing direction parameter is to the rights, not all positions are within the identification domain of the head.

2.1.1 Base position tests

Markedness of scrambled structures is thus only a pragmatic effect. Furthermore, scrambled structures can reveal effects at the syntax-semantic and syntax-pragmatic interfaces. Haider and Rosengren identify these interface effects as an *epiphenomenon* of scrambling and state that scrambling is optional in the syntax module, however, it is not necessarily optional in other modules (Haider & Rosengren, 2003, 241). Moreover, the differences at the aforementioned interfaces and new configurations of scrambled structures can be used as diagnostics to attest the base order over a derived order. In the following, I will introduce a selection of tests for base positions that were suggested for arguments that I will later apply to adverbials.

Focus projection test

The focus projection test makes use of the prosodic representation of derived word orders. *The Null Theory of Phrase Stress* (Cinque, 1993) states that focus projection from a non-verbal constituent is only possible if the constituent is the sister of the verbal head and is in the deepest embedded position. Following these assumption, the focus exponent can only project wide focus, i.e., has sentence focus if the constituent carrying the nuclear stress is in its base position. Compare Example (5), in (5a) the focus exponent can project because it is in its base position. In (5b), the nuclear stress is still carried by the object, however, it has moved out of its base position across the subject. Focus from the moved constituent cannot project and results in narrow focus. The object in (5c) has moved across the subject, which results in a structure where the stress-marked subject DP in its linear order is adjacent to the verbal complex. The requirement that the constituent carrying focal stress has to be the sister of the verbal head is not met, and the deepest embedded constituent is the empty trace in the object's base position. The focus accent of the subject below the direct object also results in narrow focus.

(5) a. Maria hat behauptet, dass [die Tante die NICHten begrüsst hat]$_F$.
Mary has claimed that the aunt the nieces welcomed has

b. Maria hat behauptet, dass [die TANte]$_F$ die Nichten begrüsst hat.
Mary has claimed that the aunt the nieces welcomed has

c. Maria hat behauptet, dass die Tante$_i$ [die NICHten]$_F$ t_i begrüsst haben.
Mary has claimed that the aunt the nieces welcomed have
'Mary has claimed that the aunt welcomed the nieces.'

(Stolterfoht & Bader, 2004, 261)

Sentences with wide focus serve as potential answers to a question such as *Was ist passiert?* ('What happened?') since the entire sentence can be interpreted as new information. Any deviation from the base order of the arguments with a stressed non-verbal constituent cannot project wide focus as the stress cannot fall on the deepest embedded constituent (Höhle, 1982). A wide focus question is not possible when sentence stress falls on a constituent other than the verb, thus only (5a) is a licit answer to the wide focus question.

Wh-indefinite test

Another test suggested by Frey and Pittner (1998b) is the wh-indefinite test. It follows from the observation that wh-indefinites (*W-Indefinita*) in German cannot move when they are interpreted existentially. Consider the following data in Example 6. Normally objects can move across the subject unless the object constituent is realized as wh-indefinite (*wen*) as in Example (6a) and (6b). The same holds for the wh-indefinite subject in (6c) and (6d). The fact that existentially interpreted wh-indefinites cannot scramble is observed by Frey and Pittner (1998b), yet it is not clear why this is the case. However, it serves as a diagnostic tool for base positions.

(6) a. weil ein Professor wen beleidigt hat.
because a professor$_{subject}$ WH.INDEF insulted has

b. * weil wen$_i$ ein Professor t_i beleidigt hat.
because WH.INDEF a professor insulted has
'because a professor has insulted someone'

c. weil wer einen Professor beleidigt hat.
because WH.INDEF$_{subject}$ a professor$_{object}$ insulted has

d. * weil einen Professor$_i$ wer t_i beleidigt hat.
because a professor WH.INDEF$_{subject}$ insulted has
'because someone has insulted a professor'

(adapted version of Frey & Pittner, 1998b, 7)

Complex fronting

The complex fronting test for base positions goes back to the fact that the German prefield, the position preceding the finite verb in V2, can host only a single constituent. This constituent can be of a complex structure such as the entire VP, as shown in Example (7). However, a complex phrase cannot be fronted if it contains an unbound trace as in (7b). This observation is caused by the fact that empty categories, according to the Binding Principle (Chomsky, 1993), have to be bound in S-Structure. This is not possible in (7b), where the trace, as part of the complex fronted VP, has moved to the prefield and is thus located higher than its antecedent.

(7) a. [Den Preis gegönnt]$_j$ hat dem Otto wohl jeder t_j.
ART.ACC award granted has ART.DAT Otto probably everyone

b. ?? [Dem Otto t_i gegönnt]$_j$ hat den Preis$_i$ wohl jeder t_j.
ART-DAT Otto granted has ART.ACC award probably everyone
'Probably everyone has granted Otto the award.'

(Frey & Pittner, 1998b, 7)

Principle C effects

Principle C of the Government and Binding program states:

(8) For an R-expression α the following conditions hold at S-Structure. α cannot be co-indexed with β iff

a. β c-commands γ or

b. β c-commands a trace of γ

where $\gamma = \alpha$ or γ contains α (Chomsky, 1993)

These conditions allow identifying of the origin of a moved constituent. A moved constituent thus may not originate from a position lower than the co-indexed R-expression. Compare Example (9), in Example (9a), the fronted complex NP origi-

nates higher than the co-indexed direct object NP *Peter*. The R-expression is thus not bound at S-Structure. In (9b), however, the complex fronted NP originates from a position lower than the co-indexed direct object *Peter* and is thus bound, which results in ungrammaticality due to a violation of Principle C. For the verb *vorziehen* ('to prefer'), the base order of arguments NOM > ACC > DAT can be attested.

(9) a. [Den Vater von Peter$_i$] hat sie t_i dem Peter$_i$ vorgezogen.
ART.ACC father of Peter has she ART.ACC Peter prefered
'She preferred Peter's father over Peter.'

b. * [Dem Vater von Peter$_i$] hat sie den Peter$_i$ t_i vorgezogen.
ART.DAT father of Peter has she ART.ACC Peter prefered
'She preferred Peter's father over Peter.'

(Frey & Pittner, 1998b, 6)

The presented diagnostics for the base order of arguments will be applied to adverbials in Section 3.2. These tests are a selection among other tests discussed in the literature, like the scope ambiguity tests or the theme-rheme tests (Lenerz, 1977), which I deliberately do not use as tools. The scope ambiguity test follows the assumption that in a sentence with two scope-taking quantifiers, movement of an existential quantifier across a universal quantifier leads to scope ambiguity. In my opinion, different readings of sentences with a scope ambiguity are not very pronounced. Moreover, the options of universally and existentially quantified adverbial expression are very limited, and they are not applicable across the board to adverbial types used in my studies. The tests reported in this chapter are more suitable for certain adverbial types than for others. The selection of tests was made to have one suitable test for each adverbial type. The VP-fronting test is particularly useful for adverbials closer to the VP, whereas the Principle C test is better suited for higher adverbials, e.g., to distinguish between frame adverbials and locative adverbials.

So far, in this section, I have described that German is a language with a relatively flexible word order and introduced the phenomenon of *scrambling*, as well as Haider and Rosengren's (2003) theory which accounts for this flexibility of constituent order in the German middlefield. The data I used to exemplify the

phenomenon were limited to argument order since the main body of research only focused on argument order. Only very few studies have been conducted in order to account for the processing of adverbial order variation. I will discuss these studies in Chapter 4.

While introducing Haider and Rosengren's (2003) scrambling account, I omitted one crucial piece of information, which I will discuss in more detail below: Haider and Rosengren (2003) explicitly understand their account to hold exclusively for constituents selected by the verb, i.e., complements and selected adjuncts. This is because base positions are defined by the ranking of the verb's complements. That is, they are selected via the verb's lexical entry. Non-selected constituents thus do not scramble. Most adverbials are not selected, and the adverbials under investigation in this dissertation are not selected by the verb. However, there has been a growing interest in research on adverbial positions and order effects within the last decades. At first glance, it seems that adverbials can appear at almost any position in the clause. Nonetheless, a closer look at adverbials shows that their distribution is restricted, and adverbial movement leads to interpretative effects such as information-structural effects, just like argument movement. In the following, I will discuss accounts for adverbial ordering in more detail.

2.2 Word order variations in adverbials

Argument order variation has intensively been studied in theoretical and experimental linguistic research. Adverbial order variations have long been neglected. However, the discussion became more vivid within the past two decades. The main question is whether adverbials are ordered and what determines their ordering. It can be distinguished between three main streams of thoughts: accounts that assume adverbials to be syntactically ordered (Cinque, 1999; Alexiadou, 2004), and accounts that assume that adverbial positions are largely determined by semantics, whereas syntax only plays a minor role in adverbial distribution (Haider, 2000; Ernst, 2007, 2020). In the following, I will briefly introduce the core ideas of these accounts. My main focus, however, will be the account of adverbial ordering,

mainly suggested by Frey and Pittner (1998b), Frey (2003), Maienborn (2001), and also Maienborn and Schäfer (2011), which is a mixed account according to which adverbial positions are semantically classified and syntactically ordered. In this dissertation, I follow this third account because it allows (i) to derive exact predictions for relative adverbial orderings and (ii) because experimental studies on adverbial order largely gave support for the base orders account and for the assumed movement operations i.e., adverbial scrambling. After introducing the accounts, I will derive predictions for orderings of the adverbials tested in the experimental studies in Chapters 5, 6, and 7. However, identifying the syntactic or semantic underpinnings of adverbial positioning is beyond the scope of this dissertation. On empirical grounds, it is barely possible to distinguish the underlying forces of adverbial positioning and order variations. The accounts predict mostly the same orderings and only assign different weights to the respective linguistic modules responsible for the positioning. Behavioral experiments, as I used them in the experimental part of this dissertation, are not fine-grained enough to disentangle the underlying nature of the phenomenon. This chapter has the purpose of giving an overview of the theoretical accounts of adverbial ordering. Furthermore it aims to point out the fundamental differences between adverbial and argument orderings.

2.2.1 Semantic accounts

As mentioned in Section 2.3, Haider and Rosengren's (2003) theory for scrambling does not account for non-selected adverbials. According to the authors, adverbials do not scramble. However, Haider (2000) and Haider (2012) propose a theory, which understands semantics to be the driving force behind adverbial ordering. Similar accounts have been proposed by e.g., Ernst, Fabricius-Hansen, Lang, and Maienborn (2000); Ernst (2004b, 2020). Within these accounts, syntax only plays a minor role in determining adverbial position (Haider, 2000, 2012).

While arguments are licensed by syntactic requirements (morphosyntactic identification) and semantic requirements (thematic licensing), adverbial positions are, according to Haider and Rosengren (2003) and Haider (2012), only semanti-

cally determined. Thus there is no fixed syntactically determined base order. The role of syntax is limited to determining potential adverbial slots within the clause structure. Hence adverbials can be base-generated everywhere where syntax does not forbid it. However, it is assumed that adverbials occupy semantically defined base positions. These positions and the relative linearization of adverbials are a function of semantically determined compositionality domains (Haider, 2012, 3). This information is encoded in the lexical entry of each adverbial. Example (10) shows Haider's understanding of adverbials ordering via subset relations of the modified semantic domain . Haider (2012) identifies three modification domains for adverbials, as given in (10a). Haider (2012) introduced the relative *interface criterion* (cf. 11) which predicts the linear order of the adverbials. The relative order between adverbials is then determined by mapping of the syntactic relations on semantic domains. Monotonic mapping states that once a higher type (more specified domain) is reached, lower type adverbials cannot be integrated anymore. Consequently, that means that *t*-adverbials (propositional modifiers) precede *e*-types (event modifiers) and *p*-types (process modifiers). Once a domain is entered, the previous domain cannot be re-opened, as re-opening a domain would result in crashing of the interpretation.

(10) a. **Interpretation**: proposition (T) $\subset$ event (E) $\subset$ process/state (P)

b. **Serialization**: [‘*t*-related’[‘*e*-related’[‘*p*-related’]]] (Haider, 2012, 29)

(11) **Interface Criterion**: Syntactic c-command relations are incrementally and monotonically mapped on semantic type domains (Haider, 2012, 29)

Consider (12)[2], the relative adverbial serialization fulfills the interface criterion in (12a), but (12b) is deviant according to Haider (2012) because the *e*-type adverbial *kürzlich* (‘recently’) precedes the *t*-type adverbial *vermutlich* (‘presumably’) and the interpretation crashes. The same holds for (12c), where the *p*-type adverbial *gewaltsam* (‘violently’) precedes the *e*-type adverbial, since the previous domain

[2]The grammaticality judgment reflects the author's judgments. As for (12b), I do not share Haider's (2012) judgment, as I judge it to be marked but acceptable.

cannot be re-opened again once the less specified domains are reached. Importantly, the deviance of the structure is due to semantic conditions and not grounded in a syntactic violation.

(12) a. Es hat *vermutlich* ja erst *kürzlich* jemand die Tür *gewaltsam* there has *presumably* PRT only *recently* someone the door *violently* geöffnet
opened

b. Es hat erst *kürzlich* ja *??vermutlich* jemand die Tür There has only *recently* PRT *presumably* someone the door *gewaltsam* geöffnet.
violently opened

c. Es hat *vermutlich* ja *??/*gewaltsam* erst *kürzlich* jemand die There has *presumably* PRT *violently* only *recently* someone the Tür geöffnet.
door *violently* opened

(Haider, 2012, 30)

A similar account has been proposed by e.g., Ernst et al. (2000) and Ernst (2020), who also advocate the view that the role of syntax is limited to the assignment of potential adverbial positions. While Haider's theory is mainly built around the main claim that adverbial order differs in OV and VO languages, Ernst's theory is, compared to Haider's, more spelled out with regard to adverbial linearization and provides a more detailed analysis for different adverbial types. Ernst observed that certain adverbials, such as event-modifiers, generally occur lower in the clause[3] while functional adverbials tend to be positioned higher in the clause structure. Certain adverbials are able to occupy various positions within the same clause without changing the sentence meaning as the comparison between (13a) and (13c) shows. Ernst, like Haider, assumes that adverbial linearization is determined by the scope the adverbials take over other types of operators. However, Ernst's (2020) understanding of semantic domains or zones is more fine-grained as (14) shows.

(13) a. (Fortunately,) he has (fortunately) not (*fortunately) lost a lot of money.

[3](Ernst, 2004b, 756) understands as *Low Range* the part of the clause below the pre-verbal position extending all the way to the right, in verb-initial languages.

b. (Possibly,) he has (possibly) not (*possibly) relinquished control of the company.

c. (Clearly,) he has (clearly) not (clearly) lost a lot of money.

(Ernst, 2020, 92)

(14) discourse oriented > evaluative > epistemic > (neg) > subject oriented > neg > manner (Ernst, 2020, 91)

A shortcoming of both Haider's and Ernst's theory is that they only aim to account for linearization and order effects between adverbials, but not between adverbials and arguments.

2.2.2 Syntactic accounts

A different family of accounts, also referred to as cartographic accounts, were proposed by Alexiadou (1994) and Cinque (1999). Within these accounts, adverbial ordering is determined by syntax. Based on the observation that adverbial order is cross-linguistically very similar, Cinque (1999) proposed that adverbials are universally ordered. He argues that adverbials are not adjoined to the phrase structure but that each adverbial type is hosted in a specifier position of its own fixed functional projection in the phrase structure. The location of this functional projection is determined by the relation between the adverbial type and the respective head of the projection, e.g., aspect-related adverbials are located in AspP. Thus, even though the account is syntactic in nature, semantics still plays a role in determining the respective functional projection to an adverbial. The assumed adverbial hierarchy is given in (15).

(15) **The universal hierarchy of clausal functional projections**

[*frankly* $\text{Mood}_{\text{speech act}}$ [*fortunately* $\text{Mood}_{\text{evaluative}}$ [*allegedly* $\text{Mood}_{\text{evidential}}$ [*probably* $\text{Mood}_{\text{epistemic}}$ [*once* T(Past) [*then* T(Future) [*perhaps* $\text{Mood}_{\text{irrealis}}$ [*necessarily* $\text{Mood}_{\text{necessity}}$ [*possibly* $\text{Mood}_{\text{possibility}}$ [*usually* $\text{Asp}_{\text{habitual}}$ [*again* $\text{Asp}_{\text{repetitive(I)}}$ [*often* $\text{Asp}_{\text{frequentative(I)}}$ [*intentionally* $\text{Mood}_{\text{volitional}}$ [*quickly* $\text{Asp}_{\text{celerative(I)}}$ [*already* T(Anterior) [*no longer* $\text{Asp}_{\text{terminative}}$ [*still* $\text{Asp}_{\text{continuative}}$ [*always* $\text{Asp}_{\text{perfect(?)}}$ [just $\text{Asp}_{\text{retrospective}}$ [soon $\text{Asp}_{\text{proximative}}$ [*briefly* $\text{Asp}_{\text{durative}}$ [*characteristically(?)* $\text{Asp}_{\text{generic/progressive}}$ [*almost* $\text{Asp}_{\text{prospective}}$ [*completely* $\text{Asp}_{\text{SgCompletive(I)}}$ [tutto $\text{Asp}_{\text{PlCompletive}}$ [*well* Voice [*fast/early* $\text{Asp}_{\text{celerative(II)}}$ [*again* $\text{Asp}_{\textit{repetitive(II)}}$ [*often* $\text{Asp}_{\text{frequentative(II)}}$ [completely $\text{Asp}_{\text{SgCompletive(II)}}$

(Cinque, 1999, 106)

Nonetheless, this universal hierarchy implies that only higher adverbial types are ordered, according to Cinque (2004). Circumstantial adverbials, which correspond roughly to event-modifying adverbials in my terminology, are not part of this universal hierarchy. For these types of adverbials, Cinque (2004) argues that they are modifiers that predicate over the VP (also see Störzer, 2017). As a consequence, these adverbials are not rigidly ordered. All adverbials hosted in functional projections are considered operators that enter into scope relations.

A major difference between the semantic approach and the syntactic approach concerns the movement of adverbials, as the adverbials are only allowed to move within the former but not the latter approach. Crucially, any order variation within the syntactic approach results from movement of other constituents but not the adverbials. Furthermore, the syntactic approach accounts for ambiguous adverbials by assuming that different readings of one adverbial form are merely homonyms that correspond to distinct functional projections. Since ambiguity in adverbials is typical and adverbial order in general is comparably free. This assumption is not very economical as it inflates the hierarchical structure to a vast extent. Furthermore, it is not entirely clear how it can account for coordinated adverbials or (multiple) fronted adverbials. The syntactic account has been critized for reduplicating an underlying semantic order of functional heads (Shaer, 2000; Maienborn & Schäfer,

2011). Finally, it has to be pointed out again that Cinque's universal account only makes predictions for a limited number of adverbials and excludes so-called 'circumstantials'. The syntactic account is thus only partially comparable to the other two accounts mentioned in this chapter. An account that attempts to offer a compromise between the two previously mentioned accounts is described in the following section.

Example (16) from Maienborn and Schäfer (2011) exemplifies the differences between the two account families. Both accounts predict that (16a) is grammatical and (16b) is not. According to the semantic approach, (16b) does not fulfill the well-formedness criteria of the adverbials, *cleverly* selects for an event and *probably* for a proposition, accordingly *cleverly* will be applied to a proposition which results in an ill-formed structure. According to the syntactic account, the serialization in (16b) is syntactically not well-formed as it does not reflect the hierarchy of the functional heads.

(16) a. Marie has probably cleverly found a good solution.

b. * Marie cleverly probably found a good solution.

(Maienborn & Schäfer, 2011, 14)

2.2.3 Mixed account

A mixed account of adverbial ordering has been suggested by e.g., Frey and Pittner (1998b). This account can be understood as a syntax-semantics interface account. It has a semantic nature in the sense that adverbials are grouped according to their lexico-semantic properties into five different classes. These classes are then defined syntactically in the sense that a class occupies a syntactic base position within the middlefield. As a consequence, adverbials are ordered with respect to other adverbials and the arguments of the sentence. Accordingly, semantic dominance is reflected in syntactic c-command relations between the adjunct class, the arguments, and the respective modified domain. The mixed character of the ap-

proach is also apparent in the terminology the authors use[4]. I use the term *adjunct* to refer to the syntactically ordered class and the term *adverbial* to the semantically defined type i.e., the respective member of the syntactic class. Their classification of adverbials has been volatile, and it has been developed and refined over time. The, to my knowledge, most recent version of adverbial order is found in Frey (2003, 203f). The order predicted for adverbials from high to low adverbial type is given in (17). I only differ from the following order by assuming with Frey and Pittner (1998b) that temporal adverbials belong to the class in (17c). I will discuss this in more detail in Chapter 3, when I will discuss the semantic adverbial types investigated for this thesis in more detail.

(17) a. Sentence adjuncts: The base position of a sentence adverbial c-commands the finite verbal form, the base positions of the arguments and the base positions of the remaining adjunct classes.

b. Frame and domain adjuncts (e.g., locative frame adverbials): The base position of a frame or a domain adjunct c-commands the base positions of the arguments and the base positions of the remaining adjunct classes except sentence adverbials.

c. Event-external adjuncts (e.g., causals, temporals): The base position of an event-external adjunct c-commands the base position of the highest-ranked argument.

d. Event-internal adjuncts (e.g., locatives, instrumentals): The base position of an event-internal adjunct is minimally c-commanded by the base position of the highest-ranked argument.

e. Process-related adjuncts (e.g., manner adverbials): The base position of a process-related adjunct minimally c-commands a base position of the main predicate.

Adverbials within the same class are not ordered syntactically, as syntax is not sensitive to fine-grained semantic differences between the adverbials (Frey, 2003,

[4] However, they do not stick to this terminology consistently.

165). However, there can be semantic preferences within a syntactic class that may cause ordering effects. For example, within the class of sentence adjuncts, scopal effects of the different semantic adverbial types cause a semantic but not a syntactic order preference. Any order that deviates from the above-stated ordering results of scrambling, i.e., they are derived by movement of the adverbials or the arguments, and the respective constituent enters into a local chain formation, making it possible to test for base and derived orders of adverbials with the tests as described in Chapter 2.1.1. The assumption that adverbials can move is a crucial difference between this mixed account and the purely syntactic account described in Section 2.2.2.

2.2.4 Position and interpretation

In the previous sections, I discussed adverbial order accounts. Before turning to the semantic description of the adverbials under investigation, I aim to address studies that have focused on ambiguous adverbials. The prediction that adverbial positions correlate with the interpretation has been mentioned early on (e.g., Thomason & Stalnaker, 1973; Jackendoff, 1974; McConnell-Ginet, 1982). This observation is an essential part of the mixed adverbial account. In particular, it is intricate when the different readings of an ambiguous adverbial modify distinct semantic modification domains. Pittner (2000) proposed an analysis of *wieder* ('again') within the base position account and argues that the distinct readings (event vs. process reading) are correlated with distinct syntactic base positions. An experimental investigation of the position-dependent interpretations of adverbials was conducted by Stolterfoht (2012) and Stolterfoht (2015). Stolterfoht (2012) used paraphrase ratings and found that for ambiguous temporal adverbials, their interpretation depends entirely on the position and, that there is no overall preference towards one reading. Stolterfoht (2015) conducted a paraphrase rating for *sicher* ('certainly', 'certain'), which comes with a sentence and a manner reading. She found that, like for temporal adverbials, position and interpretation are correlated. In the case of *sicher* it seemed at first glance that there is a general preference for the manner interpretation over the

sentence interpretation. However, a more careful inspection of the data shows that this preference is tied to the manner interpretation in the lower position. Stolterfoht (2015) argues that this preference is due to the fact that the adverbial with a manner reading in the low position is also the position that receives the main stress in a wide focus reading and is thus preferred. These studies show that positional information of an adverbial is crucial in composing its meaning and in processing it. As adverbials are notoriously ambiguous within and across classes, often the exact meaning depends on information about its syntactic position within the clause.

2.3 Summary and outlook

The first part of this chapter was dedicated to movement operations in general and scrambling in particular. I also introduced diagnostics to attest base orderings. Then I introduced three types of accounts for adverbial ordering, namely the semantic account (e.g., Haider, 2000; Ernst et al., 2000), the syntactic account (Alexiadou, 1994; Cinque, 2004), and, finally, the mixed account (e.g., Frey & Pittner, 1998b), which I follow in this dissertation. Furthermore, I focused briefly on ambiguous adverbials and how their positions and interpretations are correlated. This effect is to some extent predicted by all three theories. Since ambiguity is an essential piece to the puzzle of adverbial processing, I dedicated a section to this correlation between position and interpretation. A psycholinguistic account for adverbial (order) processing has to consider these intricacies.

Before introducing adverbial semantics, I would like to point out again that an intensive discussion about the limitations and advantages of adverbial position accounts is beyond the scope of this dissertation. Purely semantic accounts, as advocated by Haider and Ernst, are advantageous because their aim and main advantage is to reduce redundancy by stating that order preferences can be semantically solved and are then mapped onto syntax. In Frey and Pittner's account, lexico-semantic information maps onto syntactic c-command relations and is then semantically interpreted again (Ernst, 2020). However, the attempt of proposing a unifying account leads to overgeneralization. In particular, the development of

Ernst's work shows that the more adverbials are taken into account, the more complex gets the semantic machinery that is necessary to capture order preferences between different adverbials. As a result, the number of semantic rules that are proposed increases over time. Nonetheless, theories have to account for ambiguous or semantically underspecified adverbials and information-structural properties certain adverbials show. Similarly, purely syntactic accounts capture ambiguous adverbials by proposing that they are pure homonyms that correspond to different projections. It is unclear how to motivate the existence of several projections for the same adverbial if no meaning change arises due to the positional variation. A mixed account, however, seems to make the most realistic predictions for adverbials in the middlefield, and since it assumes base positions and allows scrambling, it can account for both the freedom and the restrictions in adverbial order variations at the same time.

Again, the accounts predict mainly the same ordering preferences, and an overview of the accounts is sufficient at this point. Furthermore, Cinque (2004), like Ernst (2020), pointed out the differences between higher and lower adverbials. Cinque acknowledges that their semantics differ from higher adverbials and excluded them from the proposed cartographic hierarchy. Ernst, on the other hand, notices that higher adverbials are distributionally freer than lower adverbials. This semantic distinction thus seems to affect syntactic adverbial ordering, and as my experimental work will show, it also modulates the time course of processing. In the next section, I will first discuss general remarks on adverbial semantics and then motivate the distinction between higher and lower, i.e., propositional and event-modifying adverbials, from a semantic perspective.

3 | Semantics of adverbials

The scope of this dissertation is limited to the semantic group of *predicational adverbials*. Predicational adverbials can be described by providing a gradable property to either a sentential or a verbal base (Maienborn & Schäfer, 2011, 5). Within predicational adverbials, it can be differentiated between sentential and verb-related adverbials, also referred to as high or low adverbials. This dichotomy refers to the assumed syntactic positions within the clause. Schäfer (2013) draws another distinction and also classifies so-called event-related adverbials. In this dissertation, I will refer to sentential or high adverbials as *propositional adverbials* and to the lower type as *event-modifying adverbials*. As already mentioned in the introduction, I will refer to the syntactic classes in the sense of Frey's base position account as *adjuncts* (e.g., frame adjuncts), and the semantically motivated members of the class are referred to as **adverbial types** (e.g., frame adverbial). The semantic dichotomy of propositional and event-modifying adverbials will be referred to as **semantic categories**. I will argue and later show experimentally that the semantic category of an adverbial is crucial in processing and affects the time course of adverbial order processing.

The goal of this chapter is to motivate the semantically based distinction between propositional and event-modifying adverbials. The structure of this chapter is as follows. First, I will introduce semantic criteria, which can differentiate propositional and event-modifying adverbials. Additionally, I will briefly introduce how truth-conditional semantic approaches attempted to account for adverbial modifiers in general. Moreover, I will argue why the dichotomy propositional vs. event-modifying is problematic for a generalizing semantic account. Finally, at the end of this chap-

ter, I will zoom in on the individual semantic adverbial types, first from a semantic perspective, and then derive predictions based on the mixed account introduced in Section 2.2.3 by arguing for specific linearizations between the adverbials under investigation. Figure (3.1) depicts the semantic ontology of adverbials.

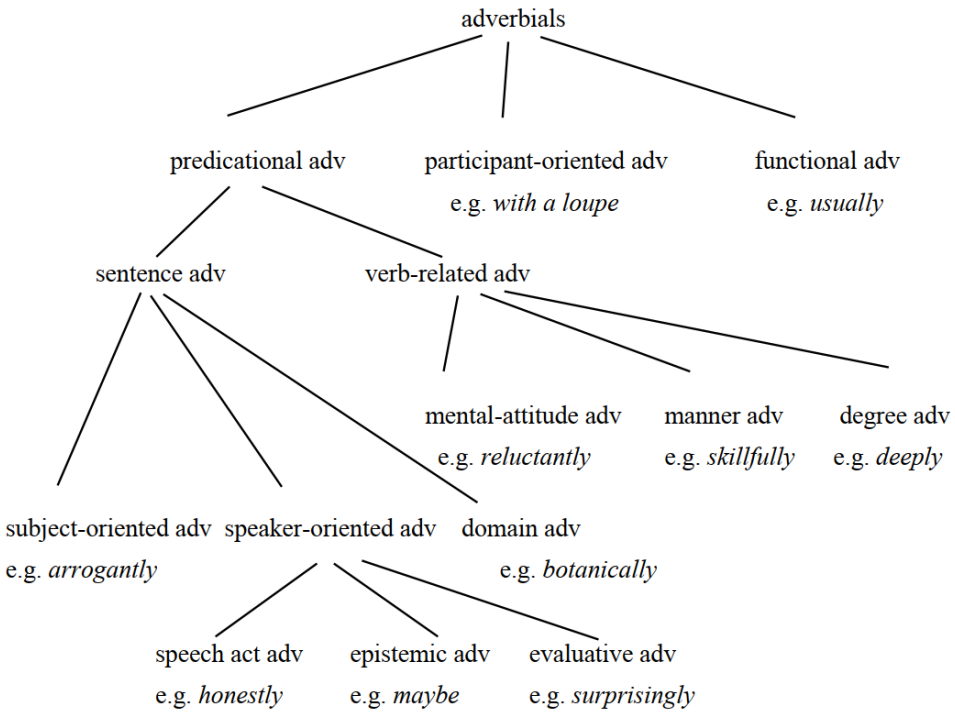

Figure 3.1: Semantic ontology

(Maienborn & Schäfer, 2011, 13)

3.1 Semantic adverbial categories: Propositional vs. event-modifying adverbials

The difference between propositional and event-modifying adverbials is displayed by the famous English example from McConnell-Ginet (1982) in (18). The adverbial in (18a) modifies the entire proposition given by the sentences, which can be paraphrased as *The fact that Claire greeted the queen was rude*, the manner of her greeting however remains unspecified. In (18b) *rudely* only modifies the manner of

the greeting-event, the fact that she greeted the queen can be considered as polite (or not). The adverbial is ambiguous between a sentence-modifying reading and a manner reading. The position of the adverbial, however, disambiguates the two readings.

(18) a. Rudely, Claire greeted the queen.

b. Claire greeted the queen rudely.

As suggested by the base position account for adverbials, the attachment site of an adverbial is correlated with its semantic adverbial type. As mentioned earlier, certain adverbials show more distributional freedom than others. It has been argued that the two types of adverbials can also be distinguished with semantic criteria (e.g., Thomason & Stalnaker, 1973; Jackendoff, 1974; Katz, 2003). This chapter will discuss semantic criteria that motivate the distinction between propositional and event-modifying adverbials.

3.1.1 Selectivity

Davidson (1967) suggested that *action*-verbs provide an invisible event-argument (*e*). Adverbial modifiers then intersectively combine with the event argument by predicate modification (Heim & Kratzer, 1998). Adverbials are thus analyzed as first-order predicates of the event. The adverbials denote a certain property of the event structure (Maienborn & Schäfer, 2011). The formal representation of Davidson's (1967) famous sentence is given in Example (19) taken from Maienborn and Schäfer (2011).

(19) a. Jones buttered the toast in the bathroom with the knife at midnight.

b. ∃e [BUTTER(jones, the toast, e) & IN (e, the bathroom) & INSTR(e, the knife) & AT (e, midnight)] (Maienborn & Schäfer, 2011, 19)

Later work within this framework came to be known as Neo-Davidsonian (e.g, Parsons, 1990). Parson has extended the framework to account for manner adverbials, as Davidson only discusses participant-oriented adverbials. Since adverbials are

analyzed as predicate modifiers, it follows that any unmodified and any less complex form of the sentence is entailed by the more complex version of it. In contrast, stative verbs do not provide an event argument and cannot combine with event modifiers due to their selectional properties.

Propositional and event-modifying adverbials differ with respect to selectivity. While propositional adverbials are not restrictive regarding the event type, event-modifying adverbials are sensitive to the event type of the verb. Katz (2003, 456) described the asymmetry in (20) as the *Stative Adverb Gap*, pointing out that if an adverbial can modify a state, it can also modify an event but not vice versa.

(20) a. John probably loved Mary.
b. John probably kissed Mary.
c. * John loved Mary quickly.
d. John kissed Mary quickly. (Katz, 2003, 456)

Katz (2003) accounts for this gap by pointing out that event-modifying adverbials are sensitive to the verbs's event type, in the sense that they require to combine with a Davidsonian event argument but propositional adverbials do not. The corresponding lexical entries for a manner and a sentence adverbial are given in (21). The event-modifying adverbial introduces an underlying event predicate, and the propositional adverbial selects for a proposition. The incompatibility of (20c) is thus a consequence of the semantic combinatorial mechanisms.

(21) a. *slowly*: λP λ(e) [P(e) & slow (e)]
b. *probably*: λP [PROB P] (Katz, 2003, 465)

3.1.2 Veridicality

The entailment pattern of event-modifiying adverbials allows to differentiate them from other adverbial types by *veridicality*. Veridicality refers to the fact that a sentence without the adverbial is entailed by its modified version (e.g, Maienborn & Schäfer, 2011). Consequently, the negative operator is classified as *anti-veridical*. However, there is no clear-cut dichotomy rendering all syntactically lower adverbials

such as event-modifying adverbials veridical and all higher adverbials non-veridical. An example is given in (22), the evaluative sentence adverbial in (22a) is veridical as the sentence without the adverbial is entailed by the version of it with the adverbial. This is not the case for the epistemic sentence adverbial in (22b).

(22) a. Sie hat glücklicherweise die Prüfung bestanden.
She has luckily the exam passed
'Luckily, she has passed the exam.'

b. Sie hat angeblich die Prüfung bestanden.
She has allegedly the exam passed
'Allegedly, she has passed the exam.'

3.2 Semantic characteristics of adverbial types and predictions for base linearizations

This section aims at bringing together the theoretical considerations and observations that I laid out in the two previous chapters. So far, I have given a more general overview of the syntactic adverbial classes and also some semantic features related to them that differentiate between propositional and event-modifying adverbials. In this chapter, I will take a closer look at the adverbials investigated in the experimental section. This section is structured as follows: First, I will define the adverbial types semantically and discuss semantic characteristics and derive order predictions for the respective adverbial type. I will start by discussing propositional adverbials and subsequently discuss event-modifying adverbials. The structure of the section follows the assumed base order of adverbials in the clause from high to low.

3.2.1 Propositional adverbials

As discussed in the previous section, propositional adverbials are assumed to be located very high in the clause structure since they operate on the entire proposition (e.g, Maienborn, 2001).

Sentence adverbials

Semantically, the class of sentence adverbials consists of a comparably heterogeneous set. For an overview of different authors' classifications of the class of sentence adverbials consult Pittner (1999). While there are discrepancies within the literature on the classification of sentence adverbials, it is accepted that sentence adverbials are not part of the assertion and operate on the entire proposition (e.g., Lang, 1979; Pittner, 1999; Schäfer, 2013). Nonetheless, I will only focus on the subtype of so-called *speaker-oriented (sentence) adverbials*, more precisely, epistemic and evidential speaker-oriented sentence adverbials. For the sake of readability, I will refer to these sub-types by the term sentence adverbial. This, however, does not mean that the class of sentence adverbials is limited to these two sub-types. Other types classified as sentence adverbials (e.g., subject-oriented adverbials or speech-act adverbials) differ in relevant semantic aspects. However, the characteristics that I understand as relevant in processing do not generalize across all types of sentence adverbials. After all, to avoid confounding factors in the experimental studies, I will only focus on a more homogeneous sub-class. Most classifications of (speaker-oriented) sentence adverbials also include evaluative speaker-oriented adverbials. I excluded this sub-group from my experiments because, unlike epistemic and evidential sentence adverbials, evaluative sentence adverbials are non-veridical and presuppose factivity. These differences also have consequences for their distribution. For a theoretical discussion, see e.g., Bellert (1977). Furthermore, the experiments in Störzer and Stolterfoht (2013) showed that evaluatives differ from epistemics and evidentials with regard to processing.

Sentence adverbials express a speakers' expectation regarding the truth of a sentence (Schäfer, 2013, 41). Pittner (1999) understands evidentials as an instance of epistemics. Like epistemic adverbials, evidentials express the speaker's commitment to the truth of a proposition. An overview of evidential adverbials and their relation to epistemics can be found in Axel-Tober and Müller (2017). Like Axel-Tober and Müller (2017), I do not make claims about the underlying nature of the two types of speaker-oriented sentence adverbials. Following Axel-Tober and

Müller (2017, 11), I understand that epistemics are referring to the primary encoding of a degree of certainty, i.e., the modal force, and that evidentials refer to the primary encoding of a reference or a source of information. In (23a), I provide examples of epistemics and in (23b) examples of evidentials.

(23) a. (Wahrscheinlich/ vielleicht/ sicherlich) hat Peter Brot eingekauft.
Probably/ maybe/ surely has Peter bread bought
b. (Angeblich/ anscheinend/ offensichtlich) hat Peter Brot eingekauft.
Allegedly/ apparently/ obviously has Peter bread bought

In fact, as discussed earlier, sentence adverbials cannot appear in the scope of sentence negation, questions see Example (24a and b, respectively). Furthermore, Lang (1979) noted that sentence adverbials cannot be in the scope of a quantifier (24c), and those sentence adverbials taking scope over a quantifier as in (24d) can only be interpreted with narrow scope: WAHRSCHEINLICH[IMMER(p)]. Lang (1979) pointed out that sentence adverbials cannot be coordinated. This seems to distinguish them from all other adverbials discussed in this dissertation (cf. Example (25)). Schäfer (2013, 40) noted that sentence adverbials outscope all other scope-bearing elements, i.e., every scope-taking element following a sentence adverbial is in the scope of the sentence adverbial.

(24) a. * Franz sagt, dass nicht wahrscheinlich/ angeblich Peter Brot gekauft
Franz says that not probably/ allegedly Peter bread bought
hat.
has
b. * Hat Peter wahrscheinlich/ angeblich Brot gekauft?
has Peter probably/ allegedly bread bought
c. * Hat Peter immer wahrscheinlich/ angeblich Brot gekauft?
has Peter always probably/ allegedly bread bought
d. * Hat Peter wahrscheinlich/ angeblich immer Brot gekauft?
has Peter probably/ allegedly always bread bought

(25) * Franz sagt, dass wahrscheinlich und leider Peter Brot gekauft
Franz says that probably and unfortunately Peter bread bought
hat.
has

Schäfer (2013) noted that whether epistemics are veridical or not depends on the exact lexical usage. Veridicality seems to be modulated by the lexico-semantic

features of the epistemic. Adverbials that express a high degree of certainty are veridical, while adverbials expressing a lower degree of certainty are non-veridical as the contrast in Example (26) shows. Ernst (2009) captured this effect by analyzing speaker-oriented adverbials as weak and strong positive polarity items.

(26) a. Certainly, John ate $\Longrightarrow$ John ate

b. Probably, John ate $\not\Longrightarrow$ John ate

As for the syntactic side, sentence adverbials show a high degree of distributional freedom, as Example (27a) shows. Frey (2003) argues that the distribution of sentence adverbials is syntactically limited. The contrast caused by the position of the wh-indefinite in (27b) and (27c) shows that sentence adverbials have to be base-generated higher than the subject. The comparison between (27c) and (27d) shows that sentence adverbials are base-generated higher than event-modifying adverbials, here a causal adverbial[1]. Furthermore, sentence adverbials cannot be part of fronted complex VP as sentence adverbials need to c-command the finite verb (cf. Example 28).

(27) a. Hans sagt, dass (wahrscheinlich) Peter (wahrscheinlich) gestern
Hans says that (probably) Peter (probably) yesterday
(wahrscheinlich) Maria (wahrscheinlich) angerufen hat.
(probably) Maria (probably) called has

b. Hans sagt, dass wahrscheinlich wer angerufen hat.
Hans says that probably someone called has

c. * Hans sagt, dass wer wahrscheinlich angerufen hat.
Hans says that someone probably called has

d. Hans sagt, dass er wahrscheinlich wegen was angerufen
Hans says that he probably because something called
hat.
has

e. * Hans sagt, dass er wegen was wahrscheinlich angerufen
Hans says that he because something probably called
hat.
has

[1] Note that the order variation are caused by scrambling of the non-adverbial constituents

(28) * [vermutlich geraucht]$_i$ wird$_j$ heute Abend t_i t_j.
probably smoked AUX-PASSIVE today evening
(Frey & Pittner, 1998a, 31)

Furthermore, it has been suggested that sentence adverbials are relevant for information structure, as they divide the middlefield into the topic and comment section (e.g., Frey, 2000a, 2003, 2004). I will discuss this in more detail in Chapter 3.2.2.

In this section, I have discussed relevant semantic features of sentence adverbials, namely that they function as operators that are applied to the entire proposition. This has the consequence that they have very lax selectional restrictions i.e., they require a proposition without further semantic specification of the event type. However, sentence adverbials are very limited when it comes to the co-occurrence with both operators of the same type and of different types, and they outscope other types of operators. The next section will discuss another type of propositional adverbial, so-called domain adverbials.

Domain and frame adverbials

Domain adverbials semantically restrict the proposition's validity to an interpretational domain (Bellert, 1977; Pittner, 1999; Schäfer, 2013), an example is given in (29).

(29) a. Hans sagt, dass dieses Argument linguistisch schwach ist
Hans says that this argument linguistically weak is

Bellert (1977, 347) proposes that domain adverbials are a semantic equivalent to a restrictive universal quantifier that operates on the proposition and defines where the proposition holds. However, their semantic classification is controversial. Ernst (2004b) subsumes domain adverbials under the class of event-internal modifiers. However, he acknowledged that domain adverbials show more distributional freedom than other event-internal adverbials. Bellert (1977) and Schäfer (2013) understand domain adverbials as sentence adverbials. I argue that they classify as propositional adverbials because they do not require an event-argument and can combine with stative verbs. Syntactically, domain adverbials are members of the frame-adjunct-class, which are assigned a distinct syntactic base po-

sition. Consequently, I combine findings from research on both types of adverbials. A potential problem in the classification of domain adverbials (and frame adverbials) could arise because they are highly ambiguous. Domain adverbials are ambiguous between a domain reading and a so-called *method-oriented* reading. Method-oriented adverbials share properties with manner and instrumental adverbials (Schäfer, 2013). Frame adverbials typically denote temporal or locative frames and are thus ambiguous with event-modifying temporals or locatives, respectively (e.g., Maienborn, 2001; Störzer, 2017). However, in a domain reading, these adverbials, like sentence adverbials, are not sensitive to specific event information. Furthermore, like sentence adverbials, domain adverbials operate on a proposition and can combine with any type of event. They can combine with stative copula verbs that do not provide an event argument (e.g., Maienborn, 2001, 2003), (cf. Example 30). Domain readings can be tested with a paraphrase, as shown in Example (31) (Pittner, 1999; Schäfer, 2013).

(30) a. Hans sagt, dass dieses Argument linguistisch schwach ist.
Hans says that this argument linguistically weak is
'Hans says that this argument is linguistically weak.'

b. Hans sagt, dass die Dissertation inhaltlich überarbeitet wurde.
Hans says that the dissertation contentwise revised AUX-PASSIVE
'Hans says that this disseration was revised with regard to its content.'

(31) a. Wenn man es linguistisch betrachtet, ist dieses Argument schwach.
when one it linguistically sees is this argument weak
'From a linguistic point of view, this argument is weak.'

b. Was das Inhaltliche angeht, hat Hans die Dissertation überarbeitet.
what the content regards has Hans the dissertation revised
'Regarding the content, Hans has revised the dissertation.'

Domain adverbials are less limited when co-occurring with other operators such as question operators (cf. 32a). Bellert (1977) attributed this behavior to the observation that domain-restricted sentences yield only one proposition, as opposed to sentence adverbials which yield two propositions. Namely, the proposition of the sentential base and the proposition given by the sentence adverbial. An incompatibility is caused because it is not possible to ask a question (or make an imperative

request) and make an assertion at the same time. In contrast, domain adverbials in combination with modal operators such as the imperative construction in Example (32b) are grammatical. Furthermore, they can be coordinated (32c), which is ruled out for sentence adverbials.

(32) a. Hast du die Dissertation orthografisch verbessert?
have you the dissertation orthographically improved
b. Überarbeite die Dissertation inhaltlich!
revise the dissertation contentwise
c. Deutsch ist morphologisch und syntaktisch kompliziert.
German is morphologically and syntactically complicated

Regarding veridicality, domain adverbials show a peculiar behavior. The modified version of the sentence does not entail the sentence without the domain adverbial (see Example 33). However, it will be interpreted either with a default interpretation or under a contextually salient domain (Schäfer, 2013, 48).

(33) Semantically, this example is relevant $\not\Rightarrow$ This example is relevant.

According to the base position account, sentence adverbials precede all types of other adverbials, including domain adverbials. The complex fronting test in (34) shows that the domain adverbial can be fronted as part of a complex VP. The options to apply different base position tests to adjacent sentence and domain adverbials are limited for several reasons. First, the lack of referentiality of both adverbials rules out the Principle C test, the scope inversion test, and wh-indefinite test. Moreover, the inability of the sentence adverbial to be part of a fronted VP limits the applicability of the Complex Fronting test to some extent, as mentioned by Frey and Pittner (1998a) and discussed in Section 3.2. However, (34) points at the direction that the domain adverbial is base-generated below the sentence adverbial i.e., closer to the verb. Further inside yields the application of the Principle C test using frame adverbials instead of domain adverbials (again assuming that they obey the same base position). Example (35a) is ungrammatical as the trace of the R-expression in the frame adverbial cannot be bound by a co-referential subject pronoun. This is not the case in (35b), which indicates that the base position of the

locative frame is below the sentence adverbial and above the subject. The Principle C violation in Example (35c) shows that frame adjuncts have to be base-generated below sentence adverbials (Frey, 2003, 169).

(34) [Syntaktisch interessant] ist das Beispiel sicherlich.
syntactically interesting is the example surely

(35) a. * [In Peters$_1$ Firma]$_2$ entscheidet er$_1$ offensichtlich t_2 t_1 allein über
in Peters company decides he obviously alone about
die Ausgaben.
the expenses

b. [In Peters$_1$ Firma]$_2$ entscheidet offensichtlich t_2 er$_1$ allein über
in Peters company decides obviously he alone about
die Ausgaben.
the expenses

(Frey, 2003, 169)

Nevertheless, the empirical evidence for the assumed base order between sentence and domain adverbials has not gained much attention and my predictions are to some extent inferred from the discussion about the respective adverbial types. For sentence adverbials, it has been suggested that sentence adverbials mark the highest position of the middlefield (e.g., Frey, 2004; Repp, 2017). For frame adjuncts (i.e., domain adverbials), I base my argumentation on Störzer's (2017) discussion as well as her experimental evidence for the base position of non-referential frame adverbials below sentence adverbials. However, the information-structural status of referential frame adverbials and the effect of this referential status on order preferences caused a debate about the base position of frame adverbials relative to sentence adverbials. In the next section, I will discuss this in more detail and argue that domain adverbials, even though they are non-referential, are subject to information structural order preferences.

3.2.2 Excursion: Domain and frame adverbials and information structure

At this point, I would like to draw some attention to the interaction between frame adjuncts and information structure as well as context. These intricacies show that

frame and domain adverbials are deeply intertwined with context information and structure, affecting order preferences. First, I will focus on the discussion held within the theoretical linguistic literature and then discuss psycholinguistic studies.

In earlier versions of the adverbial base position framework, Frey and Pittner (1998b) argue that frame adjuncts (domain and frame adverbials) have their base position above sentence adverbials. Later, this order was revised due to the information-structural properties that frame adverbials can reveal. Frey (2003) and Frey (2004) thus argue that frame adjuncts have their base position below sentence adverbials and can move across the sentence adverbial in order to be structurally marked as topics. He argues that German is discourse-configurational with regard to topics. The position above the sentence adverbial can only be filled with an aboutness topic in the sense of Reinhart (1981). Experimental evidence for this order and the medial topic position above the sentence adverbial is reported in Störzer and Stolterfoht (2013, 2018) and Repp (2017). Repp (2017), furthermore, showed that the medial topical position is strictly tied to the position of sentence adverbials and that phrases moved across locative adverbials are not topically marked. However, Reinhart's definition of aboutness topic requires referentiality. It thus follows that domain adverbials, as they are not referential, cannot function as aboutness topics. In German, domain adverbials cannot move across sentence adverbials as this would result in ungrammaticality, according to Frey (2004, 22). However, Ernst (2004a) argues for English that sentence-initial domain adverbials can have topic-like functions. Ernst (2004a) has a rather broad conception of domain adverbials and distinguished between domain adverbials with a *regular* reading (i.e., domain interpretation), a manner reading, and a method reading[2]. Crucially, he defends the claim that sentence-initial domain adverbials can fulfill information-structural needs. Ernst discussed examples like (36), for which he argues that domain adverbials with a topical reading restrict a contextually given topic in the

[2]He claimed all three readings share a base position, and differences in meaning are caused by the scope and the relation to their modified domain. I understand method and manner readings as separate adverbial types with distinct base position and their own selectional restrictions.

common ground. In this case, the provide sub-answers to the question (*What have they done in the last two years in the office?*). This is to be distinguished from, what he calls, the *regular* domain reading in which a proposition[3] is restricted to the given domain. A similar notion has been introduced by Krifka (2008b) under the term delimitation. The definition is given in (37). Krifka's definition of delimitators does not require delimitators to be referential and does not require delimitators to be of a specific part of speech. It is thus compatible with frame and domain adverbials that fulfill, as described by Ernst, the function of splitting discourse into sub-answers to a broader question under discussion (QUD) (see e.g., Roberts, 1996).

(36) What have they done in their last two years in office?
– Well, **economically**, they have passed new tax legislation; **politically**, they have raised far more money for the party than was expected
(Ernst, 2004a, 104)

(37) A delimitator α in an expression [...α...β Focus...] always comes with a focus within α that generates alternatives α0. It indicates that the current informational needs of the common ground are not wholly satisfied by [...α...β Focus...], but would satisfy it by additional expressions of the general form [...α...β Focus...]. (Krifka, 2008b, 270)

Furthermore, several authors have pointed out the discourse relevance of fronted adverbials concerning information retrieval and processing. Dickey (2001) analyzed preposed temporal adverbials as discourse markers, and introduced the *Adverbial domain hypothesis* (38). In sentence-initial position, temporal adverbials mark a shift in the discourse, and the subsequent proposition will be temporally evaluated against the information given by the adverbial. Accordingly, a sentence-initial (temporal) adverbial prevents the processor from retrieving temporal information from the context and instead sets up a new discourse segment.

[3] Ernst only speaks of events.

(38) Adverbial Domain Hypothesis:
A preposed temporal adverbial creates a new domain for temporal interpretation.

Similarly, Frazier and Clifton (2018) capture with their *topic situation hypothesis* that initial temporal and locative PPs (i.e., frame adverbials) introduce topic situations. A topic situation supplies a context for implicit domain restriction, and material following these adverbials is included in the topic situation.
Domain and frame adverbials interact with information structure and serve discourse-structuring purposes. The discussion in this section showed that a discourse-structuring function tends to be correlated with a high position in the sentence structure. In summary, I assume that frame adjuncts have their base position below sentence adverbials, but they can fulfill a discourse-structuring purpose that affects order preferences. This is in line with the discussion about referential frame adverbials (Frey, 2004; Pittner, 2004; Störzer & Stolterfoht, 2018). I will test this experimentally in Chapter 6.

3.2.3 Event-modifying adverbials

Event-modifying adverbials are distinguished from propositional adverbials by their requirement for an event argument, as proposed by Davidson (1967), and their selectional restrictions on the modified event type. It seems that, the lower the adverbials base position the more specific the requirements on the modified event. As I did in the previous chapter for propositional adverbials, I will discuss the event-modifying adverbials, that I used for the experiments, namely temporals, external locatives, manner adverbials, and internal locatives. First, I will discuss their semantic status and their semantic intricacies and then the predicted base order that holds between the respective adverbials under investigation.

Temporal adverbials

Up to date, there is a vast amount of semantic analyses of temporal (and aspectual) information. A fundamental overview would exceed the scope of this dissertation.

I thus want to focus on one distinction that has been made for different temporal adverbial types that seemed to be relevant in processing. Temporal adverbials and the semantic and syntactic differences within this adverbial class have been discussed e.g., by Smith (1978), who distinguished between *deictic adverbials* and *clock-calendar adverbials*. According to Alexiadou (2000), the former are specified according to the reference time and the latter remain unspecified for tense (past/future) until the verb provides temporal information to specify the adverbial for a past or future reading, an example is given in (39a) and (39b), respectively. It has been argued that temporal information, expressed by the adverbial and verbal information, has to be anchored to speech time in order to get interpreted (Biondo, 2017). Speech time is assumed to be located in the CP, and clock-calendar adverbials in the TP (e.g., Enç, 1987). A tensed sentences' truth value is evaluated against three times: utterance time, event time and reference time (Reichenbach (1947) (cited in: Biondo, 2017, 14). In some instances, e.g., context-free sentences, it can be the case that the adverbial remains underspecified until tensed verb information is available. These differences seem to determine the time course of processing temporal adverbials. In order to interpret temporal information, an interaction between different sources of extra- and inter-sentential meaning needs to be computed. However, for this discussion, a simplification in a Davidsonian fashion is sufficient: Purely event-modifying adverbials require an event argument to be licensed. As (39c) and (39d) show, it seems that temporals are less restrictive and can be interpreted with statives that do not provide an event argument. Maienborn (2003) suggested analyzing the types of states in (39c) and (39d) as Kimian states (short K-states). K-states are located in time but not in space, which allows them to combine with temporal modifiers even though they do not provide an event argument.

(39) a. Fritz sagt, dass Peter gestern *singen wird/ gesungen
Fritz says that Peter yesterday sing AUX-FUTURE/ sung
hat.
AUX-PAST

b. Fritz sagt, dass Peter am Montag singen wird/ gesungen hat.
Fritz says that Peter on Monday sing AUX-FUTURE/ AUX-PAST has

c. Fritz sagt, dass Peter gestern aussah wie sein Vater.
Fritz says that Peter yesterday resemble.PAST like his father

d. Fritz sagt, dass Peter wahrscheinlich am Montag ein Idiot war.
Fritz says that Peter probably on Monday an idiot was

To summarize the relevant characteristics of temporal adverbials, it is to say that they cannot be treated as a unique category (Biondo, 2017, 16). Deictic temporal adverbials do not need to interact with verb information, clock-calendar adverbials, however, do. Frey (2003) acknowledges that there are distinct base positions for temporal frames and event-modifying temporals, but he does not make a fine-grained semantic distinction beyond that in the sense of Smith (1978).

External locatives

The term *external locative* was coined by Maienborn (2001) who discussed the different meanings and correlating syntactic base positions of locative adverbials, as already mentioned in Chapter 1, she distinguished locative frames (cf. Section 3.2.1), external locatives, which require an event argument and locate the entire event description, and internal locatives, which I will discuss below. If no event variable is provided, locatives will usually be interpreted as frame adverbials. Frame adverbials have a base position high in the sentence structure, and it is thus not surprising that the higher position of the locative in (40b) is more acceptable than the lower one in (40c). As discussed in section 2.2.4, it is well attested that the adverbial position correlates with its interpretation (Maienborn, 2001; Schäfer, 2013; Stolterfoht, 2015). Syntactic information can disambiguate the two readings. The lower reading is correlated with an event-modifying locative, and the lacking event argument of the copula only allows for an interpretation as a locative frame.

(40) a. Fritz sagt, dass Peter im Auto gesungen hat.
Fritz says that Peter in.the car sung AUX-PAST

b. Fritz sagt, dass im Auto Peter rücksichtslos ist.
Fritz says that in.the car Peter reckless is

c. Fritz sagt, dass Peter im Auto rücksichtslos ist.
Fritz says that Peter in-the car reckless is

As for the syntactic ordering between temporals and external locatives, the base position test in (41) shows that they are syntactically ordered, as Frey (2000a) argues. I thus assume temporals to be base-generated higher than external locatives.

(41) a. Hans sollte wann wo darüber vortragen.
Hans should when where it.about present

b. * Hans sollte wo wann darüber vortragen.
Hans should where when it.about present

(Frey, 2000a, 113)

Manner adverbials

Schäfer (2013) analyzes manner adverbials extensively and distinguishes between uni-dimensional and multi-dimensional manner adverbials on the one hand and pure manner readings and agent-oriented manner readings on the other. The former dichotomy refers to the parameters of the event that the adverbial modifies; uni-dimensionals such as *laut/leise* ('loudly'/'quietly') modify only the parameter of loudness, whereas multi-dimensionals such as *wunderbar* ('wonderful') interact with the event description in a more complex way. Furthermore, he distinguishes between pure manner adverbials and agent-oriented manner adverbials. The former only modifies the manner an action is conducted, while the latter describes properties of the agent of the event. Schäfer (2013) suggests a paraphrase test to tease the two readings apart. Pure manner adverbials are identified by the paraphrase *Wie x* VERB *ist* ADJ ('How x VERB is ADJ'). For agent-oriented readings, he suggests extending the paraphrase by making the agent explicit: *Es ist* ADJ *von X wie X etwas tut* ('It is ADJ of X how X does something'). Schäfer (2013, 59) argues that agent-oriented manner adverbials require the agent of the event to have control over the action. Thus inanimate subjects are ruled out. An example for a pure manner reading with the paraphrase test is given in (42a-c). The paraphrase test for agent-oriented reading in (42c) shows that no such reading is available for the pure manner adverbial. On the other hand, agent-oriented manner adverbials are compatible with both paraphrases (cf. 42d-e).

(42) a. Peter singt laut.
Peter sings loudly

b. ? Wie Peter singt, das ist laut.
How Peter sings that is loud

c. * Es ist laut von Peter wie er singt.
It is loud of Peter how he sings

d. Peter argumentiert geschickt.
Peter argues skillfully

e. Wie Peter argumentiert, das ist geschickt.
How Peter argues that is skillful

f. Es ist geschickt von Peter wie er argumentiert.
It is skillful of Peter how he argues

Even though the exact specifications Schäfer (2013) makes are not primarily relevant here, it exemplifies the tight connection between the manner adverbial and the event. In fact, unlike the adverbials discussed so far, manner adverbials target a conceptual dimension of the event (Schäfer, 2013, 90). Manner adverbials depend not only on an event argument but also on a specific thematic structure of the event. Additionally, the lexico-semantic properties of the specific event need to allow for manner modification of the respective dimension. Compare (43), the agentive verb in (43b) does not combine with the manner adverbial of the given type. Manner modification of the event denoted by the psychological verb *fürchten* ('to fear') is infelicitous because manner modification requires agentive events including volitional subjects.

Regarding their position, manner adverbials cannot precede sentence negation and must be positioned below the negative operator, as Example (44) shows.

(43) a. Peter singt laut/ wunderbar/ schnell.
Peter sings loudly/ wonderfully/ fast

b. Peter singt *oberflächlich/ *intelligent/ *geschickt.
Peter sings cursory/ intelligently/ skillfully

c. * Peter hat sich laut gefürchtet.
Peter has REFL loudly scared

Nonetheless, the differences between the readings of a manner adverbial are very subtle, and often different readings are compatible. Exceptions are pure manner adverbials, which consist of a rather small group of lexical realizations. I thus ar-

gue that, as long as the prerequisites are met (animate subject and event variable provided by the verb), the exact usage of the manner adverbial can remain underspecified. Thus no commitment might be necessary to decide for one reading over the other. More precisely, it is not necessarily relevant whether a manner adverbial modifies the manner an event is conducted or whether it modifies the agent of the action as long as it results in the same event description. I will discuss this in more detail in the remainder of Chapter 8, where I will discuss the experimental results and the psycholinguistic discussion in Chapter 4.

(44) a. weil Peter nicht laut singt.
because Peter not loudly sings

b. weil Peter *laut nicht singt.
because Peter loudly/ not sings

Following Frey (2000b), who describes manner adverbials as process-related adverbials modifying only a sub-component of the event, I assume manner adverbials to be base-generated very low within the VP below the direct object. For experimental evidence, see also Gauza (2018).

Internal locatives

The description of internal locatives goes back to Maienborn (2001). She defines them as locating only parts of the event, whereas external locatives locate the entire event. Example (45a) gives an example of an internal locative. Example (45b) shows, that external and internal locatives can coexist in the same sentence, showing that they indeed modify different components of the event. It seems, however, that they are even more restrictive than manner adverbials with regard to the event description. Concerning processing, it might be a safe strategy to await verbal information in order to integrate them, especially in cases where an external locative reading is implausible, as in Example (45c). Often, locatives reveal properties of instrumental or manner adverbials (Maienborn, 2001, 196).

(45) a. Peter hat auf dem Papier unterschrieben.
Peter has on the paper signed

b. Peter hat [im Büro] [auf dem Papier] unterschrieben.
Peter has in.the office on the paper signed

c. * Peter hat auf dem Papier gekocht.
Peter has on the paper cooked

Maienborn argues that internal locatives have their base position in a very low position in the VP, between the direct object and the head of the VP. Internal locatives are not accounted for by Frey and Pittner (1998b) and Frey (2003). The base position account does not differentiate in a more fine-grained manner between different usages of locatives and only distinguishes between (locative) frames and external locatives. Based on Maienborn's (2001) compositional analysis and the different meaning contributions to the event description, it is justified to assume distinct base positions for both types of locatives. However, internal locatives need to be integrated into the base position framework I follow. As Maienborn did not make any claims concerning the order of other lower type adverbials, I will test order preferences of internal locatives and manner adverbials. There are two possible analyses. First, both manner adverbials and internal locatives constitute members of the same syntactic class, namely process-related adjuncts in Frey's terminology. As members of the same adjunct class they are syntactically not ordered. Maienborn argues that internal locatives are base-generated right above the head of V, but in Frey and Pittner's (1998b) framework, the lowest adverbial class are process-related adverbials. Henceforth, it needs to be assumed that manner adverbials and internal locatives are both process-related adverbials which are unordered . The second option is that they represent distinct syntactic adjunct classes and are thus syntactically ordered. The focus projection test in Example (46) provides first evidence that they seem to be syntactically ordered. Nevertheless, assuming that manner adverbials and internal locatives are syntactically ordered requires the assumption of another syntactic adjunct class beyond the five classes suggested by Frey and Pittner (1998b). The experimental evidence presented in Chapter 5 also points towards the direction that these two adverbials are syntactically ordered.

(46) Was ist passiert?
What has happened?

a. Das Mädchen hat [mit Elan$_{manner}$] [auf den FINGERN$_{loc.int}$] gepfiffen.
The girl has with verve$_{manner}$ on the fingers$_{loc.int}$ whistled

b. ?? Das Mädchen hat [auf den Fingern$_{loc.int}$] [mit ELAN$_{manner}$] gepfiffen.
The girl has on the fingers$_{loc.int}$ with verve$_{manner}$ whistled

3.3 Summary and outlook

The first part of this chapter focused on the semantic adverbial categories - propositional and event-modifying adverbials. The purpose was to motivate this categorization by semantic criteria. Moreover, I introduced five adverbials in more detail. Each adverbial type was analyzed from a semantic perspective. Furthermore, I applied base position tests, which I introduced in Chapter 2 in order to attest base serializations between the respective adverbials that I will pair in the experimental studies in Chapters 4, 5, and 6. The list in (47) summarizes the predicted base orders.

(47) a. sentence adverbial > domain adverbial (> subject)

b. domain adverbial (delimitator) > sentence adverbial > domain adverbial (base)

c. temporal adverbial > external locative

d. manner adverbial > internal locative

In the following chapter, I will focus on the psycholinguistic theory of sentence processing, more precisely, word order processing. Nonetheless, adverbials are an interface phenomenon, I will thus discuss research about processing of semantic phenomena and information-structural features that are related to the adverbials discussed in this section. I will argue that adverbial order processing cannot be reduced to the processing of syntactic movement.

4 | Adverbial order processing: Syntax and semantics in processing of adverbial order variation

A central task of sentence processing models is to describe the architecture of the human language processing system. The research on language processing has focused on the nature of syntactic parsing for a long time. The proposed models search to explain which kind of information the human processing system uses to generate an initial analysis and how different kinds of linguistic and non-linguistic information interact while building a structure. With regard to adjunct and adverbial processing, the past forty years of research on sentence processing leave many questions unaddressed, and not much is known about adverbial order processing.

This chapter focuses on the processing aspects related to adverbials and pivots around the question whether language processing is incremental. The chapter is divided into three main sections. The first one covers syntactic intricacies relevant to capture adverbial order processing, namely, word order processing and adjunct processing. I will begin by discussing the Garden-Path Model of sentence processing (e.g., Frazier, 1987) which can account for the processing of word order variations in complements in German to a large extent. Especially within syntactic processing models, it is mainly unchallenged that processing proceeds in an *incre-*

mental fashion, i.e., every input element is interpreted and integrated into the structure currently built as it is encountered (Marslen-Wilson, 1973; Altmann & Kamide, 1999). However, findings related to processing of ambiguous adjuncts challenged this immediacy assumption. Hence Frazier and Clifton (1997) developed *Construal*, a complementary theory to the Garden-Path model, which assumes distinct processing strategies for adjuncts without abandoning the strong immediacy assumption for complements.

The second section is dedicated to semantic processing. While numerous studies have been concerned with the question of incrementality and processing depth in syntactic phenomena, it is not very well understood whether semantic information is processed incrementally and, if yes, whether information is processed fully or only partially (e.g., Urbach & Kutas, 2010). More recent approaches that aimed to model semantic processing suggested that a linguistic input is not processed fully but rather in a shallow manner which results in underspecified or partial representations of the input. Structures are thus processed to an extent that is merely *good-enough* for the required demand (e.g., Barton & Sanford, 1993; Sanford & Graesser, 2006; Karimi & Ferreira, 2016). These models suggest that processing depth is modulated by input and demand, and that not more cognitive resources are consumed than necessary to fulfill the current demand. It has been suggested that semantic illusions (*How many animals did Moses bring on the Ark?* (Erickson & Mattson, 1981)) result from heuristic processing and underspecified representations. Susceptibility to semantic illusions are shown to be modulated by linguistic structure, i.e., passive structures which require more processing effort lead to higher illusion rates (Ferreira, 2003). In contrast, discourse focus can lead to lower illusion rates, as focused elements indicate that more attention to the information is required (Garrod & Sanford, 1994).

I will approach these questions regarding the time course of processing semantic phenomena step-wise. First, I will take a closer look at lexical semantic processing, mainly focusing on Frazier's (1999) work on interpretative processes during semantic processing. Second, I will discuss compositional semantic processing

by introducing Beck and Tiemann's (2019) 'Enlightened incrementality conjecture', a theory that searched to explain differences in time course in the processing of semantic phenomena by attempting to account for the gap between top-down psycholinguistic processing and bottom-up semantic composition.

The third section of this chapter I will provide an overview of research that has been conducted on adverbial order processing (Störzer, 2017; Gauza, 2018; Stolterfoht et al., 2019). Neither of the syntactic and semantic processing accounts discussed in this chapter can account for the entire pattern of results attested in previous studies on adverbial order processing. For this reason, I will consult findings from psycholinguistic studies on processing truth-conditional operators and event information. I will conclude that the decisive factor in adverbial processing is rather semantic in nature but interacts with the syntactic position of the adverbial. Furthermore, potential ambiguities of an adverbial affect the time course of processing.

4.1 Syntactic processing: word order processing

The *Garden-Path Theory* (Frazier, 1987) is one of the most influential theories of sentence processing. It is a *serial incremental two-stage model*. Language processing theories differ concerning the assumption of which kind of linguistic information is used to construct an initial structure and how distinct types of linguistic information interact during parsing. As a modular two-stage processing account, the Garden-Path Model assumes that an initial structure is constructed by applying syntactically determined parsing mechanisms. Modularity refers to the assumption that cognitive linguistic modules work separately from other cognitive modules such as auditory and visual processing (e.g., Fodor, 1983). Regarding sentence processing, the term modularity is usually understood in a more fine-grained way and states that the linguistic sub-domains do not interact, i.e., semantic information does not influence an initial syntactic parse. Initially, the parser has access only to syntactic categories of lexical items, and based on this information, the analysis is performed using syntactically determined parsing mechanisms. Other types

of information, such as semantic information, are only used in a second stage to evaluate and, if necessary, revise the initially built structure.

Methods with a high temporal resolution like ERP provide evidence for these independent stages (e.g., Friederici, 1995). Within the Garden-Path Model two basic parsing strategies are proposed: *Minimal attachment* (48) and *Late closure*[1]. Over the years, more principles have been introduced, such as the *Active Filler Strategy* (Frazier & Flores d'Arcais, 1989), mentioned in Chapter 1. These principles follow an underlying economy principle assuming that the parser constructs the simplest structure possible, which is computationally the least costly, as it is assumed that more complex structures require more memory resources (e.g., Gibson, 2000; Fiebach et al., 2001). Consider (49), Minimal attachment favors VP attachment and thus leads to an erroneous analysis of the bold area, which is mistakenly attached as the object of the matrix clause. This analysis causes problems in the underlined sentence-final region.

(48) **Minimal attachment:**
Do not postulate any unnecessary nodes! (Frazier, 1987, 562)

(49) The girl knows **the answer** to the math problem was correct
(Frazier, 1987, 564)

Numerous reading time studies provided evidence that there is a disruption in the disambiguating region, which was interpreted as evidence that the parser follows the postulated syntactic parsing principles and that non-structural information has no primary effect on the parsing of ambiguous sentences (Frazier, 1987).

Alternative explanations such as *Constraint Satisfaction* models (MacDonald, Pearlmutter, & Seidenberg, 1994; Tanenhaus, Spivey-Knowlton, Eberhard, & Sedivy, 1995), on the other hand, assume that processing occurs using diverse linguistic and non-linguistic sources of information. For example, the constraint-based parser has access to the lexical meaning and extra-linguistic information such as

[1] For space reasons, I only give an example for Minimal attachment, to exemplify the economic nature of the principles, the principles itself are secondary for the discussion of adverbial processing

plausibility from the beginning. Furthermore, the processor is assumed to maintain multiple analyses in parallel. Unrealistic analyses can be evaluated, taking context or frequency into account, and are inhibited if necessary. For a critical review of these processing theories consult Pickering and van Gompel (2006).

4.1.1 Two-stage processing of complements

Support for the syntax-first strategy postulated by the Garden-Path Theory comes from the processing of word order variations in German. German has a canonical subject-object (SO) order. However, deviations from this order are possible, e.g., by scrambling as discussed in Chapter 2. This dissertation is not primarily concerned with word order variations in complements, but I will briefly review the relevant insights from the processing of complement order. Only very few studies have been concerned with the processing of adverbial order, and a comparison between well-understood complement order with adverbial order is thus very helpful.

Evidence for difficulties in the processing of non-canonical complement serializations were obtained by Rösler et al. (1998). The authors investigated in an ERP study that participants while reading grammatical permutations of the canonical complement order of ditransitive verbs in German reveal ERP patterns that indicated processing difficulties. The authors interpreted this as an increased memory load that is required for the processing of non-canonical complement orders. Following the assumption that dislocated constituents leave traces in their base positions, it follows that the derived structure is syntactically more complex. An explanation related to syntactic working memory resources, which are consumed during the processing of filler-gap dependencies, was put forward by Frazier and Flores d'Arcais (1989) with the *Active Filler Hypothesis* (AFH) (50).

(50) **Active Filler Hypothesis**:

When a filler of 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.

(Frazier & Flores d'Arcais, 1989, 332)

Those principles, again, favor the simplest structure, which is a structure with all constituents in their base position. However, if a dislocated item is encountered, the filler-gap dependency should be resolved as fast as possible as it is assumed that fillers need to be held active in memory until the origin is detected. An elaborated attempt to quantify syntactic memory cost has been proposed within Gibson's (2000) *Dependency Locality Theory* (DLT). He suggested two types of processing cost: syntactic integration cost for new discourse referents that have to be integrated, while other elements have to be maintained in memory until they can be integrated. A second type of cost is caused by dependency length between a head and a dependent. Here only the latter are relevant. Evidence comes from processing of wh-dependencies (e.g., Fiebach et al., 2001) and subject and object relative clauses (Gibson, 2000; Traxler, Morris, & Seely, 2002). Even though Traxler et al. (2002) found evidence confirming the predictions made by the AFH and the DLT, they also found that the animacy of the subject played a role in first pass parsing of relative clauses. This is not predicted by the Garden-Path Model.

Compare Example (51), the canonical order is given in (51a) and the derived order of the complement DPs. Sentences as in (51), are particularly interesting, because the subject and the object DP are not clearly case marked. Even though German has a rich inflectional system, the accusative plural article *die* and the nominative singular article are ambiguous so that no cues about subject and object are given by morphology. The sentence remains ambiguous until the sentence-final auxiliary disambiguates the function of the DPs. These structures are a useful test case to investigate whether participants initially take up an SO parse or an OS parse. In online processing studies, it is measured whether comprehension difficulties arise by encountering the disambiguating region.

(51) a. Ich glaube, dass die Direktorin die Schüler angerufen hat.
I think that the headteacher$_{subject}$ the students$_{object}$ called has
'I think the headteacher called the students'

b. Ich glaube, dass die Direktorin die Schüler angerufen
I think that the headteacher$_{object}$ the student$_{subject}$ ART-NOM
haben.

'I think the students called the headteacher'

However, non-canonical complement linearization can be licensed by information structure. For example, the givenness of a moved constituent. A crucial question is whether information structure and context can mitigate purely syntactically driven preferences. Meng, Bader, and Bayer (1999) investigated ambiguous and unambiguous OS sentences with and without context. They found that unambiguous OS-sentences benefit from a licensing context, but the processing difficulties in ambiguous OS sentences cannot be eliminated by a restrictive context manipulation.

Similar results were obtained in neurophysiological studies by Stolterfoht and Bader (2004) and Stolterfoht (2005), who investigated the role of focus structural and prosodic marking in scrambled structures in ERP studies. Neither study found that information structure interacted with initial syntactic processing. It could be objected that these processing difficulties arise because the non-canonical structures are less frequent. Bornkessel et al. (2002) controlled for frequency by comparing less frequent but canonical dative object initial structures to the derived but more frequent counterparts. Their ERP study found that frequency does not facilitate order processing and that more frequent derived object orderings evoked a similar pattern as derived accusative object > subject orders. Frequency seemed to affect offline acceptability ratings but not ERP recordings. This is interpreted in favor of the claim that the initial processing is guided by syntactic preferences and is not sensitive to the frequency of word order as suggested by probabilistic models of sentence processing.

Finally, Paterson, Liversedge, and Underwood (1999) investigated the influence of the focus operator *only* on Garden-Path sentences. Compare Example

(52), while (52a) does not involve a focused constituent, (52b) does. They argue that focusing of the initial subject noun in the Garden-Path sentences should favor the reduced relative clause reading over the simple active reading and thus lead to lower Garden-Path rates. In an eye-tracking experiment they show, that participants were equally garden-pathed in both conditions. Interestingly, initial reading times for the *only horses* were higher than for the non-focused definite noun. They interpret the increased reading time on the focus operator + noun region as an indicator that the focus operator is interpreted fully and triggered a reading in which a subset of horses was established. This should favor a reduced relative clause reading of the ambiguous region. Nonetheless, a facilitation effect of the focus operator was only visible in re-reading times which suggests that initial parsing is guided by purely syntactic information and semantics, and information structure is only consulted in later processing stages.

(52) a. The horses raced past the barn fell.

b. Only horses races past the barn fell. (Paterson et al., 1999, 562)

In summary, numerous studies have found evidence that initial parsing is guided by syntax and only later processing stages are sensitive to other factors such as frequency, semantics, information structure, and plausibility in processing. Nonetheless, studies concerned with processing of adjuncts challenged the principles suggested within the Garden-Path-Theory. Several studies found that adjunct attachment does not follow purely syntactic principles but seems to take the semantic status of the attachment site into account(e.g., Clifton, Speer, & Abney, 1991; Gilboy, Sopena, Clifton, & Frazier, 1995; De Vincenzi & Job, 1993). In the following section, I will review findings regarding the processing of adjuncts which seemed to be problematic for the syntax-first strategy proposed by the Garden-Path Theory.

4.1.2 Processing of adjuncts and *Construal*

Despite the compelling body of evidence for the syntactically guided initial parsing decisions in complements, studies dealing with the syntactic integration of adjuncts showed rather heterogeneous patterns. First, Clifton et al. (1991) described

an *argument-over-adjunct* preference for prepositional phrases that are ambiguous between arguments and adjuncts. The decision about the attachment site, furthermore, was affected by probabilistic information, i.e., it is more likely to attach a PP to a verb than to a noun (Clifton et al., 1991, 267). The authors found that phrases are preferentially attached as arguments, and that argument attachment is faster than adjunct attachment. However, such a preference is not compatible with purely syntactically guided parsers. These parsers are not assumed to be sensitive to the distinction of adjuncts and arguments and should follow the same principles regardless of the input. Furthermore, it was observed that attachment preferences contradict Late Closure. In sentences with two head nouns that served as potential attachment sites for a relative clause, Late Closure predicts a general attachment preference for the lower DP. However, it was shown that there are mixed preferences and that these preferences can be modulated by semantic information such as referentiality or plausibility.

Furthermore, in adverbial and relative clauses attachment, there is a general preference to attach to the higher head noun. This was shown for several languages see Gilboy et al. (1995) for Spanish, De Vincenzi and Job (1993) for Italian, Konieczny, Hemforth, Scheepers, and Strube (1997) for German, and Hemforth et al. (2015) for a crosslinguistic study. Further evidence for distinct processing mechanisms between adjuncts and arguments comes from attachment ambiguities in adverbial clauses and secondary predicates, for a review, consult Frazier and Clifton (1997).

To account for these findings, Frazier and Clifton (1997) developed *Construal*, which is to be understood as a complementary theory to the Garden-Path Theory. Within Construal, different parsing mechanisms are considered for primary relations, i.e., obligatory constituents such as the verb and its arguments, and non-primary relations such as adjuncts. According to Construal, the parser makes a fundamental distinction between primary and non-primary relations. The Construal hypothesis is given in (53).

(53) a. Analyze an input, X, as instantiating a primary phrase if possible.

b. Otherwise associate X into the current thematic processing domain (the extended projection of the last actual theta-assigner).

(Frazier & Clifton, 1997, 280)

It is assumed that whenever possible, a phrase is preferentially interpreted as an argument, and second that the attachment of a non-primary relation can remain syntactically underspecified. A non-primary phrase will be loosely attached (associated) to the current thematic processing domain, and if there is more than one attachment site, it will be interpreted within this domain using non-structural information. Furthermore, if all attachment sites are rejected within the current domain, the structure has to be revised, and attachment outside of the current processing domain is possible. Extended projection is to be understood in the sense of Grimshaw (1991) (cited in: Frazier & Clifton, 1997, 280) (cf. 54).

(54) a. V $\Longrightarrow$ VP, IP, CP

b. N $\Longrightarrow$ NP, DP, PP (if P does not assign theta-role)

Construal assumes that different attachment principles hold for non-primary relations. While primary relations are attached following Minimal Attachment or Late Closure, non-primary relations can be interpreted anywhere in the thematic domain and will preferentially be interpreted with the most salient entity, which can be the highest DP,r a referential DP, or the subject. So far, Construal is the only full-fledged processing theory that attempts to account for the processing of adjuncts. However, the scope of the theory is limited to mechanisms that hold if there is a competition between attachment sites. Furthermore, it offers a syntactic explanation to adverbial processing. It focuses on the syntactic distinction of adjuncts and complements and runs danger of overgeneralizing and ignoring semantic intricacies of adverbials. To pay justice to the semantics of adverbials and the implications thereof on processing, I will discuss semantic processing theories and incremental processing of related semantic phenomena in the next section.

4.2 Semantic processing: Lexical and compositional processing

Over the past years, a growing number of investigations that focused on semantic processing. While the time course of processing syntactic information has been studied intensively, not much is known about (incremental) semantic processing. With regard to the processing of adverbial semantics, two main questions have to be addressed. First, how are adverbials processed on a lexical level. Since adverbials are notoriously ambiguous, it is crucial to understand when and how ambiguities in adverbials are resolved. The second question refers to the compositional semantic level. Adverbials interact with other linguistic information such propositional or event-related information. As discussed in Chapter 3, propositional and event-related adverbials differ in several semantic respects. These differences are also apparent in compositional interpretative principles: propositional adverbials have been analyzed as operators (e.g., Lang, 1979) or more specifically as quantifiers (Bellert, 1977; von Stechow & Beck, 2015), which operate on the proposition as a whole. Event-modifiers, on the other hand, are assumed to combine via predicate modification with the event argument provided by the verb (Davidson, 1967; Parsons, 1990). Not much is known about compositional processing. However, it has been suggested that the parser could have a preference for local and comparably less complex operations such as predicate modification (e.g., Frazier & Clifton, 2021). In the following, I will address these questions. First, I will give an overview of processing lexical ambiguities and derive predictions for adverbial processing. Afterwards, I will discuss Beck and Tiemann's (2019) Enlightened incrementality conjecture, a semantic processing account that deals with the time course of processing. The authors argue that the time course of processing is determined by LF configurations. Finally, I will take a look beyond adverbials, aa syntactic and semantic theories cannot account for the whole pattern of results attested for adverbial order processing. I will discuss the time course of processing for semantically related phenomena, i.e., operators and event-related information.

4.2.1 Processing of lexical ambiguities

Frazier (1999) offers a revised version of the strict immediacy assumption regarding interpretative processing. She argues that in semantic processing, it is not always necessary to decide immediately between potential analyses as the semantic processor can deal with vagueness. In contrast, as discussed above, the syntactic parser is assumed to proceed in a serial-incremental fashion and cannot delay structural decisions (such as attachment site or part of speech). In the following, I will apply Frazier's (1999) argumentation of lexical processing to ambiguity resolution in adverbials. As for the lexical processing, Frazier (1999) suggested that interpretative preferences are modulated by the exact nature of the lexical ambiguity. Based on experimental data reported in Frazier and Rayner (1990), she argues that the parser deploys different strategies for homonyms as opposed to polysemous word. For the former, she argued for *immediate partial interpretation*, which requires an immediate commitment (cf. 55), whereas polysemous words require *minimal semantic commitment* (cf. 56).

(55) **Immediate partial interpretation:**
Perceivers must choose between grammatically incompatible meanings of a word or constituent immediately, by the end of the word or constituent.
(Frazier, 1999, 50)

(56) **Minimal semantic commitment:**
Premature or arbitrary semantic commitments (concerning words) are made only when forced by (55). (Frazier, 1999, 50)

Frazier (1999) interprets the delayed disambiguation for polysemous words as evidence for partial immediacy: in case of uncertainty, a commitment to a 'family of senses' is made, but certain options might be eliminated as more information becomes available (Frazier, 1999, 50).

It has been shown for homonyms that frequency of senses and context have a boosting effect on activation levels. Thus more frequently used readings or interpretation which are supported by the context will be favored (Swinney, 1979;

Duffy, Morris, & Rayner, 1988). This does not seem to be the case for polysemous words: Processing studies found that, for polysemouos words, the frequency of a certain reading has no effect on word interpretation or lexical decision (Frisson, 2009). Those results suggest that different meanings are not ranked by e.g., frequency or context support, which is the case for homonyms. Furthermore, it has been shown that the fact whether an ambiguous word has multiple related senses does not affect the latency of a lexical decision or the reading time negatively (e.g., Rodd, Gaskell, & Marslen-Wilson, 2002). Frisson and Pickering (1999) take up the idea, that for words with related senses, an underspecified semantic representation is construed while processing. Specification of meaning can be required in certain cases, for instance, when the task required to do so or when the word is focused.

Polysemous adverbials are very common. In McConnell-Ginet's (1982) famous example, repeated here as (57), the adverbial *rudely* can be considered polysemous, as the core meaning of both usages in (57a) and (57b) refers to an evaluation of the Claire's behavior. However, the linear positions of the adverbials serve as cues to eliminate less likely interpretations, which is a manner reading in (57a) and a subject-oriented reading in (57).

(57) a. Rudely, Claire greeted the queen.

b. Claire greeted the queen rudely.

As discussed in Chapter 2.2.4, adverbial position is correlated with the adverbial meaning. Moreover event-modifying adverbials are ruled out in sentence-initial position (Ernst, 2004b). Nonetheless, the absence of supporting information, such as positional information, can result in underspecification of adverbial meaning as no commitment might be required or possible. Adverbial meanings are often related, and underspecification seems to be an economical choice. However, the compositional intricacies of different adverbials also need to be taken into account. Considering the contrast in (57) again, it can be assumed that the adverbial in (57a) operates on the entire proposition, while (57b) combines with the event argument. If no commitment to an adverbial interpretation is made, it follows that composition cannot proceed as it depend on the exact meaning contribution of the adverbial.

In these cases, the different readings have consequences on compositional mechanisms and an immediate commitment might be required, i.e., **immediate partial interpretation** holds. Nevertheless, the role of semantic composition in incremental language processing is not very well understood. It is problematic, that semantic composition is assumed to proceed in a bottom-up fashion while language processing combines top-down and bottom-up components (Bader, 1996; Beck & Tiemann, 2019). In the following, I will discuss Beck and Tiemann's (2019) model as an attempt to reconcile between language processing and semantic composition.

4.2.2 Incremental processing and semantic composition

Beck and Tiemann (2019) refrained from the idea of a strictly incremental parser by arguing that the parser is working neither in a purely incremental nor exclusively global fashion. They suggest, that the system deploys distinct processing strategies based on the linguistic input. However, their semantic processing account is very different, as it is taking semantic LF domains as increment sizes.

(58) **Enlightened incrementality conjecture:**
Units in the same LF domain (DP, VP, TP, AspP) are composed incrementally. (Beck & Tiemann, 2019, 156)

The Enlightened incrementality conjecture attempts to compromise between conflicting demands, namely working memory load in the sense that it is inefficient to wait until the end of an utterance to compose separate meanings, and reliability of predictions, assuming that composition should only start if there is enough confidence for an interpretation. Beck and Tiemann (2019) argue that predictive, i.e., immediate composition occurs in local LF domains, where confidence for a target interpretation is high. Nonetheless, the Enlightened incrementality conjecture is a post-hoc explanation for a range of selected phenomena. Beck and Tiemann (2019) offer a formal semantic analysis for each phenomenon they reviewed, and derived exact processing strategies and heuristics to explain the experimental findings. One has to be cautious in deriving predictions from the Enlightened incrementality conjecture without a formal semantic analysis, as Beck and Tiemann (2019) argue that

processing is type-driven, and LF layers are strictly defined by semantic types. Especially for propositional adverbials, the LF position depends on the lexical usage, i.e., reading of an adverbial, thus a generalization across adverbial types can be problematic.

Nevertheless, the Enlightened incrementality conjecture is phrased so that predictions beyond the discussed phenomena can barely be tested. Processing, according to the Enlightened incrementality conjecture, is assumed to be incremental within one LF domain (and delayed across LF domains), if there is enough confidence for an interpretation. Beck and Tiemann (2019) define confidence, referring to constraint-based parsing models (e.g., Tanenhaus et al., 1995). Confidence can thus be gained from context, frequency, or plausibility. This definition, however, makes these claims hard to test, and, like in constraint-based models, it is not well defined what constitutes confidence and what is the threshold of *enough* confidence for a parse to be pursued.

I will refer back to Beck and Tiemann's (2019) theory in Section 4.3.1, where I will discuss previous studies on adverbial order processing.

4.3 Adverbial order processing

In this section, I will review studies that have been conducted on adverbial order processing, which I already mentioned. I will first focus on studies by Störzer and Stolterfoht (2013), Störzer (2017), and Gauza (2018), and the review article of these studies (Stolterfoht et al., 2019). These studies have been the starting point for my experimental work, and thus, I will discuss them in more detail.

4.3.1 Previous studies on adverbial order processing

Only very few studies, so far, investigated the time course of adverbial order processing. The studies that have been conducted yield a rather mixed, yet robust, pattern of results with regard to the time course. Störzer and Stolterfoht (2013) and Störzer (2017) investigated the processing of adjacent sentence adverbials and locative frame adverbials in their assumed base order (59ba) and the derived

order (59bb). They found that deviations from the assumed base order (sentence adverbial > frame adverbial) lead to an **immediate** increase in reading times.

(59) a. Eva meint, dass wahrscheinlich$_{SAdv}$ auf Mallorca$_{frame}$ alle Urlauber
Eva thinks that probably$_{SAdv}$ on Majorca$_{frame}$ all tourists
betrunken sind.
drunk are.

b. Eva meint, dass auf Mallorca$_{frame}$ wahrscheinlich$_{SAdv}$ alle Urlauber
Eva thinks that on Majorca$_{frame}$ probably$_{SAdv}$ all tourists
betrunken sind.
drunk are.
'Eva thinks that probably in Majorca all tourist are drunk.'

(Störzer & Stolterfoht, 2013, 61)

I discussed in Section 3.2.2, that referential frame adverbials can function as aboutness topics. Störzer (2017) and Störzer and Stolterfoht (2018) observed that the referential status of frame adverbials interacts with positional preferences. They found that non-referential and thus non-topical frame adverbial are preferred in their base position below sentence adverbials. A referential frame adverbial can move across the sentence adverbial into a designated medial topic position adjacent to the sentence adverbial. However, these preferences are only visible in acceptability judgment experiments. The reported reading time studies only showed a penalty for the derived order regardless of referential status.

Furthermore, Gauza (2018) investigated the time course of processing between manner adverbials and the direct object in the assumed base order (60a) and the derived order (60b). He attested evidence for the base order but only in offline studies. These preferences can be modulated by the definiteness of the object NP. However, reading time studies did not show an order effect. He concludes that order variations between manner adverbial and the direct object are processed with a **delay**.

(60) a. Elisabeth sagt, dass Björn das Gedicht laut$_{manner}$ vorgetragen hat.
Elisabeth says that Björn the poem loudly$_{manner}$ performed has

b. Elisabeth sagt, dass Björn das Gedicht laut$_{manner}$ vorgetragen hat.
Elisabeth says that Björn the poem loudly$_{manner}$ performed has
'Elisabeth says that Björn performs the poem loudly.'

(Gauza, 2018, 30)

An attempt to reconcile these heterogeneous time course patterns for different adverbial types was made by Stolterfoht et al. (2019). The authors evaluated the findings in the light of the two processing theories mentioned above, Construal and the Enlightened incrementality conjecture. They argued that the immediate effects for sentence and frame adverbials attested in Störzer and Stolterfoht (2013) and Störzer (2017) are compatible with the Enlightened incrementality conjecture because it predicts immediate composition for elements within the same LF domain, if there is enough confidence for an interpretation. As discussed earlier, sentence and frame adverbials are assumed to be base generated in the same LF domain (CP) above the proposition (mapped onto TP). The findings reported in Gauza (2018) are not in line with the predictions derived from the Enlightened incrementality conjecture as the direct object and the manner adverbial are both located within the VP and should thus be composed immediately. The authors interpreted the order effects for manner adverbials and the direct object as delayed effects, because they were visible in offline but not in the online experiments. These patterns were interpreted as evidence for Construal, and incompatible with the Enlightened incrementality conjecture. The fact that neither theory can capture the entire pattern of findings, is highly problematic for a model of adverbial order processing. Stolterfoht et al. (2019) offered a third option to account for the mixed pattern of results, similar to the Enlightened incrementality conjecture, referring to the LF structure and the relation of the adverbials to the domain they modify: adverbials that are located outside of the domain they modify can be processed incrementally, and adverbials located within the LF domain they modify will be processed with a delay. The former case refers to the propositional adverbials which are located in the CP above the proposition in TP, the latter case describes the manner adverbials as they are located within VP modifying parts of the event. This explanation was tested with a set

of different adverbials in the described LF configurations in Specht and Stolterfoht (2022) which is the core of Chapter 5.

Before addressing the processing of related semantic phenomena, I will review the applicability of the above-mentioned processing theories on the processing of adverbial order. First, Störzer (2017) argues that her results, i.e., immediate effects for sentence and frame adverbials contradict Construal. On the other hand, the order effects that were only visible in the acceptability judgment but not in reading times in Gauza's (2018) data were interpreted as evidence for Construal.

As I introduced earlier, Frazier and Clifton's (1997) theory takes the extended projection of the last theta assigner as a processing domain. However, in both Störzer's (2017) Gauza's (2018) items, the extended domain of the last theta assigner is the entire embedded clause, in which the adverbials are located. Construal states that an adjunct phrase is syntactically loosely attached to the domain of the last theta-assigner and interpreted within this domain under use of syntactic and non-syntactic information. Disruptions in processing occur if interpretation within the domain of the last theta-assigner is not possible, and this structure has to be revised accordingly. In the cases mentioned above, this domain is the entire CP. A structural revision of the sentence is neither required in Störzer and Stolterfoht (2013) nor in Gauza (2018). Hence Construal would not predict processing problems or disruptions for the moved adverbials.

Furthermore, Construal provides a strategy the parser pursues in case of competing attachment sites for an adjunct. Based on experimental evidence that reported a strong reading time penalty for a repair in argument attachment compared to a minor reading time increase for a repair in secondary predicates i.e., adjuncts, Frazier and Clifton (1997) concluded that adjuncts are only *associated* to a domain, association is to be understood as a type of syntactic underspecification, which the authors assume to be tolerable in the case of non-primary phrases, i.e, adjuncts. It has to be noted that increased reading times are only predicted if there is evidence that the initially built structure must be revised. To my understanding, for adverbial order variations, Construal does not predict processing difficulties. Order effects

are a reflex of a syntactically guided parser. If, however, for adjuncts, it is assumed that non-structural information is available in a first pass, order effects are ruled out.

Again, the immediacy of effects for frame and sentence adverbials was taken as evidence for the Enlightened incrementality conjecture, and the absence for immediate effects for manner adverbials in the direct object as problematic for the Enlightened incrementality conjecture. However, as I mentioned in Section 4.2, Beck and Tiemann argue that processing is bound to local LF layers, and these layers are explicitly defined by semantic types. Henceforth, immediate processing is predicted for event descriptions, as they are tied to VP (type <*e,t*>), and for temporals within TP <*i,t*> (von Stechow & Beck, 2015). The compositional analysis of frame adverbials is not entirely clear to me, the Enlightened incrementality conjecture would only opt for incremental interpretation if frame adverbials would be of type <i> and thus composed within TP. Without an explicit temporal meaning contribution, it does not seem justified to assume that they are located within TP. Moreover, Beck and Tiemann (2019) do not make any claims concerning processing within CP. This, I believe, because they restrict their claims to the phenomena they analyzed, and none of these phenomena involves the CP.

In summary, the pattern of results regarding the time course in adverbial order processing is indeed puzzling. None of the processing accounts presented can consider for this entire pattern. In search for a unifying account to explain the data, I will test the above-mentioned explanation put forward by Stolterfoht et al. (2019), which is the time course of processing is modulated by the position of the adverbials at LF and the relation to their modified domain. They propose that adverbials located outside of their modified domain can be processed immediately and adverbials located within their modified domain with delay. They, furthermore, suggest that adverbials modifying the proposition do not need to combine with any element within the proposition, whereas manner adverbial depend on information provided by the verb. This latter explanation results in different predictions regarding time course for propositional and event-related information. I will consult studies that were concerned with the processing of operators, which like propositional adver-

bials, do not require access to the proposition and different types of event-related information that is construed by information that is scattered over a larger unit, i.e., the event description. Given the diverse ways adverbials interact with other types of linguistic information in the sentence, I believe that adverbials cannot be treated as a natural class that is processed uniformly. In the following, I review psycholinguistic studies on incrementality in the processing of operators and propositional information and event information.

4.3.2 A look beyond adverbial processing

In the previous section, I introduced syntactic as well as semantic processing theories. However, none of the theories captures the full picture of adverbial order processing. In the following, I will discuss processing phenomena that I believe are related to the adverbials under investigation. I will argue that the dichotomy of propositional vs. event-modifying adverbial modulates the time course of processing due to how these two semantic adverbial types interact with their respective modification domain. I will discuss studies that investigated the processing of other operators and argue that truth-conditional information i.e., information concerning the propositional level, is processed very fast. Moreover, I will give an overview of studies that corroborate the claim that event-related information is processed with delay.

4.3.3 Processing of truth-conditional operators

I laid out in Chapter 3 how propositional adverbials interact with the proposition. Namely, that sentence adverbials take scope over the entire proposition and express a speaker's commitment to the proposition. Frame and domain adverbials, on the other hand, restrict the proposition to a locative or temporal frame or an interpretation domain. Crucially, the adverbials do not require access to the proposition but are rather analyzed as truth-conditional operators. It is thus reasonable to step aside from adverbial processing and review the broader picture of incremental processing of operators.

Early works on the processing of truth-conditional operators suggested that operators such as quantifiers and negations are not processed incrementally but in two stages. Namely, the unnegated proposition is processed first, and the negation is applied in a second stage (e.g., *'a robin is not a tree*') would be processed in a way that initially ('*a robin is a tree*') is processed, and subsequently the negation is applied (Carpenter & Just, 1975). Experimental evidence for the delayed processing of these operators is reported in Kounios and Holcomb (1992), who were there first to investigate quantifier comprehension in an ERP experiment. They did not find immediate effects of positive or negative quantifiers.

However, more recent studies point to the direction that quantifiers and operators are processed at least partially incrementally. Urbach and Kutas (2010) investigated the real-time processing of non-logical quantifiers (*most* and *few*) as well as quantificational adverbials (*often*, *rarely*) in isolated sentences. The authors presented sentences like in (61). where the quantifiers are paired with either typical or atypical objects. They conducted an ERP study and hypothesized that if the quantifiers are processed fully and incrementally an effect should be visible as soon as the atypical objects are encountered. A complementary offline plausibility rating found a pronounced interaction of typicality and quantifier meaning, indicating that the full meaning of the quantifier is available at the end state. However, this effect was only partially mirrored in the online study, as the effect did not show to the same extent, especially because the difference was less pronounced for *few*-type quantifiers. The authors conclude that operators are processed immediately, but not fully, and that the depth of processing is modulated by operator type, since the effect for most-type quantifiers was more pronounced than for few-type quantifiers.

(61) a. Most/ few farmers grow crops/ worms.

b. Farmers often/ rarely grow crops/ worms.

(Urbach & Kutas, 2010, 161)

Urbach, DeLong, and Kutas (2015) replicated this study but used prior context in their study and found that processing depth can be modulated by supporting context. Those studies indicate that non-logical operators are processed incremen-

tally, but rather partially, processing depth can be modulated by supporting context. Other studies have found that operators are processed highly incrementally and fully (e.g., Nieuwland & Kuperberg, 2008; Freunberger & Nieuwland, 2016).

Furthermore, there is experimental evidence that truth-conditional adverbials are processed highly incrementally: Arkhipova, Sostarics, Law, Xiang, and Yee (2019) report evidence from an ERP study showing that the sentence-initial concessive adverbial '*nonetheless*' is processed immediately and affects expectations about the truth value of the upcoming proposition. Nieuwland and Martin (2012) provided evidence from the processing of counterfactuals. Their study shows that information given by restricting context can be used immediately during semantic processing.

In conclusion, recent evidence from studies that used methods with a high temporal resolutions provided evidence that information about the propositional truth value is processed highly incrementally. Since sentence adverbials are analyzed as truth-conditional operators (e.g., Lang, 1979), and domain adverbials resemble logical operators (Bellert, 1977), I suggest they are processed highly incremental. I will provide experimental evidence for these claims in Chapters 5 and 7.

4.3.4 Event processing

Despite the vast amount of semantic investigations of event structures since the advent of Davidson's (1967) framework, psycholinguistic investigations about the processing of events are only a rather recent development. It has been observed that eventive verbs are harder to process than stative verbs (Gennari & Poeppel, 2003). Furthermore, it has been noted that events are semantically complex because besides argument- and thematic structure, causation and internal event structure have to be processed (McKoon & Macfarland, 2000, 2002). Interestingly, Gennari and Poeppel (2003, B34) observed that the more complex an event structure, the longer it takes to access these structures. Even though this study was not concerned with the processing of event modification, some conclusions might be derived from their

findings. It can be assumed that event-modifying adverbials add further semantic complexity to the event description and thus result in a higher processing effort.

Insights into the time course of the processing of event-modifying adverbials can largely be drawn from mismatch paradigm studies about temporal and aspectual processing. First, Bott (2013) and Bott and Gattnar (2015) investigated the time course of aspectual processing utilizing a mismatch paradigm, an example item from their study is given in (62).

(62) Ganze zwei Stunden *erreichte der Bergsteiger den Gipfel
Whole two hours reach.PAST-SG the mountaineer the summit.
(Bott & Gattnar, 2015, 16)

Aspect in German is not grammatically encoded. Even though lexical aspect is assumed to be encoded in the verb's semantics (Vendler, 1957), aspectual meaning and Aktionsart can depend on the interaction of the verb and its arguments (Bott & Gattnar, 2015, 7). These studies found that for German, an aspectual mismatch between an adverbial and the Aktionsart of the verb is only detected after the verb received all of its arguments, i.e., after the event description is complete. The authors suggest that increment sizes are not fixed and that it is not necessarily the case that incrementality means that processing proceeds in a *word-by-word*-fashion. Certain structures can call for different mechanisms as an adaption to the grammatical system of a language. It has to be compromised between increased working memory load on the one hand, as immediate interpretation reduces working memory load, and on the other hand, of avoiding risks of costly reanalyses (Bott & Gattnar, 2015). Bott and Gattnar (2015) showed that in Russian, a language with morphological aspect marking on the verb, mismatches are detected immediately, unlike in German, where processing only took place after the entire event was present. It seems that the parser opts for immediate composition when enough information is present but, in case of uncertainty, awaits the relevant information. Similar findings are reported in Dickey (2001), who investigated the processing of tense in case a *minimal event* structure is available. He obtained evidence that full interpretation of temporal in-

formation from the AspP and the TP is delayed until information about telicity and event type is available (Dickey, 2001, 216).

Furthermore, Biondo (2017) provides evidence from agreement violations. In her dissertation, she investigated the time course of detecting agreement violations between temporal adverbials and verb tense in Italian, English, and Spanish. She found that mismatch detection for agreement violation between a temporal adverbial and the verb differed from subject - verb agreement violations. Moreover, the temporal mismatches were detected later across methods (eye tracking and self-paced reading), and affected a global rather than a local level, as compared to syntactic violations that cause an immediate pertubation that quickly returns to base line (Biondo, 2017, 214). This finding conforms with Bott and Gattnar's (2015) late effects for aspectual mismatches in German.

Moreover, Biondo (2017) investigated how the adverbial position affects time course of temporal mismatch detection between the information expressed by the temporal adverbial and the verb tense. An example sentence from her Spanish study is given in (63) which showcases the two different positions for temporal adverbials in combination with matching and non-matching verb tense. She reported that the time course of processing differed when the adverbial was in sentence-initial position compared to the adverbial in verb-adjacent position. In sentence-initial position, mismatches were detected immediately and the time course resembled the time course of subject-verb mismatch detection. Biondo (2017) argues that the difference between sentence-initial and pre-verbal adverbials is due to an anchoring process, as the deictic temporal adverbials need to be anchored to the context. She argues that in the initial and thus verb-distal position, there was sufficient time to initiate this anchoring process. The anchoring in the verb-adjacent position co-occurs with other processing steps and is thus not visible.

(63) a. Mañana temprano los comerciantes *emperezaron/ empezarán las
Tomorrow early the vendors begin-FUT/ begin-PAST the
rebajas de venta.
reduction of sales

b. Los comerciantes mañana temprano *emperezaron/ empezarán las
The vendors tomorrow early begin-FUT/ begin-PAST the
rebajas de venta.
reduction of sales

(Biondo, 2017, 129)

In line with my discussion in Section 2.2.4, I propose a potential alternative explanation to the findings in Biondo's dissertation. Since temporal adverbials can be ambiguous, the processing differences observed in Biondo (2017) could be caused by the semantic differences beween the adverbial readings modified by their position. At least some of the temporal adverbial in the fronted position can be interpreted as temporal frame adverbials (see (63), and can thus be understood as propositional adverbials with discourse-structuring purpose. The observed differences for temporal adverbials in Biondo's study could thus also be the result of qualitative differences in the processing of semantically different adverbials, i.e., event-modifying and propositional adverbials. in a verb-adjacent position, they are interpreted as event-modifying adverbials. In the pre-verbal position, the effect was less pronounced, which also points towards the direction that the temporal adverbials in her studies differ.

This review of related phenomena showed two main trends concerning incremental processing. On the one hand, truth-conditional information that operates on a propositional level is processed incrementally. On the other hand, semantic information that modifies the event description, such as temporal or aspectual information, seems to be processed with a delay and semantic violations are only visible until the event description is complete. Event information is scattered across a sentence, and event meaning is available when the adverbials, the verb, and the complements are composed. The online experiments reported in Biondo (2017) show that the processing system for event modification is taxed differently compared to agreement violations for subject and verb and also for sentence-initial adverbials. These findings are compatible with the immediate effects attested for frame and sentence adverbials (Störzer & Stolterfoht, 2013; Störzer, 2017) and the delayed effects for manner adverbials and the direct object (Gauza, 2018).

4.3.5 Summary and outlook

This chapter has introduced relevant sentence processing models and findings from word order processing for complements and adjuncts. None of the presented processing theories, neither syntactic nor semantic, can fully capture the heterogeneous pattern of results attested for the time course of adverbial order processing.

I summarized studies concerned with adjunct processing and adverbial order processing and showed that the findings yield a rather heterogeneous picture with regard to the time course, namely that high adverbials are processed highly incrementally. In contrast, lower adverbials only showed late effects. These patterns can hardly be explained with existing processing theories. I argued that the time course of adverbial processing is determined by the semantic contribution the respective adverbial has to the sentence meaning and, how the information within a sentence interacts. As for propositional adverbials, they do not interact with proposition-internal information, but they affect the proposition on a global level, immediate processing is thus more cost efficient than consuming memory resources to process them at a later stage. Event-modifying adverbials depend on an event argument (Davidson, 1967), and they interact tightly with the event structure, as they interact with temporal, aspectual information, and with the information given by the verb. I argue that event-modifying adverbials are processed with delay when enough information is available.

In summary, the attested pattern of results for the time course in adverbial order processing leaves many open questions. The following chapter, which includes the article Specht and Stolterfoht (2022), attempts to explain the inconsistencies regarding incrementality. In this chapter I discussed a possible answer, which has been raised by Stolterfoht et al. (2019) in order to reconcile the heterogeneous pattern of results of adverbial order processing. The authors offer a potential explanations for the attested pattern of results by attempting to capture the differences between sentence and frame adverbials on the one hand and manner adverbials and the direct object on the other. They refer to the relative position of the adverbials to the modified domain at LF. Sentence and frame adverbials are assumed to

be located outside the LF position they modify and do not need to await specific information within the modified LF domain and can thus be integrated immediately. Manner adverbials on the other hand are located within the domain they modify and need to await information provided by the verb. They propose that they are processed only when the entire LF domain, i.e., the verbal information is present. I captured their proposal in sub-question 1:

• Does the position of the adverbials at LF and their relation to the modified domain determine the time course of adverbial order processing?

In next chapter, I will report two studies that have tested this explanation by introducing four semantically different adverbial types, which resemble the above-mentioned configurations at LF. I created experimental materials with adverbial types that are matched in pairs of two adjacent adverbials, which are presented in their assumed base order and in the derived order. To exclude potential confounding factors of earlier studies, I created materials only with adverbials and not complements as the complement status of the direct object in Gauza (2018) could have affected the results.

5 | Incrementality in the processing of adverbial order variations in German

This chapter consists of the article published as:

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Abstract

Research on the processing of word order variations has shown that deviations from the canonical word order in German induce processing difficulties (see e.g., (Rösler et al., 1998), among many others). These findings provide evidence for a high degree of incrementality in complement processing. Furthermore, the results can be interpreted as evidence for the claim that complement processing is guided by syntactic information (Frazier, 1987). Studies concerned with the processing of adjuncts, however, show that their interpretation is influenced by non-syntactic information and that the degree of incrementality differs for adjuncts and complements (Clifton, Frazier, & Rayner, 1994).

The current study focuses on the role of incrementality in the processing of adverbials. Previous experimental studies provided evidence for base positions of ad-

verbials in the German middlefield. Processing of adverbials in non-base positions leads to higher processing costs. However, these studies also yield mixed results with regard to the time course of adverbial processing (Gauza, 2018; Störzer, 2017; Stolterfoht et al., 2019). Movement of certain adverbial types lead to an immediate increase in reading times. The attested increase in reading times, however, was not found for all types of adverbials. In two online reading time experiments, we tested two different explanations for the heterogeneous results with regard to the time course. The first is a syntactic explanation, which refers to the different configurations of the adverbial and its modified domain at LF; the second one refers to the semantic type of the modified entity (i.e., proposition, event, or process). Our results speak in favor of the second approach.

5.1 Background: Processing of adverbial order variation

Several studies have shown that sentence processing proceeds in a highly incremental fashion. The notion of incrementality in sentence processing refers to the well-attested assumption that the human parser performs a fine-grained analysis of a linguistic structure in which each input element is being analyzed immediately (e.g., Marslen-Wilson, 1973; Altmann & Kamide, 1999). One influential model of sentence processing is the *Garden-Path Theory* (Frazier, 1987), according to which syntactic information influences the initial stage of processing. The Garden-Path Theory is a modular two-stage language processing approach, which states that initial processing is guided by purely syntactic parsing principles. However, it has been observed that adjuncts and arguments differ in several respects when it comes to processing (see e.g., Clifton et al., 1991). The Garden-Path Theory, as a syntax-first model, cannot account for adjunct processing to the same extent as it does for complements. The overall picture seems to be that in many cases no clear structural preferences for adjunct attachment can be found. To fill the explanation gap, Frazier and Clifton (1997) proposed *Construal* as a complementary theory to the Garden-Path Theory. Within Construal, the authors distinguish between *primary-relations* (roughly complements), which are parsed highly incre-

mentally according to the syntactic principles of the Garden-Path Theory and *non-primary relations* (adjuncts), which are at first only loosely associated to the domain of the last theta-assigner i.e., most recent theta-assigner before the adjunct is encountered.[1] Attachment occurs only in later processing steps in which all sorts of non-syntactic information is available. Consequently, no immediate effects are expected for adjuncts.

Word order processing in German, a language with relatively flexible word order, provides evidence for the mechanisms proposed by the Garden-Path Theory. Several studies have shown that topicalization as well as scrambling of complements leads to processing costs. Futhermore, online processing studies have provided evidence that processing costs for non-canonical argument order can be modulated by non-syntactic factors such as context or focus, but order preferences are not entirely overridden by these factors (e.g., Meng et al., 1999; Bornkessel, Schlesewsky, & Friederici, 2003; Stolterfoht, 2005).

Only very few studies have investigated word order variations with adverbials. The studies conducted so far yield a mixed pattern of results with regard to the time course of processing. Stolterfoht et al. (2019) report a series of online and offline studies on adverbial order variations in German with different types of adjacent adverbials. Order preferences in the studies were either tested between different adverbial types (Störzer, 2017) or between adverbials and arguments (Gauza, 2018; Störzer & Stolterfoht, 2018). The hypotheses for the reported studies were derived from base position accounts for adverbials (e.g., Frey & Pittner, 1998b; Frey, 2003), assuming that adverbials, like complements, are assigned to base positions in the German middlefield and can undergo scrambling. Frey and Pittner (1998b) and Frey (2003) argue that adverbials in German and English are categorized into five semantically defined classes. Each class has a syntactic base position whereas adverbials within the same class are not ordered

[1] Note that the description and the predictions derived from the Construal framework in this chapter differ from the discussion in Chapter 4. This is due to the fact that this dissertation was written cumulatively and the understanding by the time Chapter 5 and the corresponding article was written differed. For the overall argumentation, please refer to the discussion in Chapter 4.

syntactically, but might exhibit a semantically driven preference for a certain order. The base positions of the adverbials are reflected in c-command relations to other adverbials, the arguments, and the finite verb. The postulation of base positions for adverbials has implications for language processing. The ovement of adverbials thus should lead to higher processing costs, and acceptability ratings should reflect a preference for the base order. A more detailed overview of the predictions for adverbial positions derived from the base order account is given in Section 5.1.2. As the studies presented in this paper are an attempt to reconcile the mixed pattern of results exhibited in the studies mentioned earlier, we will give an overview of relevant findings on adverbial order processing. Based on these findings, we will develop our hypotheses and present our study.

5.1.1 Previous experimental studies

Störzer and Stolterfoht (2013) compared reading times for the base order to the reverse (henceforth: derived) order of speaker-oriented sentence adverbials (e.g., *leider* 'unfortunately', *wahrscheinlich*, probably') and locative frame adverbials. Locative frame adverbials are frame-setting modifiers that restrict the validity of a proposition to certain places given by the adverbial (Maienborn, 2001). The frame adverbial in Example (64b) restricts the validity of the proposition to Majorca.

(64) a. Eva meint, dass wahrscheinlich$_{\text{SAdv}}$ auf Mallorca$_{\text{frame}}$ alle Urlauber
Eva thinks that probably$_{\text{SAdv}}$ on Majorca$_{\text{frame}}$ all tourists
betrunken sind.
drunk are.

b. Eva meint, dass auf Mallorca$_{\text{frame}}$ wahrscheinlich$_{\text{SAdv}}$ alle Urlauber
Eva thinks that on Majorca$_{\text{frame}}$ probably$_{\text{SAdv}}$ all tourists
betrunken sind.
drunk are.
'Eva thinks that probably in Majorca all tourist are drunk.'

(Störzer & Stolterfoht, 2013, 61)

Störzer and Stolterfoht tested whether the movement of the frame adverbial out of its base position across the sentence adverbial[2], as illustrated in Example (64b), leads to processing costs. They found an immediate reading time penalty in the region of the adverbials with significantly lower acceptability ratings for the derived order. Similar online effects and the offline preference for the base order were found by Störzer and Stolterfoht (2018), who compared order preferences for sentence adverbials and the subject in the base and the derived order. It should be noted though that in this case, the immediate effect on reading times might be caused by the subject and not by the movement of an adverbial. The studies conducted so far suggest that the parser immediately integrates high adverbials, like sentence and frame adverbials.

Finally, Gauza (2018) tested order preferences for manner adverbials and the direct object. Unlike the studies mentioned above, he did not find an effect on reading times caused by the movement of the manner adverbial out of its base position across the direct object. Example (65b) shows the manner adverbial in its base position below the direct object. However, the preference for the base order was observed in the offline judgment data.

(65) a. Elisabeth sagt, dass Björn das Gedicht $\text{laut}_{\text{manner}}$ vorgetragen hat.
Elisabeth says that Björn the poem $\text{loudly}_{\text{manner}}$ performed has

b. Elisabeth sagt, dass Björn das Gedicht $\text{laut}_{\text{manner}}$ vorgetragen hat.
Elisabeth says that Björn the poem $\text{loudly}_{\text{manner}}$ performed has
'Elisabeth says that Björn performs the poem loudly.'

(Gauza, 2018, 30)

Based on the previous findings, and with the assumption of a tight syntax-semantics mapping, we derived two possible explanations for the data pattern in adverbial order processing, namely a syntactic and a semantic explanation. The syntactic explanation refers to the position of the adverbials in relation to their modified domain at LF. Beck and Tiemann (2019) observed that LF domains play an important role in incremental language processing. The adverbials in the mentioned studies differ

[2] In all of the reported experiments, the adverbials were adjacent to each other.

with regard to their position at LF: the adverbials in Störzer and Stolterfoht (2013, 2018) yielded immediate effects in reading times. Both adverbials are base generated in CP and modify the TP. Hence they are located outside of the domain they modify. Gauza (2018), however, attested no online effects for order variations of a manner adverbial, which is base generated within the LF domain it modifies (the VP). From our syntactic explanation, we derived the following two predictions:

1) Adverbials that are base generated external to the LF domain (CP, TP, VP) they modify can be processed incrementally; adverbials located within their modification domain are processed with delay

2) Two adverbials distributed across an LF boundary (above and below) will be processed with delay

We tested these syntactic predictions in two self-paced reading experiments. In our first experiment, two adjacent adverbials were either located inside or outside the VP. In a second experiment, we tested two adjacent adverbials, one of them was located in CP and the other one in TP, and compared them to conditions with two adverbials within the same LF domain.

The semantic explanation refers to the entity the adverbial modifies (i.e., proposition, event, process). Immediate effects were attested for propositional adverbials while no online effects were caused by the movement of event-modifying adverbials. The adverbials do not only differ with regard to the syntactic LF configurations as explained above but also in what they modify: while the former adverbials modify an entire proposition, the latter modify an event. At first glance, the explanations seem similar to each other. Event-modifiers, however, can modify the event while being located inside or outside of their modified domain (VP). In contrast, propositional adverbials in their base position are always located above the domain they modify. Across our two experiments, we tested whether the processing of propositional adverbials proceeds incrementally while event-modifying adverbials are processed with a delay. In Experiment 1, we focussed on event-modifying adverbials (e.g., temporal, locative, and manner adverbials) and in Experiment 2 on propositional

adverbials (sentence and domain adverbials). We tested whether the time course of processing is shaped by the semantic type of the modified entity. High adverbials such as sentence adverbials express the speaker's attitude towards the proposition and do not depend on specific lexical information conveyed by the proposition. Event-modifying adverbials, however, depend on specific lexical information that is conveyed by the verb and can only be integrated as soon as this information is available.This results in delayed processing for event-modifying adverbials such as for the manner adverbials in Gauza (2018). Possibly, a place holder for the event is established, and full interpretation is only possible when the entire event is unfolded, and the place holder can be filled with the actual event. This explanation dovetails with Bott and Gattnar's (2015) finding on aspectual processing in Russian and German. They investigated aspectual mismatches and found delayed effects for German, which does not exhibit grammatical aspect encoded by the verb. Mismatches in their study were caused by a combination of a temporal adverbial and verb information. They observed that aspectual mismatch detection in German was delayed when the temporal adverbial preceded the verb and the object, but no delay was attested when the adverbial followed the verbal information. Hence, processing only takes place after the verb has received all its argument, i.e., the entire event is unfolded.

Therefore, we formulated the alternative semantic explanation, namely that the semantic type of the modified entity modulates the time course of adverbial order processing and the degree of incrementality. The results of our two studies speak in favor of the alternative semantic explanation. Before presenting our results, we will shortly introduce the adverbials under investigation.

5.1.2 Event-modifying and propositional adverbials

As there are several types of adverbials introduced throughout this article, we provide a brief overview of the adverbials and the respective categorizations that are relevant for the following two experiments.

Event-modifying adverbials like *temporal* or *locative adverbials* locate events in time and space or give more specific information about a process described by the event such as *manner adverbials*. According to Davidson (1967), event-modifying adverbials are licensed by an event variable provided by the verb. Event-modifying adverbials can be classified as **event-external adjuncts**, which are assumed to be base-generated outside the VP (event), and **event-internal adjuncts**, which are base-generated within the VP. Based on Frey's (2003)[3] syntactic base position account for adverbials, we selected four different adverbials that fulfilled our requirements with regard to their relation to the modified LF domain. Event-external adjuncts such as temporal adverbials and *external locative adverbials* c-command event-internal adjuncts such as manner adverbials. Frey (2003) applied a battery of base position tests to adverbials to find evidence for his claim. Based on Frey we assume that temporal adverbials have a higher base position than external locatives, both, however, are located outside VP, and therefore outside the LF domain they modify. For the event-internal conditions, two lower adverbials, that are base generated within VP, were chosen. In order to replicate the results by Gauza (2018), we selected manner adverbials. According to Frey (2003), they are base-generated below the direct object and above V^0. Gauza (2018) found experimental evidence for the assumed base position. In addition to the event-related adjuncts discussed by Frey, we also included so-called *internal locative adverbials* introduced by Maienborn (2001). She makes a more fine-grained distinction within the class of locative adverbials. Internal locatives modify only parts of the event, and are base-generated above V^0 and are to be distinguished from external locatives which are base-generated above VP and locate the entire event.

We applied the focus projection test (Höhle, 1982) as a first indicator that manner adverbials and internal locatives exhibit an order preference. The focus projection test states that following a wide focus question a constituent has to be in

[3]Note that Frey and Pittner (1998b) and Frey (2003) distinguish between *event-related*, *event-internal*, and *process-related* adjuncts. We do not stick to this terminology as for us only the relation to the VP is relevant, a more fine-grained distinction is not necessary. Our terminology, however, partly overlaps with theirs.

its base position in order to project wide sentence focus, as illustrated in Example (66).

(66) Was ist passiert?
What has happened?

a. Das Mädchen hat [mit Elan$_{manner}$] [auf den FINGERN$_{loc.int}$] gepfiffen.
The girl has with verve$_{manner}$ on the fingers$_{loc.int}$ whistled

b. ?? Das Mädchen hat [auf den Fingern$_{loc.int}$] [mit ELAN$_{manner}$] gepfiffen.
The girl has on the fingers$_{loc.int}$ with verve$_{manner}$ whistled

'The girl whistled vigorously on her fingers.'

Propositional adverbials are located high in the LF structure as they operate on the entire proposition but are not part of it. Their syntactic position is assumed to be below the C head and above the TP. *Sentence adverbials* see e.g., Pittner (1999), are not part of the proposition but describe the attitude of the speaker towards the proposition. In the assumed base order, sentence adverbials precede all other adverbial types, including *frame adverbials* as well as the subject (Frey, 2003). *Speaker-oriented sentence adverbials* provide a speaker's comment on the expressed proposition (e.g., Schäfer, 2013), which could be of an evaluative, epistemic or evidential nature. As it is not entirely clear whether evaluatives have the same syntactic and semantic properties as epistemics and evidentials (Axel-Tober & Müller, 2017; Störzer, 2017), we limit the discussion to epistemic and evidential speaker-oriented sentence adverbials, for the sake of readability, however, we only use the term *sentence adverbial*.

We further want to introduce another type of proposition-modifying adverbials, so-called *domain adverbials* which function akin to frame adverbials introduced in Section 5.1.1. Unlike frame adverbials, they do not restrict the proposition to a locative or temporal frame but to a certain interpretation domain (Bellert, 1977; Ernst, 2004b). The proposition does not necessarily hold outside of the mentioned domain. As Example (67) shows, the assertion that Tina is fine is restricted to the domain of physical health and does not give information about e.g., her financial

situation. Examples (67) furthermore exhibits that propositional adverbials, unlike event-modifying adverbials, do not depend on an event variable. Their licensing restrictions are less severe than for event-modifying adverbial.

(67) Gesundheitlich$_{domain}$ geht es Tina gut. 'With regard to her health situation
Healthwise$_{domain}$ goes it Tina good
Tina is fine'

Concerning the ordering of sentence adverbials and domain adverbials, we assume domain adverbials to behave like frame adverbials and also occupy to the same base position. It has been debated whether frame adverbials are located higher than sentence adverbials (Frey & Pittner, 1998b; Pittner, 1999; Maienborn, 2001; Salfner, 2014) or vice versa (Hohaus, 2015). We follow Frey (2000b, 2003), who claims that frame adverbials are located below sentence adverbials and can move across the sentence adverbial into the designated topic position in the middlefield directly above the sentence adverbial. Experimental evidence in favor of this analysis is obtained by Störzer and Stolterfoht (2013).

In the following, we will present two self-paced reading experiments, in which we tested how the location at LF affects the time course of adverbial processing.

5.2 Experiment 1: Event-modifying adverbials

In Experiment 1, we focused on event-modifying adverbials. The aim of the experiment was to provide an explanation for the differences with regard to the temporal processing dynamics in earlier studies. More precisely, we investigated, whether adverbials outside the VP can be integrated incrementally, and therefore lead to an immediate increase in reading times, while VP-internal adverbials do not. According to the findings of earlier studies and the assumed base positions for adverbials in the German middlefield, we formulated the following hypothesis for the first self-paced reading study:

Experimental hypothesis 1: For adverbials located outside of their modified domain at LF (here VP) we expect longer reading times for the derived order in the critical region than the base order. Adverbials located within the modified domain

should not cause longer reading times immediately but delayed processing difficulties. Statistically, we expect a corresponding interaction of the relation to the modified domain and adverbial order. We interpret effects on the critical region as immediate effects and effects on the spill-over region as delayed effects[4]

5.2.1 Method

Participants

44 students of the University of Tübingen (mean age = 22.9; SD = 7.4) participated in the experiment for either course credit or a financial reimbursement of 5 € / 30 minutes. All were native speakers of German and naive with respect to the purpose of the experiment.

Materials

We constructed 24 sentence quadruplets according to 2×2-within-item and within-subject design. We manipulated two factors: ORDER of two adjacent adverbials ('base' or 'derived') and DOMAIN ('internal' or 'external'), which reflects the location of the adverbials in relation to the modified domain at LF, here the VP. The DOMAIN manipulation was achieved by choosing four adverbial types (2 per condition) that were either base-generated above the VP (temporal adverbials and external locatives), or within the VP (manner and internal locatives). In order to keep the lexical material homogeneous with respect to part of speech and length, all four adverbials were realized as PPs. Each experimental sentence consisted of a matrix clause and an embedded sentence. With regard to verb position, the embedded sentence structure reflected the base order with the verb in sentence-final position. Each manner adverbial occurred three times within one experimental list since the set of genuine manner adverbials is limited. The other adverbials were not repeated. The

[4] An anonymous reviewer pointed out that immediate effects on the critical region are not expected in the self-paced reading paradigm for this type of manipulation. However, effects on the critical region for adverbial order processing are reported in Störzer and Stolterfoht (2013, 2018) (see also Tiemann et al. (2011) for immediate effects on the critical region in the processing of presuppositions).

experimental sentences were segmented into eight regions as depicted in Example (68). The critical region was the segment, including the two adverbials. The subsequent spill-over regions consisted of the verb and the auxiliary and were followed by a coordinated sentence in order to provide spill-over areas for possible delayed effects. The spill-over regions remained equal within the item.

The items were distributed over four lists according to a Latin square design. Each list contained one version of each item. The items were randomized and presented along with 72 additional filler sentences. Participants were asked a comprehension question about the preceding sentence in 50 % of the trials. Half of the comprehension questions required a *'yes'* and the other half required a *'no'* answer. In order to prevent participants from creating a strategy to answer questions and therefore read the items in a sloppy manner, questions were constructed to ask for information that could be conveyed by every constituent of the experimental item.

(68) Maren sagt,| dass| die Mutter|
Maren says that the mother

a. am Vortag$_{temp}$ – in der Küche$_{loc.ext}$| external – base

b. in der Küche$_{loc.ext}$ – am Vortag$_{temp}$| external – derived
in the kitchen$_{loc.ext}$ – on.the day.before$_{temp}$

c. mit Routine$_{manner}$ – auf dem Herd$_{loc.int}$| internal – base

d. auf dem Herd$_{loc.int}$ – mit Routine$_{manner}$ internal – derived
on the stove$_{loc.int}$ – with routine$_{manner}$

gekocht hat$_{spill\text{-}over}$| und danach| zur Tür hinaus| gegangen ist.|
cooked has and afterwards through.the door out gone is
'Maren says that the mother [adv + adv] cooked and left afterwards through the door.'

Procedure

The experiment was presented on a computer using the software E-Prime 2.0. Sentences were presented segmentwise, using a self-paced reading task with moving window technique. Participants were instructed to read at their natural pace. By pressing the space bar, participants started the experiment: lines of dashes ap-

peared on the screen, each dash representing a character of the stimulus sentence. By each pressing of the space bar, the sentence was uncovered segment by segment. When a new segment was uncovered, the previous segment changed back to dashes. Half of the sentences were followed by a *yes/no* comprehension question. Before the actual experiment started, participants were presented with five practice trials and were invited to ask clarification questions. The entire session lasted approximately 20minutes.

5.2.2 Analysis and results

First, we analyzed the responses to the comprehension questions to exclude participants who did not read the items thoroughly. Data of participants who answered more than 25 % of the questions incorrectly were excluded. This treatment led to a loss of six participants. The data of 38 participants entered the statistical analysis. Furthermore, reading times were corrected for outliers by removing all data points above 3 standard deviations of a mean per participant and segment. This treatment led to a loss of 1.7 % of the data.

The remaining reading times were log-transformed and analyzed using the R statistics software (R Core Team, 2021) by means of a linear mixed effects model (LMEM) using the lmer-function of the lme4-package (Bates, Mächler, Bolker, & Walker, 2015). The experimental factors and the interaction thereof were entered into the model. We used sum coding, which means that the intercepts reflect the unweighted grand mean and fixed effects compared the factor levels against each other. The model included random intercept for items and participants. We use the same random effect structure within and across the experiments to allow for comparisons of the data. The model and the results for both the critical region and the spill-over region are reported seperately in the following. We obtained *p*-values by Satterthwaite's method using the lmerTest-package (Kuznetsova, Brockhoff, & Christensen, 2017).

The descriptive reading times for the critical region and the spill-over region are given in Figure 5.1. We observed a tendency for the base order to be read

faster than the derived order for the critical region. The full model summary is given in Table (5.1). The differences in reading times for the base and the derived order were not significant, neither did the factor DOMAIN nor the interaction approach significance. The statistical analysis and the full model summary for the spill-over region, which contained the auxiliary and the main verb is given in Table 5.2. The analysis showed a main effect ORDER with significantly longer reading times for the derived order and a main effect for DOMAIN. The interaction, however, was not significant.

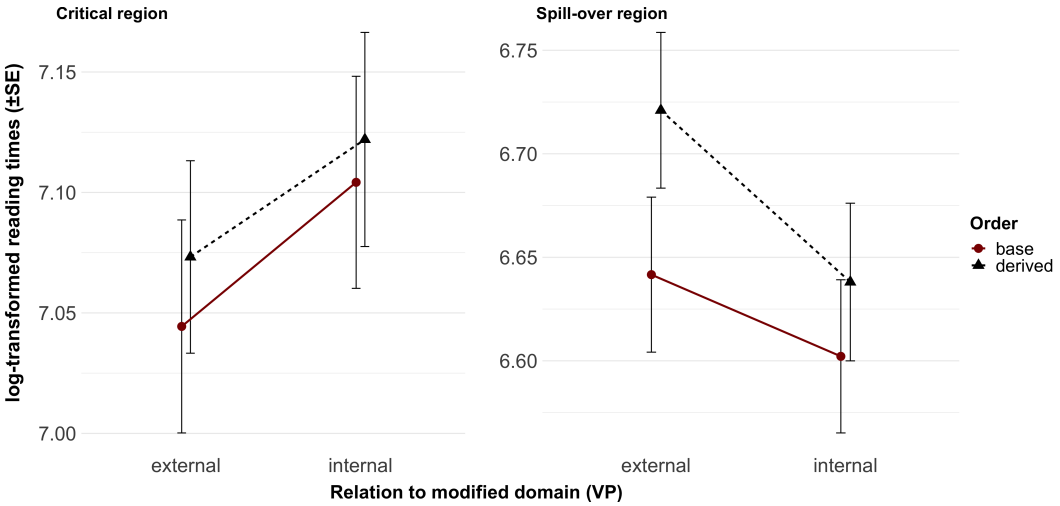

Figure 5.1: Exp. 1: log-transformed mean reading times in critical region (left) and spill-over region (right) (n = 38), including standard errors calculated on data aggregated across participants

Formula: log(reading time) $\sim$ order $*$ domain + (1 | participant) + (1| item)

	Estimate	SE	df	t-value	p
(Intercept)	7.089	0.08	39.8	85.93	
ORDER	-0.007	0.01	832.4	-0.53	.6
DOMAIN	-0.023	0.01	835.06	-1.68	.09
DOMAIN:ORDER	-0.002	0.01	834.4	-0.15	.9

Table 5.1: Exp. 1: Statistical analysis LMEM of reading times in the critical region (adverbial + adverbial)

Formula: log(reading time) $\sim$ order $*$ domain + (1| participant) + (1 | item)

	Estimate	SE	df	t-value	p
(Intercept)	6.65	0.07	44.1	95.8	
ORDER	-0.03	0.01	828.94	-2.1	.04*
DOMAIN	0.032	0.01	830.73	2.8	.01*
DOMAIN:ORDER	-0.008	0.01	831.24	-0.7	.5

Table 5.2: Exp. 1: Statistical analysis LMEM of reading times in the spill-over region (verb + auxiliary)

5.2.3 Discussion

The major result of Experiment 1 is a reading time penalty for the derived order of adverbials in the spill-over region following the two adverbials. The base order was processed faster than the derived order for temporal and external locative adverbials, as well as for manner adverbials and internal locatives. As already attested for complements e.g., Rösler et al. (1998), our findings show that the movement of adverbials comes with processing costs. Another interesting finding is that the processing costs show a delay; the significant effect is only visible in the spill-over region following the adverbials. Our findings are in line with the Construal theory for the processing of adjuncts. Frazier and Clifton (1997) state that adjuncts, unlike arguments, are processed in a later processing phase. When they are first encountered, the parser loosely associates them to the current processing domain (in this case, the VP) and only attaches them during a later processing step.

As the interaction of the ORDER of the adverbials and the relation to the modified DOMAIN did not reach significance, we did not find evidence for the experimental hypothesis 1 that the placement of adverbials inside or outside the LF domain they modify plays a role for incremental processing. Accordingly, we were not able to gather evidence for our syntactic explanation 1. We cannot conclude that movement of VP-external and VP-internal adverbials seem to tax the processing system in different ways. In order to understand the mechanisms behind the processing pattern, it is worthwhile to take a further look at the semantic properties of the adverbial types that have been used in our experiment. Following a Davidsonian

approach (Davidson, 1967) for event-modifying adverbials, temporal, locative, and manner adverbials target the event argument which is provided by the verb. External locatives locate events in space, and they are ungrammatical with stative verbs and individual-level predicates, which lack an event argument (Maienborn, 2001; Maienborn & Schäfer, 2011). The internal locative and the manner adverbial need access to the internal dimensions of the event in order to modify the event, as Schäfer (2013) proposes for manner adverbials. Hence, the adverbials require information given by the verbal predicate. Therefore, the parser might wait for this verbal information in order to attach the adverbials, as they depend on the entire event information. The spill-over region contained the main verb, which delivers semantic information about the event type and dimensions about the event. It seems that the parser does not commit to a final decision before the verbal information is available. Thus, the attachment of adverbials is delayed until the parser has access to semantic information conveyed by the verb. This interpretation conforms with the Construal theory (Frazier & Clifton, 1997) and also resemble the findings by Bott and Gattnar (2015), who also found that processing of an event-modifying adverbial depends on verbal information and is delayed.

So far, we did not find evidence for our syntactic explanation 1, namely that adverbials external to the modified domain are processed immediately whereas the processing of adverbials internal to the modified domain is delayed. We observed, however, that the movement of both types of event-modifying adverbials (VP-internal and VP-external) led to an increase in reading times. In a second self-paced reading experiment, we tested whether the distribution across two LF domains affects processing. Furthermore, we investigated, whether the semantic type of the modified entity shows a different pattern when it comes to the time course of processing.

5.3 Experiment 2: Semantic type of modified entity

The experimental materials for Experiment 2 are based on the materials and the findings of the studies reported in Störzer (2017) and Störzer and Stolterfoht (2018).

The former found immediate effects for the derived order with high adverbials that were both located within CP and outside the domain they modify (TP). The latter study reported immediate effects when the subject (in TP) had moved across an adverbial located in CP and henceforth across an LF boundary. We tested exactly the same configuration with two adjacent adverbials across two LF domains, namely CP and TP. We only manipulated the order of adverbials relative to each other in order to control for potential effects due to the argumenthood of the subjects that might have caused the immediate increase in reading times in Störzer and Stolterfoht (2018). In Experiment 1, we did not find evidence for the syntactic explanation that the relation to the modified LF domain (internal vs. external) affects the time course of processing. In fact, the time course was the same for the different adverbial types. We furthermore gathered first evidence for our semantic explanation, namely, that the time course of processing is not modulated by the syntactic LF position but by the semantic type of the modified entity since we found delayed effects for event-modifying adverbials, as predicted. By comparing the results of Experiment 1 with the results of Experiment 2, we gathered further evidence for the semantic explanation.

Another aim of Experiment 2 was to test whether we can find evidence for our syntactic explanation, that is, the LF position affects the time course of processing. Therefore, we included a condition with one adverbial below and one above the LF boundary. The main purpose to include this configuration, was to replicate the findings of Störzer and Stolterfoht (2018), who found immediate effects for the order manipulation of sentence adverbial and subject in a similar configuration. However, it is not clear whether the significant effect attested in Störzer and Stolterfoht (2018) is caused by the movement of an argument, i.e., the subject. In order to control for potential confounding factors of the argument movement in Störzer and Stolterfoht's (2018) study, both constituents in our study were adverbials which are assumed to be located in CP and TP, respectively. Besides the syntactic manipulation, we also tested semantically different adverbials. While Experiment 1 only included event-

modifying adverbials, we tested whether we can find different temporal dynamics for propositional adverbials in Experiment 2.

We constructed a new set of experimental items to test the effect of different relations between adverbials and their modified domain, which in this experiment was the TP. In order to establish these configurations, different adverbial combinations were required. To create the across LF domain condition, we again used temporal adverbials as event-modifying adverbials, which are located within TP.
The following hypotheses were tested:

Experimental hypothesis 2.A: We expect an interaction of the factors DOMAIN ('external' vs. 'across' LF domain) and ORDER ('base' vs. 'derived') due to our syntactic explanation 2, that is the position of the adverbials at LF affects processing.
Experimental hypothesis 2.B: If the semantic type of the modified entity (proposition vs. event) plays a role in the immediacy of effects, we expect, in contrast to Experiment 1, immediate effects of the derived word order.

5.3.1 Method

Participants

44 students of University of Tübingen (mean age = 22.9; SD = 7.4) participated in the experiment for either course credit or a financial reimbursement of 5 € / 30 minutes. All were native speakers of German and naive to the purpose of the experiment.

Materials

As in Experiment 1, we constructed 24 sentence quadruplets according to a 2×2-within-item and within-subject design, with the factors ORDER and DOMAIN. An example item is shown in Example (69). ORDER followed the same pattern as in Experiment 1: two adjacent adverbials were either presented in their 'base' order or in a 'derived' order, in which the lower adverbial has moved across the higher one.

The factor of DOMAIN manipulated whether the two adverbials were located outside ('external') of their modified domain (TP) or in two different LF domains ('across') with domain adverbials in CP and temporal adverbials in TP.

We used eventive verbs to allow for the temporal adverbials. Domain adverbials are potentially ambiguous between a domain restricting reading and a manner reading. The materials were constructed in such a way that a manner reading is highly implausible. The adverbials preceded the subjects of the sentences as their base positions are assumed to precede the subject. Each domain adverbial occurred twice on one experimental list, whereas the sentence adverbials occurred six times and temporal adverbials four times. We applied the same list distribution as in Experiment 1, and added 72 filler sentences and comprehension questions after 50 % of the trials.

(69) Hanna sagt,| dass|
Hanna says that

a.	wahrscheinlich$_{Sadv}$ – gesundheitlich$_{domain}$|	external – base
b.	gesundheitlich$_{domain}$ – wahrscheinlich$_{Sadv}$ | healthwise$_{domain}$ – probably$_{Sadv}$	external – derived
c.	gesundheitlich$_{domain}$ – gestern$_{temp}$ |	across – base
d.	gestern$_{temp}$ – gesundheitlich$_{domain}$ | yesterday$_{temp}$ – healthwise$_{domain}$	across – derived

Tim etwas $_{\text{spill-over}}$ | vorgetäuscht hat$_{|}$ und sich deshalb entschuldigt.|
Tim something pretended has and himself therefore excuses

'Hanna says that [adv] Tim [adv] faked someting and thus apologizes.'

Procedure

The procedure of Experiment 2 is identical to the procedure in Experiment 1

5.3.2 Analysis and results

Before analyzing reading times, we analyzed the responses to the comprehension questions as we did in Experiment 1. Participants with error rates higher than 25 % were discarded from the data analysis. This led to the loss of six participants, and 38 participants entered the statistical analysis. Reading times were corrected for outliers by removing all data points above 3 standard deviations of the mean per participant and segment. This treatment led to a loss of 1.4 % of the data. The remaining data set was analyzed using the R statistic software (R Core Team, 2021). To test for significant effects, the log-transformed reading times were analyzed by linear mixed modeling following the same procedure as in Experiment 1. The full model summaries are reported separately for the critical region (containing the two adverbials) and the spill-over region in Tables 5.3 and 5.4, respectively.

The statistical analysis and the model summary for the critical region, which was the two adverbials, are reported in Table 5.3. We observed a statistical main effect for ORDER as well as for DOMAIN. The corresponding descriptive data for both regions are plotted in Figure 5.2. The main effect for DOMAIN was not interpretable, as the condition included different lexical elements, which means that the attested effect could be caused by other lexical properties e.g., frequency or word length. An effect caused by DOMAIN would only be meaningful in an interaction with ORDER. The statistical analysis for the spill-over region is given in Table 5.4. There was no significant effect for ORDER and also no effect for DOMAIN or the interaction of the factors.

Formula: log(reading time) $\sim$ order $*$ domain + (1 | participant) + (1 | item)

	Estimate	SE	df	t-value	p
(Intercept)	6.812	0.07	44.98	102.55	
ORDER	-0.066	0.03	838.15	-2.25	.02*
DOMAIN	-0.11	0.03	839.08	-3.72	<.001**
DOMAIN:ORDER	0.063	0.06	838.88	1.0	.28

Table 5.3: Exp. 2: Statistical analysis LMEM of reading times in the critical region (adverbial + adverbial)

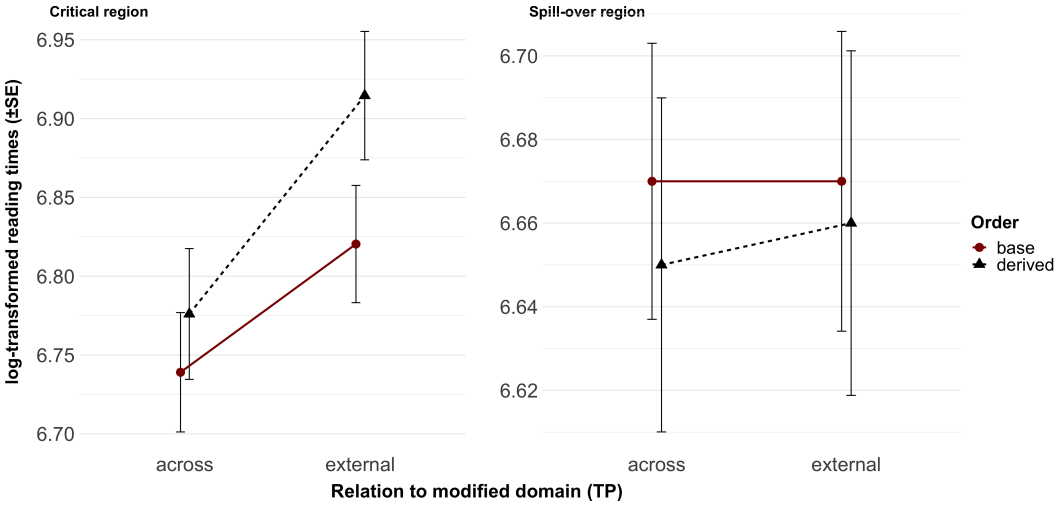

Figure 5.2: Exp. 2: log-transformed mean reading times in critical region (left) and spill-over region (right) (n = 38), including standard errors calculated on data aggregated across participants

Formula: log(reading time) $\sim$ order $*$ domain + (1 | participant) + (1 | item)

	Estimate	SE	df	t-value	p
(Intercept)	6.68	0.07	54.98	96.29	
ORDER	-0.015	0.04	829.67	-0.38	.7
DOMAIN	-0.003	0.04	830.45	-0.07	.94
DOMAIN:ORDER	0.001	0.05	829.96	0.02	.98

Table 5.4: Exp. 2: Statistical analysis LMEM of reading times in the spill-over region (subject + object)

5.3.3 Discussion

We were could not confirm the experimental hypothesis 2.A., since there was neither an immediate nor a delayed interaction of ORDER and DOMAIN. As in Experiment 1, we did not find evidence for the two syntactic explanations, namely that only adverbials, that are located outside of their modified domain are processed immediately. Since we found an ORDER effect for both DOMAIN conditions in the critical region, we were able to find evidence for the experimental hypothesis 2.B. and henceforth our semantic explanation, according to which the semantic type of the modified entity modulates adverbial processing. The interaction did not reach

the level of statistical significance. Therefore, the LF configuration again does not matter for the temporal dynamics of adverbial processing.

In order to understand the different temporal dynamics between Experiment 1 and Experiment 2, we discuss the types of the moved adverbials in more detail. Before, however, we would like to briefly address an objection raised by an anonymous reviewer against the comparability of the data obtained in the two experiments. The critical regions were of different lengths in Experiment 1 (two PPs summing up to five words, cf. (5)) and Experiment 2 (two words, cf. (6)). This length difference might have caused more noise in the critical region of Experiment 1 as compared to Experiment 2, which potentially could have covered a significant effect in Experiment 2 but not in Experiment 1. In discussing the comparison of the two experiments, we will thus act with caution. Yet, we point out that the standard errors in the LMEM analyses on the critical regions do not support this suspicion as they are smaller in Experiment 1 (cf. Table 5.1, all SE = 0.01) than in Experiment 2 (cf. Table 5.3, SE = 0.03 for the main effects and 0.06 for the interaction). Therefore, the fact that the t-values are smaller in Experiment 1 than in Experiment 2 is due to the different coefficients, not to the error variance in the data[5]. In Experiment 2, we attested a main effect for ORDER. In the 'external' condition, a domain adverbial moved across the sentence adverbial. Both types of adverbials operate on the proposition which is mapped on the TP. They are not part of the assertion made by the proposition but modify the proposition. For epistemic sentence adverbials, Krifka (2019) argued for a layered approach and introduced syntactic representations higher than the TP that host epistemic and evidential adverbials, which give information about the speaker's commitment towards the proposition. Therefore, they are not part of the proposition itself. Maienborn (2001) stated that frame adverbials (which function similar to domain adverbials) should be treated semantically as operators, which only restrict the speaker's claim and are not part of the assertion itself. The high adverbials in the external condition do not depend

[5]We would like to thank an anonymous reviewer to point this out and Robin Hörnig for helpful comments on the statistical analysis.

on an element within their modified domain. High adverbials take an entire proposition as their argument. Their selectional restrictions regarding the verb type are less severe since they do not depend on an event argument. An implication for language processing could be that high adverbials can be integrated immediately, as they do not depend on a proposition internal element. Incremental attachment of high adverbials before the actual proposition unfolds would therefore allow for the immediate attachment and interpretation of the adverbials (i.e., immediately restricting the assertion to an interpretational domain in the case of domain adverbials or the respective epistemic or evidential commitment of the speaker in the case of sentence adverbials). We interpret the differences between Experiment 1 and Experiment 2 as first evidence for our alternative semantic explanation. The time course of processing depends on the semantic type of the modified entity. However, this explanation needs to be further investigated with an experiment with propositional adverbials and event-modifying adverbials as separate experimental conditions.

Our preliminary conclusion is that propositional adverbials, unlike event-modifying adverbials that have to wait for the event argument provided by the verb, can be intergrated in the syntactic structure immediately during processing.

The 'across' condition manipulated the order of a domain adverbial and a temporal adverbial, which is an event-modifying adverbial. The movement of the temporal adverbial across the domain adverbial led to an immediate reading time penalty as well. At first glance, this result seems at odds with our preliminary conclusion that propositional adverbials but not event-modifying adverbials can be integrated immediately. This effect, however, might be caused by the semantic properties of the temporal adverbials since they were of different types across our two experiments. Due to the intention to include only adverbs and not PPs in Experiment 2, temporal adverbials were all *deictic temporals* (*gestern* 'yesterday', *morgen* 'tomorrow', etc.,). In Experiment 1, temporal adverbials were so-called *clock-calendar adverbs* (*am Montag* 'on Monday', *am Nachmittag* 'in the afternoon'). The former are bound to the reference time and are specified for past or present while the latter

remain underspecified for tense and are interpreted according to the verb (Smith, 1978; Alexiadou, 2000; Biondo, 2017), which would explain the observed delayed processing in Experiment 1, but not in Experiment 2. A discussion about temporal modification and processing of tense would exceed the scope of this paper, but our interim conclusion is that the effect of order in Experiment 1 was caused by adverbials that require verb information. In contrast, the moved domain adverbials and temporal adverbials in Experiment 2 do not depend on this specific information to get finally attached and interpreted.

5.4 General discussion and summary

In this article, we investigated two approaches to account for the heterogeneous findings in prior research regarding the time course of processing different adverbial orders. The first approach referred to the syntactic position of the adverbials at LF, which assumes that the configuration of the adverbials and their modified domain affects incremental sentence processing. With the alternative semantic approach, we investigated whether the semantic type of the modified entity modulates the temporal dynamics of processing. After bringing the findings of our two online processing studies together, we conclude that the assumed syntactic base positions of the adverbials affect processing: the base position was always processed faster than the derived order. Based on these results, we can conclude that not only complement movement but also adverbial movement leads to increased processing costs. However, our experiments did not confirm the hypotheses regarding the relation between adverbials and their modified domain at LF. There was no evidence suggesting that the internal or external position at LF affects the time course of processing. In fact, our evidence suggests that the time course is modulated by the semantic type of the modified entity. Hence, propositional adverbials are integrated highly incrementally, leading to an immediate penalty for the derived order, whereas event-modifying adverbials only show a delayed increase (emerging in the spill-over region) in reading times for the derived order. This conclusion needs to be drawn cautiously as it is only based on the comparison between our two stud-

ies. Thus further investigation in this regard is needed. We are currently running an experiment, in which the semantic type of the modified entity is entered as an experimental factor.

The interpretation of our findings partly aligns with the predictions of Construal, but Construal can only account for the findings related to event-modifying adverbials, which showed delayed order effects. To explain our findings, we, therefore, refer to the semantic properties of the compositional mechanisms connected to the different adverbial categories we tested. Adverbials can be divided into operators (propositional adverbials such as sentence adverbials) and modifiers (event-modifying adverbials), the two classes differ with regard to their compositional mechanisms (McConnell-Ginet, 1982). Operators and modifiers differ among others in their selectional properties. The former category takes an entire proposition as their operand and modify the proposition by, e.g., adding the speaker's attitude or comment, or by restricting it to a specific frame or domain. From a processing perspective, one can argue that it is safe to integrate high adverbials in their base position immediately. There is no need to wait for specific information. However, this is the case for (event-modifying) adverbials, which need specific information about the event to get finally attached and interpreted. They combine with events but not with stative verbs and are thus only licensed if the verb provides an event argument. German is a verb-final language and the base position of all adverbials is higher than the main verb. By the time, the parser encounters the event-modifying adverbials, it might loosely associate the adverbials to the structure currently being built, as predicted by Construal. The adverbials will be attached as soon as sufficient lexical information by the verbal head is given to felicitously integrate the adverbial since event-modifying adverbials, unlike sentence operators, have access to the internal structure of the event. As already discussed in the previous section, we do not take the immediate effects related to temporal adverbials as critical to our interpretation since we assume that, due to the heterogeneity of temporal adverbials, the deictic adverbials in Experiment 2 differ from the clock-calendar temporal adverbials tested in Experiment 1 in relevant aspects.

Nonetheless, our interpretation of the findings has to be understood as preliminary and needs further investigation. A crucial question for upcoming experiments is whether the delayed effect for event-modifying adverbials indeed depends on verbal information or whether it is merely a spill-over effect that accidentally coincides with the region that contained the main verb. Another question that should be addressed is whether the immediate effects for the propositional adverbials generalize for other types of propositional adverbials or whether the sample of high adverbials tested share independent features that reinforce immediate integration. One such feature might be veridicality as all propositional adverbials tested here and in Störzer (2017) are non-veridical sentence adverbials. Veridicality might be a factor driving incremental processing as non-veridical adverbials affect the truth of a proposition: a sentence with a non-veridical adverbial hence does not necessarily entail the sentence without it (Maienborn & Schäfer, 2011), see contrast in Example (70). If veridicality is the driving force in incrementality, evaluative speaker-oriented adverbials (70b) might pattern with event-modifying adverbials but not with epistemic sentence adverbials (70a).

(70) a. Probably, John ate $\not\Longrightarrow$ John ate

b. Luckily, John ate $\Longrightarrow$ John ate

Our conclusion so far is that the syntactic position of the adverbials affects adverbial processing. Furthermore, our results reveal first evidence that the time course of processing is modulated by the semantic type of the adverbial with its respective selectional properties.

5.5 Addendum: Experiment 3: Acceptability judgment experiment

In this chapter, we have argued for certain base orderings for the adverbials we have tested in the self-paced reading studies. The predictions were derived from Frey's (2003) account for base positions of adverbials, and the experiments followed the assumption that the base order is processed faster than the derived order. Nev-

ertheless, so far there is no experimental evidence that the predicted base orders of sentence and domain adverbials, as well as domain and sentence adverbials, are in fact more acceptable. In the following, I will report an acceptability judgment experiment with the same materials used in Experiment 1, to provide independent evidence for the base order between the respective two adjacent adverbials. As an acceptability judgment experiment for the materials used for the self-paced reading study in Experiment. 2 are part of Chapter 6. I will, at this point, only report the acceptability judgment experiment accompanying Experiment 1. From Frey and Pittner's (1998b) base position account, I derive the following hypothesis 3, for a more detailed discussion see Chapter 2.2.3 and 3.2.3, respectively.

Hypothesis 3: A main effect ORDER with a preference for the base order (temp > loc.ext; manner > loc.int).

5.5.1 Method

Participants

36 students (mean age = 23.03, *SD* = 8.62) of the University of Tübingen participated in the experiment for either course credit or a financial reimbursement of 5 €/ 30 minutes. All participants were adult native speakers of German, according to their self-reports, and naive with respect to the purpose of the experiment.

Materials

I used the same materials as in Experiment 1, but I excluded the spill-over regions and the comprehension question. An updated version of the materials is repeated in (71).

(71) Maren sagt, dass die Mutter
Maren says that the mother

a. am Vortag$_{temp}$ – in der Küche$_{loc.ext}$ external – base

b. in der Küche$_{loc.ext}$ – am Vortag$_{temp}$ external – derived
in the kitchen$_{loc.ext}$ – on.the day.before$_{temp}$

c. mit Routine$_{manner}$ – auf dem Herd$_{loc.int}$ internal – base

d. auf dem Herd$_{\text{loc.int}}$ – mit Routine$_{\text{manner}}$ internal – derived
on the stove$_{\text{loc.int}}$ – with routine$_{\text{manner}}$

gekocht hat
cooked has
'Maren says that the mother [adv + adv] cooked.'

Procedure

Participants were invited to the lab to fill in a computer-based questionnaire. The experiment was programmed with the software E-Prime 2. Sentences had to be rated on a 5 - 1 Likert scale, 5 = perfectly acceptable, 1 = completely unacceptable. The endpoints of the scales were labeled. Participants were given five practice items. The entire procedure lasted about 15 minutes.

5.5.2 Analysis and results

For the analysis, I ran a cumulative link mixed model (CLMM). As fixed effects, I entered the experimental factors, as well as their interaction. Both factors were analyzed as within-items and -subject manipulations. The model included random intercepts and slopes for items and participants with the maximal random effect structure supported by the data. I obtained p-values by Laplace approximation. The descriptive data are presented in Figure 5.3. The output of the model as well as the model formula are shown in Table 5.5. The model revealed a main effect of ORDER with higher ratings for the base order (base mean = 4.33, SD = .05; derived mean = 3.8, SD = 1.11) and a main effect of DOMAIN with higher ratings for the external condition (mean = 4.19, SD = 1.01) than the internal condition (mean = 3.94, SD = 1.13). As the interaction of the factors was significant, I conducted a post-hoc Tukey test, which revealed that the difference for the base order is more pronounced for the external condition (z = 4.76; p = .0005) than for the internal condition (z= 3.08; p = .02). However, both adverbial combinations seem to be ordered.

Formula: rating ∼ order ∗ domain + (order + domain | subject) + (order + domain | item)

	Estimate	SE	z-value	p
DOMAIN	0.66	0.31	-2.16	.031*
ORDER	1.41	0.23	6.18	<.0001***
DOMAIN:ORDER	0.78	0.29	2.69	.007**

Table 5.5: Exp. 3: Statistical analysis CLMM of acceptability ratings

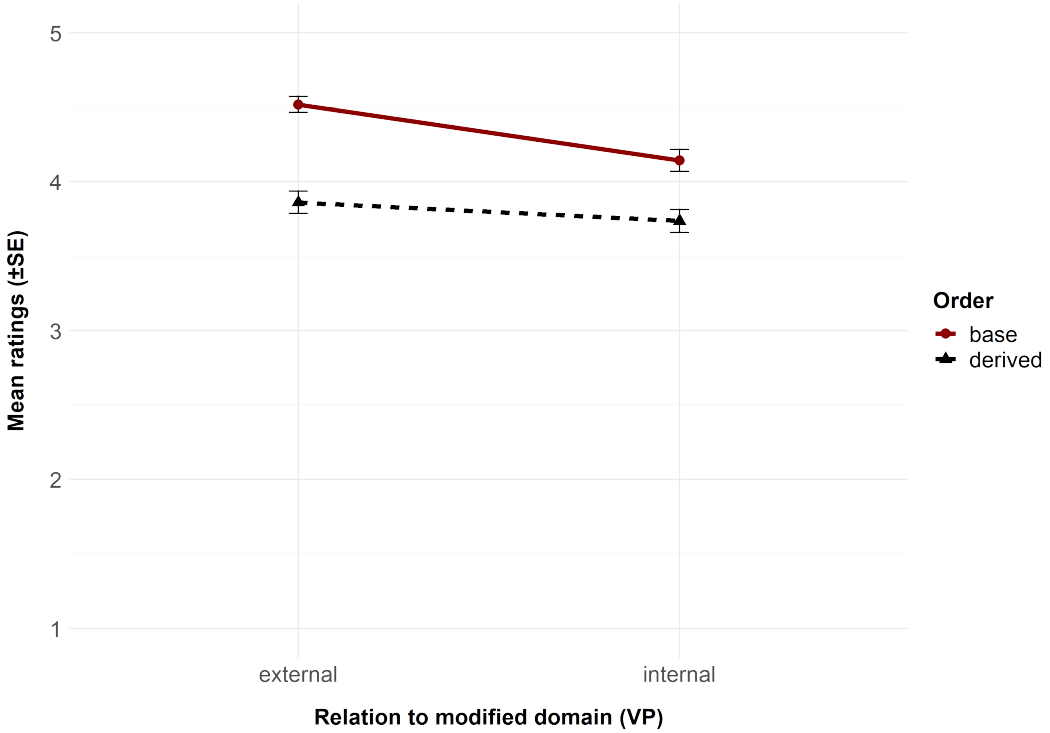

Figure 5.3: Exp. 3: Mean ratings (n = 36), including standard errors calculated on data aggregated across participants

5.5.3 Discussion

The acceptability rating experiment provided evidence that the predicted base order between the adverbial is perceived more acceptable than the derived order. This holds for both conditions, the two event-external adverbials (temporal > external locative) and the internal condition (manner adverbial > internal locative). Even though the differences between base and derived were significantly more acceptable for both combinations, the difference was more pronounced in the external condition. In Chapter 3, I used the focus projection test as a first indication that manner adverbials and internal locatives are syntactically ordered. The experimen-

tal evidence obtained here provides further evidence that the assumed base order between the manner adverbial and the internal locative holds. Nonetheless, it cannot be unambiguously concluded that this preference is syntactically determined or is the result of e.g., semantic ordering effects.

Finally, I attested a significant interaction between the two factors. This interaction occurs because the preferences for the respective adverbial combination are not equally strong. Since I used different adverbial combinations this effect is not problematic and to some extent expected. A potential reason could be that the combination of temporal and locative is more frequent compared to the combination of manner adverbials and internal locatives, and the preference for the former is thus more pronounced. Temporal and Manner are a less frequent combination, Thus, it can be assumed that offline preferences are less pronounced. Importantly, there is preference for the assumed base order in both cases which is also confirmed by a post-hoc test.

5.6 Summary and outlook

This chapter was dedicated to the research question whether the position of the adverbials at LF affects the time course of adverbial order processing. The question has to be disregarded. In the experimental studies, we tested whether the location of two event-modifying adverbials within or outside of the VP affected the time course of processing to the same extent that it has been observed (and tested again) for two adverbials located outside of the TP. However, we found that event-modifying adverbials, independent of their relation towards their modified domain, are processed with a delay. The additional acceptability judgment study (Experiment 3) showed that the base order is preferred for event-modifying adverbials. Nonetheless, this preference is not seen immediately in the self-paced reading experiment (Experiment 1). Only propositional adverbials lead to an immediate increase in reading times when presented in the derived order (Experiment 2).

The following chapter is dedicated to propositional adverbials and will attempt to answer sub-question 2:

• How does information structure affect adverbial order preferences and the time course of processing?

It has been shown that frame adverbials interact with information structure (Störzer & Stolterfoht, 2018). In Chapter 6, we tested whether domain adverbials, a type of frame adjunct also interact with information structure, even though they are non-referential. We investigated whether their order preferences are modulated by information structure. It has been argued that domain adverbials function as a certain type of discourse-structuring entity.

6 | Syntax, semantics, and information structure in processing propositional adverbials in German

This chapter consists of the submitted version of the article later published as:

Specht, L. & Stolterfoht, B. (2023). Processing word order variations with frame and sentence adjuncts in German: Syntactic and information-structural constraints. Glossa: a journal of general linguistics, 8(1).

Abstract

Prior research on the processing of order variations with adverbials showed that they exhibit different behavior concerning the degree of incrementality. Adverbials positioned high in the sentence structure, such as sentence adverbials, frame, and domain adverbials, are processed highly incrementally. In contrast lower adverbial types such as manner and locative adverbials are processed with a delay. This discrepancy might be caused by compositional semantic differences between the mentioned adverbial categories (propositional vs. event-modifying adverbial). However, it has also been shown that information-structural characteristics play a role in processing adverbial order variations (Störzer & Stolterfoht, 2013, 2018).

This leads to the questions, how and when the parser integrates different types of linguistic information (i.e., syntactic, semantic, and information-structural) into the sentence structure. We argue that syntactic and semantic properties of propositional adverbials are integrated highly incrementally, while the information-structural status only affects later processing stages. In the present study, we tested this claim with another type of propositional adverbial, namely domain adverbials, and avoided some confounding factors of the earlier studies. Furthermore, we will show that information-structural characteristics of domain adverbials influence order preferences, but only in later processing stages. We, therefore, argue for a two-stage processing, with a priority of syntax and semantics.

6.1 Introduction

It has been argued that adverbials – just as complements – have syntactic base positions in the German middlefield (the area between C^0 and V^0) and are ordered with respect to each other, the verbal arguments, and the base position of the finite verb (Frey & Pittner, 1998a; Frey, 2003). These preferences are reflected in acceptability judgments and online sentence processing (Gauza, 2018; Störzer & Stolterfoht, 2018). Stolterfoht et al. (2019) provided an overview of studies that compared online processing and offline ratings for the ordering of different adverbial types. Within these studies, there was a focus on the relative order of adjacent adverbials but also of adverbial adjuncts and complements. Example (72a) provides an example item tested in Störzer and Stolterfoht (2013) with frame and sentence adverbials in their base order. The authors measured reading times on the two adverbials in the base order and a derived order in which the frame adverbial moved across the sentence adverbial (72b). Gauza (2018) investigated order variations with manner adverbials and the direct object in a similar experimental design. An example sentence with a manner adverbial and direct object in the assumed base order is given in (73a), the respective derived order in (73b). These studies showed that the semantic type of the adverbials with their correlating syntactic position determines the temporal dynamics of processing. We refer to syntactically

high adverbials as propositional adverbials because they take scope over the entire proposition without changing its internal properties (Steube, 2014). Adverbials that modify the event or parts of the event, such as manner adverbials, are referred to as event-modifying adverbials.

(72) Eva meint, dass [wahrscheinlich]$_{Sadv}$ [auf Mallorca]$_{frame}$ alle Urlauber
Eva means that probably on Majorca all tourist
betrunken sind.
drunk are
'Eva thinks that probably in Majorca all tourists are drunk.'

(Störzer & Stolterfoht, 2013, 61)

(73) Elisabeth sagt, dass Björn [das Gedicht] [laut]$_{manner}$ rezitiert hat.
Elisabeth says that Björn the poem loudly recited has
'Elisabeth says that Björn recited the poem loudly.' (Gauza, 2018, 4)

Concerning the time course of adverbial order processing, Störzer and Stolterfoht (2013) found an immediate increase in reading times for frame and sentence adverbials, while Gauza (2018) only found an effect for manner adverbials and the direct object in offline studies but not in reading times. Based on these findings, we assume that propositional adverbials, such as sentence and frame adverbials, can be processed immediately since they are positioned outside the domain they modify (the proposition mapped onto TP). Their interpretation does not depend on a specific lexical element within the modified domain. Propositional adverbials, furthermore, are less restrictive than event-modifying adverbials and felicitously combine with any verb type i.e., stative or eventive (e.g., Katz, 2003). Manner adverbials, on the other hand, are base-positioned within the domain they modify (the event mapped onto VP) and are integrated with a delay. As German is a verb-final language, verbal information in most embedded clauses is available only at the end of the sentence. Therefore, order effects appear only with delay when the required information is available and semantic composition can start. Specht and Stolterfoht (2022) tested whether this explanation holds for other propositional and event-modifying adverbials and were able to replicate the findings for other adverbial types. They used another type of propositional adverbials, so-called domain

adverbials. Domain adverbials semantically resemble frame adverbials as they restrict the proposition to an interpretational domain and thus occupy the same base position below sentence adverbials, where they can scope over the entire proposition. An example is given in (74).

(74) Frieda findet, dass syntaktisch die Analyse einwandfrei ist.
Frieda finds that syntactically this analysis spotless is
'Frieda thinks that this analysis is syntactically spotless.'

It has been argued that frame adverbials function as topical elements, more precisely as aboutness topics in the sense of Reinhart (1981). Per definition, aboutness topics are required to be referential. However, it has been debated whether all referential frame adverbials are necessarily aboutness topics (Pittner, 2004, 276) or whether the topical status of referential frame adverbials is optional (Frey, 2004). Nevertheless, the information-structural status of frame adverbials is assumed to affect ordering. This assumption was supported by the results of Störzer and Stolterfoht (2013), who found that referential frame adverbials are preferred in the position above the sentence adverbial – according to Frey, this is a position in the German middlefield designated for aboutness topics. In contrast, non-referential frame adverbials are preferred in their assumed base position below the sentence adverbial. However, looking at the materials of the study, it is not clear whether the results reflect solely the information-structural status of the frame adverbials, or whether referentiality or phrase length influenced the results as well since topicality and referentiality are tightly linked. For word order processing in complements, it has already been shown that referentiality and information structure influence order preferences to a different extent (Bader & Meng, 1999). In order to gain a better understanding of the role of information structure on adverbial order processing, it is worth investigating these two factors independently. We will take care of these potential confounding factors in the present study.

Störzer (2017) gave an overview about different topical dimensions that frame adverbials can be analyzed as, namely Krifka's (2008a) delimitators (see Chapter 3) as well as aboutness topics. Since domain adverbials, like frame adverbials

fulfill discourse-structuring purposes, but are non-referential, they cannot be analyzed as aboutness topics but as delimitators that restrict the validity of the proposition (Krifka, 2008a). We will discuss this point in more detail below. The results in Specht and Stolterfoht (2022) suggest that the initial processing of domain adverbials is guided by information about the semantic adverbial type and syntactic position only. It is not clear yet how the information-structural status of domain adverbials affects sentence processing. Therefore, we conducted two acceptability judgment experiments with two aims:

1. Replicating the findings reported in Störzer and Stolterfoht (2013) by taking care of potential confounding factors, namely, referentiality and phrase length of the PP-frame adverbials

2. Investigating whether information-structural properties of domain adverbials affect offline acceptability judgments (but not online reading times)

We will provide further experimental evidence that information-structural properties of adverbials only affect later processing stages and that adverbial order is sensitive to discourse structuring functions that facilitate information management (Krifka, 2008b). We will finally integrate our findings into our two-stage model for adverbial order processing.

In the following, we will first outline the semantic and syntactic properties of the propositional adverbials in question and discuss findings of earlier studies concerned with order preferences of similar adverbials types (sentence and frame adverbials). Furthermore, we will argue that domain adverbials can be analyzed as non-referential topical elements in the sense of delimitator topics and present experimental studies related to the processing of adverbial order variation.

6.2 Theoretical background

We derived our predictions with regard to adverbial order preferences from base position accounts for adverbials, such as Frey and Pittner (1998b) and Frey (2003). These accounts postulate that adverbials, like complements, are base generated in

the German middlefield (the area between C^0 and V^0) and can undergo scrambling. The authors argue that adverbials in German and English fall into five categories according to their lexico-semantic properties. We use these authors' terminology by referring to the classes as *adjuncts* and the respective members of the class as *adverbials*. This terminology reflects the mixed character of the account: the adverbials within one class are classified according to semantic properties, and these properties hence enter the syntactic derivation in terms of syntactic base positions. The classes are ordered with respect to each other and the arguments of the sentence, as well as the finite verb. The predicted order is given here:

(i) sentence adjuncts (*e.g., sentence adverbials*)

(ii) frame adjuncts (*e.g., temporal and locative frames, and domain adverbials*)

(iii) event-external adjuncts (*e.g., temporal adverbials, causals*)

(iv) event-internal adjuncts (*e.g., locative, instrumental*)

(v) process-related adjuncts (*e.g., manner*)

In the assumed base position, adverbials c-command the domain they modify (i.e., TP, VP, V). Other accounts suggested that adverbials follow a rigid syntactic order and are not able to move (e.g., Cinque, 1999) or that adverbial position is mainly determined semantically (e.g., Haider, 2000). An extensive discussion about the driving forces, i.e., semantics or syntax, is beyond the scope of this paper, and the interested reader is referred to the cited work. We remain agnostic about the underlying forces of adverbial ordering, i.e., whether they are semantic or syntactic in nature. The base position account for adverbials, however, allows us (i) to derive precise predictions about order preferences and (ii) to assume that adverbials scramble and henceforth move out of their base positions. Several psycholinguistic studies on word order variations, mainly focusing on complements, have shown that movement comes with a processing cost (e.g., Rösler et al., 1998; Bader & Meng, 1999). The assumption that adverbials occupy base positions and therefore

scramble, entails that moved adverbials should also lead to higher processing costs and lower ratings.

6.2.1 Order preferences for propositional adverbials

For the present study, we will focus on order preferences of propositional adverbials, more precisely on speaker-oriented sentence adverbials and domain adverbials. Sentence and frame adjuncts are assumed to be located high in the sentence structure, namely above the subject (e.g., Frey & Pittner, 1998a; Cinque, 1999; Maienborn, 2001). We assume that they are located below the C-head and above the TP, and that the TP maps onto the proposition. Sentence adjuncts do not form a homogeneous group, consisting at least of evidential, epistemic, and evaluative sentence adverbials. Evaluative sentence adverbials (e.g., unfortunately), however, differ profoundly in semantic aspects from the two other types. Evaluatives, in contrast to epistemics and evidentials, are veridical and thus presuppose factivity of the modified sentence. They are known to have different ordering preferences (Störzer, 2017). We, therefore, focus on epistemic and evidential speaker-oriented sentence adverbials in order to avoid confounding factors. Semantically, the former express the speaker's expectation regarding the truth of the expressed proposition. The latter relativizes the speaker's commitment to the truth of the proposition by referring to a certain source. An example for epistemic and evidential sentence adverbials is given in (75). For an overview of the different types of sentence adverbials see Schäfer (2013).

(75) Präsident Franklin war wahrscheinlich$_{epi}$/ angeblich$_{evi}$ Veganer.
President Franklin was probably allegedly vegan
'President Franklin was probably/allegedly vegan.'

Domain and frame adverbials, on the other hand, are both classified as frame adjuncts. Semantically, domain and frame adverbials share the property of restricting the proposition to a certain locative or temporal frame (Maienborn, 2001) or to an interpretational domain. Ernst (2004) characterizes domain adverbials as event-modifying. Bellert (1977) and Schäfer (2013) subsume domain adverbials as an

instance of sentence adverbials. As stated above, we understand domain adverbials and frame adverbials as instances of the same semantic class and classify both as propositional adverbials. We distinguish frame adjuncts from sentence adjuncts because domain adverbials share some but not all properties with sentence adverbials. Like sentence adverbials, but unlike lower event-modifying adverbials, they cannot be in the scope of sentence negation (Example 76). However, frame adjuncts do not provide a comment on the proposition as speaker-oriented sentence adverbials do. Finally, they are not sensitive to modal operators such as questions (compare the examples in (77), for an overview also see Pittner (1999).

(76) a. Dieses Beispiel ist syntaktisch nicht (*syntaktisch) interessant.
this example is syntactically not syntactically interesting
'Syntactically, this sentence is not interesting.'

b. Peter sagt, dass Björn (*laut) nicht laut singt
Peter says that Björn loudly not loudly sings
'Peter says that Björn does not sing loudly.'

(77) a. Überarbeite den Artikel inhaltlich!
revise the article contentwise
'Revise the article with regard to content.'

b. Hast du den Artikel orthografisch verbessert?
have you the article orthographically improved
'Did you improve the article regarding orthography?'

c. * Überarbeite den Artikel wahrscheinlich!
revise the article probably

d. * Hast du den Artikel wahrscheinlich überarbeitet?
have you the article probably revised

The assumption that domain adverbials belong to a separate class, namely frame adjuncts, has direct implications on the relative syntactic ordering between sentence and domain adverbials. Example (78) reflects the postulated order preferences for sentence adverbials relative to domain and frame adverbials. Domain and frame adverbials differ in their restrictions on universal quantification. While in (78a) the set of all tourists is contextually restricted to the locative frame *in Majorca,* the domain adverbial in (78b) does not restrict the interpretation of the universally quantified NP *all students* to the interpretational domain provided by the adverbial

(Pittner, 2004). Domain adverbials are non-referential but denote an interpretational domain. It seems that only referential domains, i.e., frame adverbials, can restrict quantifiers. We make use of this difference in referentiality between frame and domain adverbials in order to avoid the referentiality as a potential confounding factor for order preferences attested in Störzer and Stolterfoht (2013).

(78) a. Eva meint, dass [wahrscheinlich]$_{\text{Sadv}}$ [*auf* Mallorca]$_{\text{frame}}$ alle
Eva means that probably in Majorca all
Urlauber betrunken sind.
tourist drunk are
'Eva thinks that probably in Majorca all tourists are drunk.'

b. Eva meint, dass [*wahrscheinlich*]$_{\text{Sadv}}$ [*finanziell*]$_{\text{domain}}$ alle
Eva means that probably financially all
Studierenden Probleme haben.
students problems have
'Eva thinks that financially all students are in difficult situations.'

6.2.2 Previous experimental studies on order preferences in propositional adverbials

For frame and sentence adverbials, Störzer and Stolterfoht (2013) attested an immediate increase in reading times for the derived order and higher ratings for the base order in acceptability judgment experiments. However, their results reveal an interaction with the referentiality of the frame adverbials. The base position preference was observed for non-referential frames like *auf jeder Insel* ('on every island'), but not for referential ones like *auf Mallorca* ('in Majorca'), see example (72). Störzer and Stolterfoht (2013) give an explanation in terms of the topicality of frame adverbials. Following Frey (2004) who argues that German is discourse configurational with respect to topics and has a designated topic position within the middlefield above sentence adverbials, referential frame adverbials preferentially seem to move out of their base position below sentence adverbials to this topic position. Sentence adverbials thus serve as a boundary between topic and comment, and only topics can fill the position above sentence adverbials (for a similar view, see Haftka (2003)). Consequently, any phrase positioned higher than the sentence adverbial has to express topicality. Frey distinguishes between frame ad-

verbials and aboutness topics with regard to topicality. However, he argues that frame adverbials are required to be referential in order to occupy the topic position above the base position of sentence adverbials. Experimental evidence for a topic position above sentence adverbials (TopP) and the processing of topic movement is reported in Stolterfoht, Frazier, and Clifton (2007) for English, in Störzer and Stolterfoht (2013), and Störzer and Stolterfoht (2018) for German. These authors concluded that the processing of information structure takes place in a later processing stage and is hence only visible in the offline data but not in the online self-paced reading data. These experiments showed that online processing only seems to be sensitive to syntactic information, indicating that processing is facilitated when adverbials appear in their base order in an early processing stage. However, information-structural characteristics are evaluated in a later processing step since the effects are only visible in the offline rating data.

Specht and Stolterfoht (2022) report a similar experiment but used another type of frame adjunct, namely domain adverbials. To control for ordering effects caused by phrase length, domain adverbials were realized as adjectives and matched in length with the adjacent sentence adverbials. The results of this self-paced reading experiment provided further evidence that deviations from the base order of propositional adverbials lead to an immediate increase in reading times. This pattern of results again shows that propositional adverbials are processed highly incrementally and that initial processing is influenced by the semantic adverbial category and syntactic position. However, given the discrepancies between online and offline data in earlier studies (e.g., Stolterfoht et al., 2019), it remains to be seen whether the topicality of domain adverbials influences acceptability ratings. Since Specht and Stolterfoht (2022) do not provide offline data, and given the results of the previous studies on adverbial order processing, data from offline methods such as acceptability studies are crucial to capture the temporal dynamics of adverbial order processing fully. Therefore, we will present two acceptability rating studies investigating domain adverbials. Before we will present our experiments, we will address the information-structural characteristics of domain adverbials.

6.3 Domain adverbials as delimitators

Referential frame adverbials can undergo movement across the sentence adverbial into the assumed medial topic position. We argue that frame adverbials and domain adverbials behave similarly, even though domain adverbials are non-referential and therefore no suitable candidate for an aboutness topic. According to Reinhart's (1981) famous metaphor, aboutness topics are understood as entries in a library catalog. The proposition expressed by a sentence is stored under that entry as it provides information about the respective topic. Tests for topicality involve fronting the topic phrase in order to identify it as the sentence topic. The proposition in (79a) and (79b) is the same. However, (79a) provides a comment on the topics *Benni* and (79b) on Vivian.

(79) a. As for Benni, he invited Vivian to dance with him.

b. As for Vivian, Benni invited her to dance with him.

(80) How is Jonas doing?

a. As for his health, he just recovered from the flu.

b. Financially, he is doing fine, but his boyfriend just split up with him.

Example (80) shows that domain adverbials exhibit similar behavior. The proposition in (80a) *Jonas just recovered from the flu* is restricted to the domain of Jonas' health, and in (80b) it is restricted to his financial situation, respectively. However, the topic throughout (80a) and (80a) is Jonas' well-being. In (80b), it becomes even more apparent that the assertion *he is doing fine* is limited to the financial domain while the remaining comment is stored under the alternative domain of his love life. The current Question-Under-Discussion (QUD) (see, e.g., Roberts, 1996) is addressed by a sequence of partial answers. Similarly, Ernst (2004) discussed topical readings of domain adverbials. He argues for a semantic topic rule that can be applied to sentence-initial adverbials such as domain and frame adverbials. The topic rule adds the possibility that the domain adverbial does not only restrict eventualities to an interpretational domain, as in their regular reading, but also restricts

a common ground topic into subsets. The information-structural properties of frame setters have been furthermore described by Jacobs (2001). He assumed four dimensions of topicality. Relevant for the discussion of our findings are the following two given in (81) and (82):

(81) **Adressation**: In (X Y), X is the address for Y iff X marks the point in the speaker– hearer knowledge where the information carried by Y has to be stored at the moment of the utterance of (X Y)

(Jacobs, 2001, 650)

(82) **Frame Setting**: In (X Y), X is the frame for Y iff X specifies a domain of (possible) reality to which the proposition expressed by Y is restricted

(Jacobs, 2001, 656)

Adressation is compatible with Reinhart's aboutness topic definition. According to Krifka (2008a, 3), *Addressation*, furthermore, applies to a basic principle of how humans store information. He understands addresses as pointers from which information can be accessed and where it will be attached. Krifka assumes that address-centered storage coincides with linguistic strategies. One such strategy is *Address first!*, which states that identifying the pointer first facilitates information management. Frame setting goes back to Chafe's (1976) conception of Chinese style topics which is not understood in terms of *aboutness* but as restricting the assertion to a spatial, temporal, or locative frame. Krifka (2008b) introduced the term *Delimitation*, under which he subsumed Jacob's frame setters as well as contrastive topics (e.g., Roberts, 1996). Delimitation applies *'(...) if the informational need cannot be satisfied by a simple statement, break up the issue into sub-issues, and indicate how they answer the big issue'* (Krifka, 2008a, 3). Addressation and delimitation are both selectional functions with regard to information packaging.

Delimitators are not required to be referential. Krifka acknowledges that addressation and delimitation have certain commonalities as both determine information packaging. These characteristics coincide with similar linguistic strategies to mark them, such as a preference for a sentence-initial position, and the possibility

to replace them with *as for*-constructions. However, it is possible for addressation and delimitation to co-occur in the same sentence. In Example (83), Tom is the topic while the domain adverbial functions as a delimitator.

(83) a. Finanziell$_{\text{delim}}$ geht es Tom$_{\text{topic}}$ gut, aber er hat einen
Financially goes it Tom good but he has a
Herzfehler.
heart.problem

b. Tom$_{\text{topic}}$ geht es finanziell$_{\text{delim}}$ gut, aber er hat einen
Tom goes it financially good but he has a
Herzfehler.
heart.problem.
'Tom is financially well off but he has a heart problem.'

Krifka (2008a) observed that delimitators preferably occur sentence-initially. However, in certain cases, other information-structural reasons might prevent delimitators, such as domain adverbials, from occupying high positions. One such reason is captured by the above-mentioned *Address first!*.

Delimitation and discourse structuring functions of certain adverbials have also been observed by Salfner (2014). She analyzed German *mäßig*-adverbials, which reveal similarities to English adverbs with *-wise*. She distinguished between restricting and characterizing *mäßig*-adverbials as in (84a) with the adverbial in a high position, where the assertion is limited to the interpretational domain of *'regarding the contract'*. In (84b), the adverbial in the lower position characterizes the means of *'fixing something'*. Only the former type fulfills discourse structuring functions.

(84) a. Ich befürchte, Peter wird vertragsmäßig was festmachen.
I fear Peter will contractwise something fix
'I am afraid Peter will fix something regarding the contract.'

b. Ich befürchte, Peter wird was vertragsmäßig festmachen.
I fear Peter will something contractwise fix
'I am afraid Peter will fix something by means of a contract'

(Salfner, 2014, 61)

According to Salfner, the two types of *mäßig*-adverbials do not only differ with regard to information-structural properties but also concerning their syntactic base

position. For restricting adverbials, she assumes a base position above sentence adverbials. Hence, she does not follow Frey's (2004) approach that restricting *mäßig*-adverbials (and domain adverbials) only move across sentence adverbials in order to meet topical requirements. She refers to Frey's theory which requires entities in TopP to be referential, a feature that *mäßig*- and domain adverbials clearly lack. According to her, only restricting, hence higher, mäßig-adverbials can function as delimitators while characterizing mäßig-adverbials cannot. In contrast, we argue for domain adverbials, which have characterizing as well as restricting readings, that they are base generated below the sentence adverbial. They can, however, move across the sentence adverbial in order to fulfill the role of a delimitator.

Against this background, we suggest that Frey's topic position is also open to delimitators, assuming that domain adverbials, like frame adverbials, serve as suitable candidates for the assumed topic position above sentence adverbials. The driving force behind the movement across the sentence adverbial under this view is not referentiality but topicality or delimitation. The base position of domain adverbials, however, is assumed to be below the sentence adverbial, but the domain adverbials move to meet information-structural needs. We tested these assumptions in the following acceptability judgment experiments.

6.4 Experiment 4: Acceptability judgment of adverbial order variations

The results in Specht and Stolterfoht (2022) yield evidence for the base order account in proposition modifying adverbials. Movement of a domain adverbial across a sentence adverbial, as well as movement of a temporal adverbial across a domain adverbial caused processing cost immediately. The temporal adverbials in their study had the purpose of testing whether adverbials located in different LF domains affect reading times to a different extent. They tested two adjacent adverbials within the same domain, namely CP (sentence adverbial and domain adverbial) and two adverbials located in two different domains, namely a domain adverbial in CP and a temporal adverbial in TP. Nevertheless, this manipulation

does not modulate the time course of processing. We use the temporal adverbials as a control condition to keep the materials maximally parallel. Moreover, the inclusion of a temporal adverbial had the secondary purpose of testing, whether the discourse-structuring function of domain adverbial is tied to the position above the sentence adverbial, as suggested by Frey (2004) and Repp (2017). Furthermore, the information-structural properties of domain adverbials do not seem to affect initial sentence processing. Therefore, in the current study, we address the question of whether discourse structure affects offline ratings and thus later processing stages. We conducted an acceptability judgment experiment using the same materials as the above-mentioned study. We derived two possible hypotheses, one referring to the syntactic base position account, assuming that acceptability judgments only reflect syntactic preferences, and an alternative information-structural hypothesis with the assumption that information-structural preferences influence adverbial order:

Syntactic hypothesis 4.a: A main effect ORDER with overall higher ratings for the syntactic base order (sentence adverbial > domain adverbial and sentence adverbial > temporal adverbial)
Alternative information-structural hypothesis 4.b: An interaction of ORDER and DOMAIN with overall higher ratings for the derived order of domain adverbial and sentence adverbial, hence the domain adverbial in the medial topic position, but a preference for the base order for the domain and the temporal adverbial (domain adverbial > sentence adverbial and domain adverbial > temporal adverbial).

6.4.1 Method

Participants

36 students (mean age = 23.03, SD = 8.62) of the University of Tübingen participated in the experiment for either course credit or a financial reimbursement of 5 €/ 30 minutes. All participants were adult native speakers of German, according to their self-reports, and naive with respect to the purpose of the experiment.

Materials

We used the same 24 experimental items as in the self-paced reading study reported in Specht and Stolterfoht (2022). An example item is presented in Example (85). The materials manipulated two factors ORDER ('base' vs. 'derived') and DOMAIN ('external' vs. 'across') as within-item and within-subject manipulation. The items consisted of embedded sentences to maintain the verb-final base order of German. The factor DOMAIN manipulated the positional relation of the two adjacent adverbials towards the domain of modification at LF. 'External' refers to two propositional adverbials (sentence and domain adverbial) located outside of the TP, which is the domain they modify. Furthermore, 'across' refers to the condition in which two adverbials are scattered across an LF boundary, namely a domain adverbial outside the TP and event-modifying adverbial (temporal) within the TP. However, we were primarily interested in the order preferences for the two propositional adverbials in the 'across' condition. Nevertheless, we implemented the factor DOMAIN, to keep the materials maximally similar to the online experiment reported in Specht & Stolterfoht, but we will not discuss the hypothesis for this manipulation. In the context of the current study, the materials with temporal adverbials are used as control conditions since, according to Frey and Repp (2017), only sentence adverbials, but no other types of adverbials, mark the position of the sentence topic.

(85) Hanna sagt,| dass|
Hanna says that

a. wahrscheinlich$_{Sadv}$ – gesundheitlich$_{domain}$| external – base

b. gesundheitlich$_{domain}$ – wahrscheinlich$_{Sadv}$ | external – derived
healthwise$_{domain}$ – probably$_{Sadv}$

c. gesundheitlich$_{domain}$ – gestern$_{temp}$ | across – base

d. gestern$_{temp}$ – gesundheitlich$_{domain}$ | across – derived
yesterday$_{temp}$ – healthwise$_{domain}$

Tim etwas spill-over | vorgetäuscht hat | und sich deshalb entschuldigt.|
Tim something pretended has and himself therefore excuses

'Hanna says that [adv] Tim [adv] faked something and thus apologizes.'

Procedure

Participants were invited to the lab to fill in a computer-based questionnaire. The experiment was programmed with the software E-Prime 2. Sentences had to be rated on a 5 - 1 Likert scale, 5 = perfectly acceptable, 1 = completely unacceptable. The endpoints of the scales were labeled. Participants were given five practice items. The entire procedure lasted about 15 minutes.

6.4.2 Analysis and results

For the analysis, we ran a cumulative link mixed model (CLMM). As fixed effects, we entered the experimental factors, as well as their interaction. Both factors were analyzed as within-items and -subject manipulations. The model included random intercepts for items and participants with the maximal random effect structure supported by the data. We obtained p-values by Laplace approximation. The descriptive data are presented in Figure 6.1. The output of the model is shown in Table 6.1. The data showed low overall ratings for all conditions ('base': mean = 2.37, SD = 1.07; 'derived': 2.63, SD = 1.13: 'across': mean = 2.47, SD = 1.11; 'external' mean = 2.52, SD = 1.11). The model revealed a main effect of ORDER with higher ratings for the derived order. DOMAIN did not reach the level of significance. As the interaction of the factors was significant, we conducted a post-hoc Tukey test, which revealed that the difference for the base order is mainly carried by the external condition (z = -4.812; p <.0001) while the difference between the 'base' and 'derived' within the 'across' condition is not significant (z= -1.179; p = .64).

6.4.3 Discussion

This experiment provided evidence for the alternative information-structural hypothesis 4.b. The model revealed a significant preference for the derived order over the

Formula: rating ∼ order ∗ domain + (1 | subject) + (1 | item)				
	Estimate	SE	t-value	p
ORDER	-0.53	0.13	-4.12	<.0001***
DOMAIN	-0.09	0.13	-0.71	.47
DOMAIN:ORDER	0.71	0.26	2.77	.005**

Table 6.1: Exp. 4: Statistical analysis CLMM of acceptability ratings

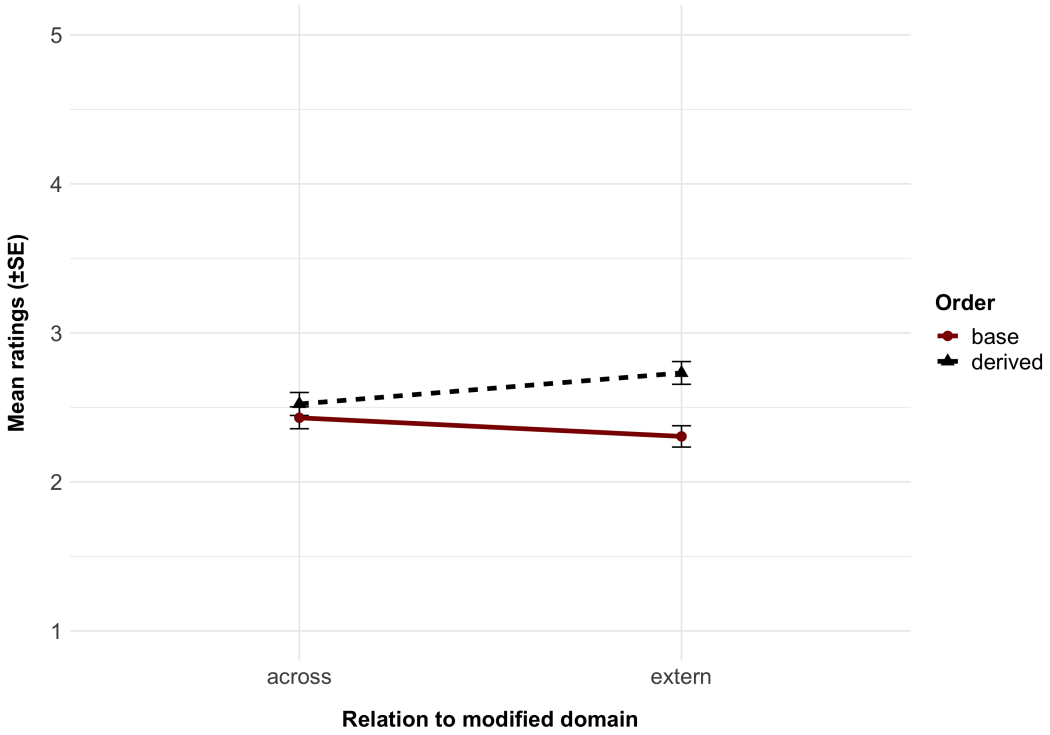

Figure 6.1: Exp. 4: Mean ratings (n = 36), including standard errors calculated on data aggregated across participants

postulated base order. This preference was caused by the external condition only, with significantly higher ratings for the derived order (domain adverbial > sentence adverbial), hence the propositional adverbials. We interpret this as evidence that Frey's medial topic position is tied to the position above the sentence adverbials but not by temporal adverbials. Furthermore, that this position is also open to delimitator topics, since domain adverbials, despite the fact of being non-referential, are preferred in the topic position above sentence adverbials. Based on the results by Specht and Stolterfoht (2022) and the findings for frame adverbials by Störzer and Stolterfoht (2018), we assume that the base position of domain adverbials is nevertheless below the sentence adverbial, but it can move to meet information-

structural constraints. Furthermore, the pairing of domain and temporal adverbials did not provide evidence for the postulated base order (domain $>$ temporal adverbial), in fact the analysis showed that there is no order preference between these two adverbials. A potential explanation is that some temporal adverbials can be ambiguous and be intepreted as purely eventive temporals but also temporal frames. The latter as an instance of frame adjuncts are syntactically not ordered towards domain adverbials as they belong to the same syntactic adjunct class. As stated in Frey and Pittner (1998b) and discussed in Chapter 2, adverbials of the same syntactic class are not ordered. Moreover, the possibility of interpreting these adverbials als either eventive adverbials and frame adverbials could have caused the observed absence of a preference, as the sentence material did not allow for disambiguation. As a consequence, no order effects were observed.

Overall ratings were comparably low (base mean = 2.37; SD = 1.07; derived mean = 2.63; SD = 1.13). A possible reason for the generally low ratings might be that the subjects of the sentences were positioned in their base position below the adverbials. All the subject DPs in our items were proper names hence definite referential DPs. A definite DP is a prototypical candidate for an aboutness topic. We decided to use this word order with the subjects in this low position to preserve the base order of the adverbials and the subject. The low ratings we attested for this order are thus not caused by a syntactic violation but are due to a violation of an information-structural preference. We introduced the *Address first!* principle discussed by Krifka (2008b) above, according to which delimitators should be preferred in a position before delimitators. The subjects in our items were the best candidates for being the aboutness topic but were located lower than the delimitator, and therefore *Address first!* was violated. Consequently, the subject should be preferred in the medial topic position and thus precede the delimitators and sentences obeying the *Address first!* principle should receive higher ratings. We will test this explanation for the overall low ratings in a second acceptability judgment experiment.

6.5 Experiment 5: Adverbial order and information structure

We argued that the low ratings in Experiment 4 were subject to a violation of more general discourse structuring preferences that enable efficient information management, namely addressation over delimitation. To test this hypothesis, we created a new set of materials. We assume that domain adverbials should be preferred in their base position below sentence adverbials when a prototypical aboutness topic like a definite DP entity fills the medial topic position and, therefore, blocks the domain adverbial's movement into TopP.

Example (86) illustrates the experimental conditions we tested in Experiment 5. We manipulated POSITION (subject 'before' vs. 'after' the adverbials) and ORDER ('base' vs. 'derived') of the adverbials.

(86) Lukas bericht,| dass|
Lukas reports that

a. $\text{vermutlich}_{\text{Sadv}}$ – $\text{wirtschaftlich}_{\text{domain}}$ $\text{Clara}_{\text{subject}}$ — before – base

b. $\text{wirtschaftlich}_{\text{domain}}$ – $\text{vermutlich}_{\text{Sadv}}$ $\text{Clara}_{\text{subject}}$ — before – derived
$\text{economically}_{\text{domain}}$ –$\text{presumably}_{\text{Sadv}}$ $\text{Clara}_{\text{subject}}$

c. $\text{Clara}_{\text{subject}}$ $\text{vermutlich}_{\text{Sadv}}$ – $\text{wirtschaftlich}_{\text{domain}}$ — after – base

d. $\text{Clara}_{\text{subject}}$ $\text{wirtschaftltich}_{\text{domain}}$ – $\text{vermutlich}_{\text{Sadv}}$ — after – derived

informiert ist.
informed is

'Lukas reports that Clara is presumably economically informed.'

Based on the discussion in the previous section, we formulate the following hypotheses:

Hypothesis 5: An interaction of ORDER and DOMAIN with overall higher ratings for the 'derived' order (domain adverbial > sentence adverbial), hence the domain adverbial in the medial topic position, i.e., the subject 'after' the adverbials, but a

preference for the 'base' (sentence adverbial > domain adverbial) if the adverbials are 'before' the subject.

Hypothesis 6: We expect a main effect for adverbial position with higher ratings for the adverbials following the subject, reflecting the preference for subjects over domain adverbials in the medial topic position (*Address first!*).

6.5.1 Method

Participants

32 participant (mean age = 31.9; SD = 11.2) were recruited in Prolific.co. All participants were adult native speakers of German, according to their self-reports, and were paid 2,20€ for 15 minutes.

Materials

We constructed 24 sentence quadruplets and manipulated the two factors POSITION (subject 'before' vs. 'after' the adverbials) and ORDER ('base' vs. 'derived') as within-item and within-subject manipulation. As in the previous experimental materials, the items consisted of embedded sentences to maintain the verb-final base order of German. In contrast to the previous experiment, predicates consisted of not eventive verbs but of stative copula constructions. The eventive verbs in the earlier experiments were required to allow for event modification with temporal adverbials, but since we were only interested in propositional adverbials, which are compatible with stative constructions, we used only copula-adjective constructions. Furthermore, this construction type excludes a potential reading of the domain adverbials as event-modifying adverbials (method-oriented or manner adverbials) since these adverbials are only licensed by eventive verbs. An example item is shown in Example (86) above.

Procedure

The experiment was programmed as an online questionnaire with the help of the open-source experimental software PsychoPy3 (Peirce et al., 2019) and the hosting platform Pavlovia.org. In the experiment, sentences had to be rated on a 5 - 1 Likert scale, 5 = perfectly acceptable, 1 = completely unacceptable. The endpoints of the scale were labeled. Participants were given five practice items. The entire procedure lasted about 15 minutes.

6.5.2 Analysis and results

The mean acceptability ratings for the four conditions are given in Figure 6.2. The ratings were analyzed by means of a cumulative link mixed model (CLMM). We entered the independent variables POSITION and ORDER as fixed factors, and subject and items as random intercepts and slopes. Table 6.2 gives the model formula and the output with the maximal random effect structure supported by the data. We obtained p-values by Laplace approximation. The model shows a highly significant main effect for POSITION caused by a preference for adverbials in post-subject position. Furthermore, the interaction of POSITION and ORDER was highly significant. As predicted, the derived order was rated higher in the pre-subject position. The base order received higher ratings in the post-subject position. ORDER did not reach the level of statistical significance. In comparison to Exp. 4, the subject in a position following the adverbials improved ratings profoundly (condition 'before': mean = 3.87, SD = 1.18).

Formula: rating $\sim$ order $*$ position + (order $*$ position | item) + (order $*$ position | subject)

	Estimate	SE	z-value	p
POSITION	-3.61	0.4	-9.02	<.0001***
ORDER	0.25	0.19	1.31	0.19
POSITION:ORDER	-2.1	0.4	-5.28	<.0001***

Table 6.2: Exp. 5: Statistical analysis CLMM of acceptability ratings

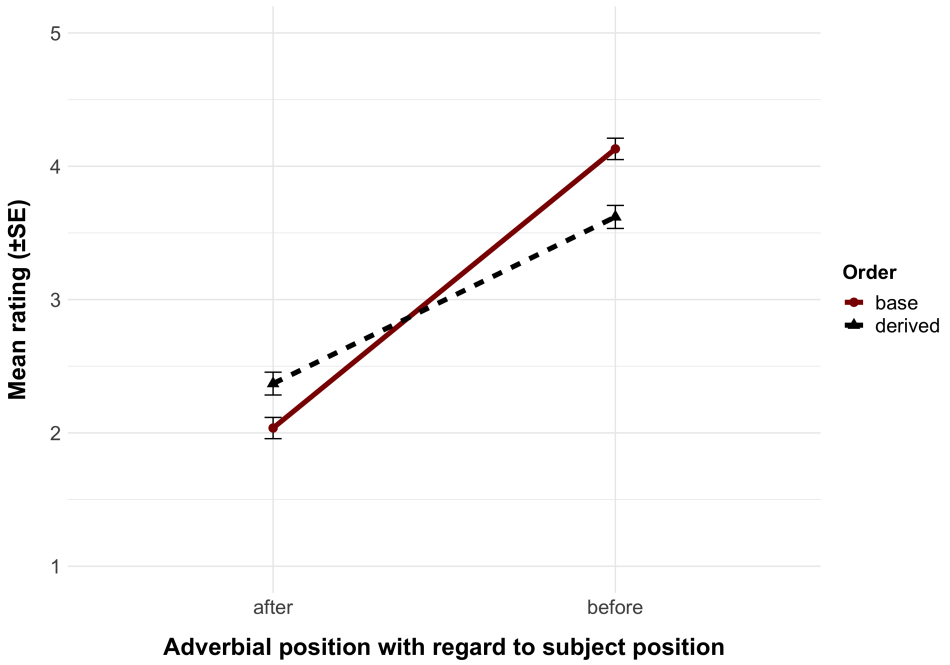

Figure 6.2: Exp. 5: Mean ratings (n = 32), including standard errors calculated on data aggregated across participants

6.5.3 Discussion

As predicted by the hypotheses, we found an overall preference for the adverbials in the position following the subject. Within these two conditions, ratings were significantly higher when the subject, a prototypical topic, was in the structural topic position preceding the sentence adverbial. We interpret this as evidence for the assumption that subjects are better candidates for topics than domain adverbials and are therefore preferred in the medial topic position described by Frey (2004). The significant interaction between POSITION and ORDER confirmed our hypothesis 5 regarding the delimitation function of the domain adverbial. The derived order was rated more acceptable when the subject remained in situ below the adverbials, and the base order received higher mean ratings when the topic position was filled with the subject, and the adverbials were below the subject. This also means that participants preferred sentences with a filled topic position. If the preferred sentence topic candidate, the subject, is not available because it remained in situ in TP/VP, the other discourse structuring element, in this case, the domain adverbial,

is preferred in this position. The overall preference for subjects in the high position above the sentence adverbial provides evidence for the *Address first!* principle proposed by Krifka (2008b), assuming that address-centered storage facilitates discourse management. Krifka also described the high positioning of delimitators as a strategy to signal that the assertion to follow only serves as a partial answer to the QUD. It thus seems reasonable to prefer discourse-structuring devices in a high, and hence early position, as this facilitates information packaging. Consequently, the attested movement of a discourse-structuring entity, i.e., the domain adverbial, to the designated medial topic position in the conditions with the subject below the adverbials seems to be preferred in order to facilitate information packaging.

6.6 General Discussion

Our experiments aimed to control for possible confounding factors that might have affected the order preferences for frame and sentence adverbials in Störzer and Stolterfoht (2013). Moreover, we investigated experimentally how the information-structural status of domain adverbials as delimitators affect order preferences for propositional adverbials. We presented evidence from two acceptability judgment experiments. Furthermore, we showed that the effects attested in Störzer and Stolterfoht (2013) were not due to confounding factors of frame adverbials, such as referentiality and heaviness of the locative PPs. The medial topic position is not restricted to referential topics, but also a suitable landing site for other discourse-structuring elements. We replicated the results of Störzer and Stolterfoht with another type of frame adjunct, namely domain adverbials, which were realized as non-referential, adjectival adverbials. Additionally, we found further evidence for the postulated base position of frame adjuncts below sentence adjuncts. More importantly, and similar to Störzer and Stolterfoht, we attested a discrepancy between the online reading times for domain and sentence adverbials reported in Specht and Stolterfoht (2022) and the offline data as reported in the current study. Movement of the domain adverbial across the sentence adverbial, i.e., the deviation from the base order, leads to an immediate processing cost. Surprisingly, the offline data

in Exp. 4 revealed a preference for the derived order, an effect that can be plausibly explained by discourse structuring principles. These principles, however, did not affect online sentence processing, which seems to be modulated by syntactic order principles only. These results are further evidence for a two-stage processing, in which syntactic and semantic constraints affect processing immediately, and information structure is evaluated with delay.

We also argued that the low ratings in our first experiment were caused by a violation of the *Address first!* strategy described in Krifka (2008b), and that the preference for the derived order, on the other hand, reflects an information-structural preference, maintaining efficient discourse management. Domain adverbials can fulfill the function of delimitators. Therefore, the movement of domain adverbials to the medial topic position is preferred, at least in the absence of a structurally marked aboutness topic, and thus overrides the preference for the base order. It, therefore, does not put the base position account for adverbials in jeopardy but shows that information-structural constraints can override syntactically-based preferences in a second processing step. Experiment 5 confirmed this hypothesis, the base order of the adverbials was preferred when the topic movement of the domain adverbial was inhibited by a referential subject, i.e., a prototypical aboutness topic, in the designated medial topic position.

Our findings are an essential piece to the puzzle of how adverbials are processed. Earlier studies concerned with adverbial order processing showed that propositional adverbials are processed highly incrementally. We found further evidence for the hypothesis that information-structural properties of the adverbials affect later processing stages since information-structural constraints were only visible in the offline data. Early processing stages are guided by syntactic and semantic information, and information-structural characteristics are processed with delay. We could not able to identify the point in time when information-structural processing starts. Therefore, an alternative explanation of the discrepancy of the online and offline data could be that the nature of the rating task forces participants to make sense of a somehow deviant structure. The domain adverbial, as a discourse-

structuring element, was then interpreted as such only if participants were forced to evaluate the sentences. However, our results align with several neurocognitive studies on the interaction of context and word order during online processing of non-canonical ordering of complements in German. It has been shown that initial processing is guided by syntactic principles whereas information-structural properties are only processed in later stages and on a global sentence level (Bader & Meng, 1999; Paterson et al., 1999; Bornkessel et al., 2003; Stolterfoht, 2005; Bornkessel & Schlesewsky, 2006). Propositional adverbials in this respect seem to pattern with complements.

In our experiments, participants were asked to rate a sentence without preceding context. The question of how context interacts with adverbial order processing is subject to future research. For frame adverbials, Störzer (2017) observed that topic marking of a frame adverbial by a preceding context facilitated processing, but only in the spill-over region following the frame adverbial and not immediately on the critical region itself. What we can conclude from her and our findings for order variations with propositional adverbials is that without overt information-structural marking by a preceding context, first processing stages are guided purely by syntactic and semantic information. Information-structural processing might set in later because participants have to accommodate information-structural characteristics, such as topicality, givenness, and delimitation, when it is not explicitly marked by preceding context. In cases where contextual information is available beforehand, processing can proceed in a forward-looking, anticipatory fashion to reduce processing cost (Altmann & Kamide, 1999; Kaiser & Trueswell, 2004).

To sum up, our results provide evidence for (i) two-stage processing on the level of single sentences, and (ii) the discourse-structuring effects of adverbial position, even in cases where referentiality and definiteness are excluded as possible confounding factors

6.7 Summary and outlook

The experimental studies reported in this chapter were dedicated to the question whether domain adverbials interact with information-structural properties. Krifka (2008a) introduced so-called *delimitators*. Domain adverbial can be analyzed as such. Störzer and Stolterfoht (2018) found that frame adverbials can function as aboutness topics. This topical function influences order preferences for frame adverbials. However, the referential nature of the frame adverbials as aboutness topics might have been a confounding factor in their studies. Domain adverbials, as a non-referential type of discourse-structuring entity, are an ideal test case to eliminate referentiality as a confounding factor. We found that the delimitator function of domain adverbials influences the order preferences equally, and domain adverbials, like frame adverbials, are preferred in a medial topic position. Interestingly, these preferences are, like in Störzer and Stolterfoht's (2018) case, only visible in offline studies. Furthermore, if a more prototypical topical entity than the delimitator i.e., the subject, is placed in the topic position, the base order between the sentence and the domain adverbial is preferred. We take this as evidence that the acceptability status is affected by efficiency in information packaging. However, immediate online processing is guided by syntactic position and semantic category only, and information-structural preferences are only visible in later stages.

So far, the results reported in this dissertation are in line with previous studies on adverbial order processing, indicating a difference in the time course between propositional and event-modifying adverbials. However, there was no systematic comparison between the two categories. This will be done in the following chapter, by answering sub-question 3:

• Is the time course of adverbial order processing modulated by the adverbial category?

I conducted a self-paced reading study and a complementary acceptability judgment study. Once again, I constructed materials with two adjacent adverbials in base and derived order. For these studies, I entered adverbial category as an

experimental factor in order to compare reading times and order preferences systematically for the different categories.

7 | Bringing the findings together: Propositional vs. event-modifying adverbials

7.1 Introduction

In this chapter, I will report evidence for the immediate integration of propositional adverbials and the delayed effects for event-modifying adverbials. So far, I concluded that the former, but not the latter, can be processed incrementally due to their semantic and selectional properties. In this chapter, I will report two additional experiments that I conducted to test the explanation in a controlled experiment. Furthermore, I tested whether the same time course of order effects can be observed in a different sentence structure. The experimental materials in Chapter 5 and 6 were constructed to maintain the base order of adverbials and arguments. The word order variation in the material was limited to the two adjacent adverbials under investigation in order to avoid confounding factors that could have been introduced by the movement of other constituents than the adverbials. However, keeping movement of constituents other than the adverbials minimal had the disadvantage that the referential subjects, which I used in the previous studies are in a less preferred position. Referential subjects serve as prototypical topics and are preferred in the topic position in the prefield (Frey, 2003; Störzer & Stolterfoht, 2018). However, especially for the propositional adverbials this resulted in a rather marked struc-

ture (cf. Experiment 4). In Chapters 5 and 6, I obtained evidence for the assumed base order of different propositional adverbials, namely sentence adverbials and domain adverbials. Furthermore, the impact of information structure and the preference of filling the medial topic position with a topic-like entity was investigated. Nevertheless, an objection that could be raised is that the high reading times for propositional adverbials in Experiment 2 could be due to fact that the subjects are in a marked position, namely after the adverbial. For this reason, the experimental materials used in the experimental studies reported in this chapter use a less marked order, in order to exclude potential confounding factors introduced by the comparably marked structure used in Experiment 2. I will report the findings of a self-paced reading experiment and an acceptability judgment experiment.

7.2 Experiment 6: Self-paced reading experiment

In order to gain insight into online processing, I conducted a self-paced reading experiment in which I compared reading times of two adjacent propositional adverbials to two adjacent event-modifying adverbials both in base and derived order. The experiment had two aims. The first aim was to investigate whether the same time course pattern, namely immediate effects for propositional adverbials and delayed effects for event-modifying adverbials would be found. So far, there has been no systematic comparison in an experimental study. The second aim was to investigate whether the findings obtained for propositional adverbials would also be attested with a less marked sentence structure. The experimental materials of the previous experiments were all constructed in a way that the base order in embedded clauses in German is maintained. This was based on the assumption that adverbial order effects might be more subtle than complement order effects (e.g., Clifton et al., 1991; Tutunjian & Boland, 2008), and could, henceforth, be overshadowed by processing costs of moved complements. The experiments reported in Chapters 5 and 6, however, yield evidence that propositional and event-modifying adverbials are syntactically ordered. The purpose of this experiment is i) to eliminate confounding factors of previous studies, namely word order preferences with

regard to the subject and the high averbials ii) directly compare propositional and event-modifying adverbials with regard to online processing and offline preferences. An example item is given in (87).

For the self-paced reading experiment, I derive the following hypotheses:

Hypothesis 7: An interaction of ORDER and CATEGORY on the critical region (adv + adv) carried by a larger difference for 'proposition'-'base' vs. 'proposition'-'derived'.

Hypothesis 8: An interaction of ORDER and CATEGORY on the spill-over region carried by a larger difference for 'event'-'base' vs. 'event'-'derived'.

(87) Mark hat|
Mark has

a. wahrscheinlich$_{\text{sentence}}$ – gehaltlich$_{\text{domain}}$| proposition – base

b. gehaltlich$_{\text{domain}}$ – wahrscheinlich$_{\text{Sadv}}$ | proposition – derived
salarywise$_{\text{domain}}$ – probably$_{\text{Sadv}}$

c. im Salon$_{\text{locative ext.}}$ – vorsichtig$_{\text{manner}}$| event – base

d. vorsichtig$_{\text{manner}}$ – im Salon$_{\text{loc.ext}}$ | event – derived
carefully$_{\text{manner}}$ – in the saloon$_{\text{loc.ext.}}$

etwas gewagt, $_{\text{spill-over}}$ | sagt Anja
something risked says Anja

'Mark has [adv + adv] risked something says Anja.'

7.2.1 Method

Participants

80 participants (mean age: 28.3; SD = 9.7) were recruited in Prolific.co. Participants reported to be native speakers of German and were paid 2,20€ for 20 minutes.

Materials

I constructed 24 sentence quadruplets with the factors ORDER and CATEGORY. An example item is shown in Example (87). ORDER followed the same pattern as above: two adjacent adverbials were either presented in their 'base' order or in a 'derived' order, where the lower adverbial has moved across the higher one. The factor CATEGORY manipulated whether the two adverbials are propositional adverbials ('proposition') or event-modifying adverbials ('event'). For the former, I used sentence adverbials and domain adverbials and for the latter external locatives and manner adverbials. The manipulations were restricted to the critical region of the sentences. The rest of the sentences i.e., subject and the verb remained equal across the items.

Unlike in the previous experiment, I used main clause constructions, with verbs in perfect tense to preserve the structure with the lexical verbs in their base position in clause-final position. This manipulation served two purposes. First, propositional adverbials and event-modifying adverbials differ with regard to their relative position to the subject. The former are assumed to be base-generated above the subject and the latter below. The topicalized subjects make it possible to position both adverbials types in the same critical region. The second purpose refers to the potential confounding factor with regard to the subject in the position below the adverbials.

Items were created with a transitive verb and with indefinite pronouns as direct objects. I chose transitive verb structures for practical reasons. It is easier to find transitive verbs that work with propositional and manner modification. However,

transitive verbs could lead to a potential problem due their relative position with regard to the manner adverbials and the direct object. In order to avoid potential effects caused by the referential status of the direct object, I chose the indefinite pronoun *etwas* ('something') as the direct object. According to Frey (2001) and Jacobs (1993) (cited in: Gauza, 2018, 95f), verb-adjacent indefinites can be incorporated into the predicate complex; manner adverbials, above a verb-adjacent indefinite, are still assumed in their base position. Gauza (2018) provided experimental evidence for this claim.

Each domain adverbial appeared two times in one experimental list, whereas the sentence adverbials appeared four times, and manner adverbials three times on each list. Locative adverbials were not repeated at all. In order to prevent heaviness effects that could affect order preferences, adverbials were matched in syllable length and maximally differed by one syllable. I applied the same list distribution as in the previous experiments and added 48 filler.

Procedure

This experiment was programmed in JavaScript and hosted on the server of the University of Tübingen, it was distributed via Prolific.co. Sentences were presented segment-wise, using a self-paced reading task with moving window technique. Participants were instructed to read at their natural pace. By pressing the space bar, participants started the experiment: lines of dashes appeared on the screen, each dash representing a character of the stimulus sentence. By each pressing of the space bar, the sentence was uncovered segment by segment. When a new segment was uncovered the previous segment changed back to dashes. Participants were asked a comprehension question about the preceeding sentence in 50 % of the trials. Half of the comprehension questions required a *'yes'* and the other half required a *'no'* answer. After a third of the sentences, a catch trial was implemented in which participants had to press a certain key within a set time frame. This procedure was to ensure that participants were attentively reading the sentences on the screen. Before the actual experiment started, participants were presented with five sentences as practice trials. The entire procedure lasted approximately 20 minutes.

7.2.2 Analysis and results

Participants who missed more than one of the catch trials were excluded from the data analysis. Furthermore, participants with reading times shorter than 200ms and longer than 5000ms were excluded from the analysis. In total 64 participants were considered for the statistical analysis. Finally, I eliminated data points that deviated for more than 2.5 SD from the mean per segment and participant. This treatment led to an additional data loss of 2.9% of the data points. The reading times were log-transformed and analyzed by means of a linear mixed effects model (Bates et al., 2015). I entered CATEGORY and ORDER as fixed effects and participants and items as random effects. The statistical analysis for the critical region with the model formula with the maximal random effect structure supported by the data are reported in Table 7.1. The descriptive statistics are presented in Figure 7.1. For the critical region, there was no main effect for ORDER. However, I attested a significant main effect for CATEGORY as well as a significant interaction. As the interaction was significant, and the hypotheses differed for the two adverbial categories, I conducted a post-hoc Tukey test, which showed that the difference between the 'derived' and 'base' order for propositional adverbials was significant (t = -2.72, p = .04), but for event-modifying adverbials it was not significant (t = 1.83, p = 0.27).

The corresponding table for the spill-over region is given in Table 7.2. The statistical analysis for the spill-over region did not reveal any significant results, i.e., there were no differences for either event-modifying adverbials, as predicted by the hypothesis, or for propositional adverbials.

Formula: log(reading time) $\sim$ order $*$ category + (1| participant) + (order + category | item)

	Estimate	SE	df	t-value	p
(Intercept)	6.74	0.05	81.16	136.9	
ORDER	-0.01	0.02	23.27	-0.55	.59
CATEGORY	0.08	0.03	23.68	-2.76	.01*
ORDER:CATEGORY	0.14	0.03	1622.02	3.99	<.0001***

Table 7.1: Exp. 6: Statistical analysis LMEM of reading times in the critical region (adverbial + adverbial)

Formula: log(reading time) ∼ order ∗ category + (1| participant) + (category | item)

	Estimate	SE	df	t-value	p
(Intercept)	6.632e+00	4.449e-02	8.331e+01	149.06	
ORDER	1.518e-02	1.517e-02	1.650e+03	1.001	.32
CATEGORY	1.025e-02	2.074e-02	2.364e+01	0.494	.63
ORDER:CATEGORY	2.785e-02	3.035e-02	1.649e+03	0.917	.36

Table 7.2: Exp. 6: Statistical analysis LMEM of reading times in the spill-over region (object + participle)

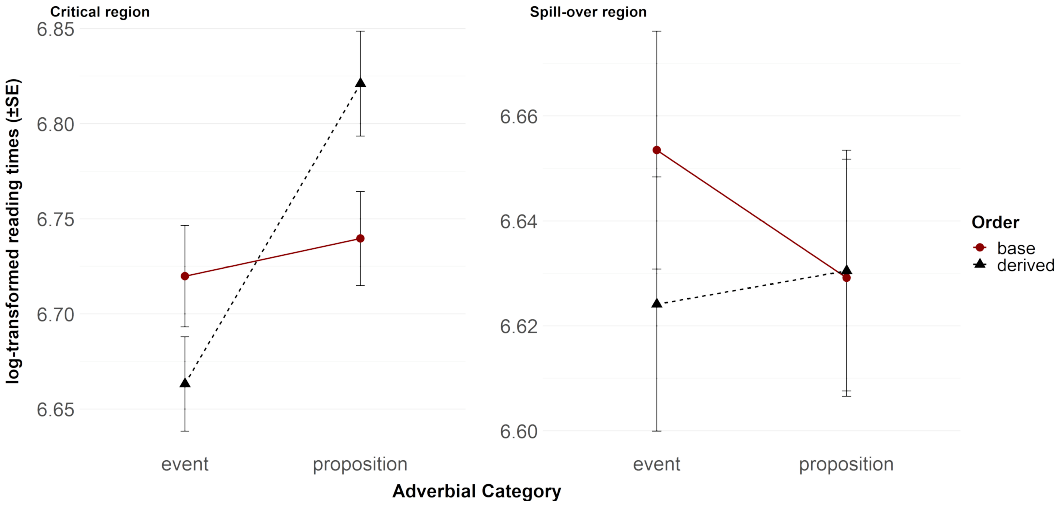

Figure 7.1: Exp. 6: log-transformed mean reading times in critical region (left) and spill-over region (right) (n = 64), including standard errors calculated on data aggregated across participants

7.2.3 Discussion

The self-paced reading experiment revealed a similar time course pattern for propositional adverbials as Experiment 2. Deviations from the predicted base order (sentence adverbial > domain adverbial) lead to an immediate increase in reading times on the adverbials. These results confirm hypothesis 7. Hence, it provided further evidence for the assumption that they are processed highly incrementally. This finding seems to hold for embedded sentences as in the previous experiments but also for main clauses with a fronted subject. I thus conclude that the immediate increase

in reading times in Experiment 3 was not caused by a highly marked structure but by the domain adverbial's movement across the sentence adverbial.

For event-modifying adverbials, I did not attest any differences in reading time. Hypothesis 8 has to be disregarded, as the movement of a manner adverbial across a locative did not lead to slower reading times. I will first report the acceptability judgment experiment and then discuss the results of both experiments in more detail.

7.3 Experiment 7: Acceptability judgment experiment

For the acceptability judgment experiment, I predict the following hypothesis:

Hypothesis 9: A main effect ORDER with a preference for the 'base' order in both pairs of adverbial category.

Conversely, it could be argued that a preference for the derived order of sentence and domain adverbials can be observed, as it was the case in Experiments 4. As already discussed in Section 7.1., the materials constructed for this experiment involved main clause constructions, which means that the prefield, the position preceding the main verb, is filled with the subject DP constituting of a proper name and thus qualifying as a topical entity. The results of Experiment 5, reported in Chapter 6 provide evidence for a preference of the adverbial base order as long as the information-structurally relevant positions are filled with a topical entity, in this case the prefield.

7.3.1 Method

Participants

42 participants (mean age: 28.9; SD: 9.5) were recruited in Prolific.co. Participants were native speakers of German, according to their self-reports, and were paid 2,20€ for 15 minutes.

Materials

Materials were the same as in the self-paced reading experiment study in Experiment 6 with the necessary methodological adaptions, i.e., spill-over regions and comprehension questions were excluded. An updated version is given in Table (88)

(88) Mark hat
Mark has

a.	wahrscheinlich$_{\text{sentence}}$ – gehaltlich$_{\text{domain}}$	proposition – base
b.	gehaltlich$_{\text{domain}}$ – wahrscheinlich$_{\text{Sadv}}$ | salarywise$_{\text{domain}}$ – probably$_{\text{Sadv}}$	proposition – derived
c.	im Salon$_{\text{locative ext.}}$ – vorsichtig$_{\text{manner}}$	event – base
d.	vorsichtig$_{\text{manner}}$ – im Salon$_{\text{loc.ext}}$ carefully$_{\text{manner}}$ – in the saloon$_{\text{loc.ext.}}$	event – derived

etwas gewagt.
something risked

'Mark has [adv + adv] risked something.'

Procedure

The experiment was programmed as an online questionnaire with the help of the open source experimental software PsychoPy3 (Peirce et al., 2019) and the hosting platform Pavlovia.org, like Experimet 6, it was distributed via Prolific.co. In the experiment, sentences had to be rated on a 5- 1 Likert scale, 5 = perfectly acceptable, 1 = completely unacceptable. Participants were given five practice items. The entire procedure lasted about 15 minutes.

7.3.2 Analysis and results

The mean acceptability rating for the experiments are given in Figure 7.2. Data of 6 participants had to be excluded due to incomplete data sets and unreasonable use of the scales. The data of the remaining 36 participants were analyzed by means

of a cumulative link mixed model (CLMM). I entered the independent variables as fixed factors, and subject and items were entered as random intercepts. Table 7.3 provides the model formula and the output with the maximal random effect structure supported by the data. As predicted, the model reveals a significant effect for ORDER with a preference for the base order for event-modifying adverbials and propositional adverbials. The difference between the adverbial CATEGORIES and the interaction of the two factors were not significant. The overall means across conditions are 'base': mean = 3.35, SD = 1.25; 'derived': 3.2, SD = 1.24: 'event': mean = 3.3, SD = 1.24; 'proposition' mean = 3.25, SD = 1.26.

Formula rating $\sim$ order $*$ category + (category + order | subject) + (category|item)

	Estimate	SE	z-value	p
CATEGORY	0.04	0.27	0.18	.89
ORDER	0.3	0.15	2.03	.04**
ORDER:CATEGORY	0.03	0.26	0.11	.91

Table 7.3: Exp. 7: Statistical analysis CLMM of acceptability ratings

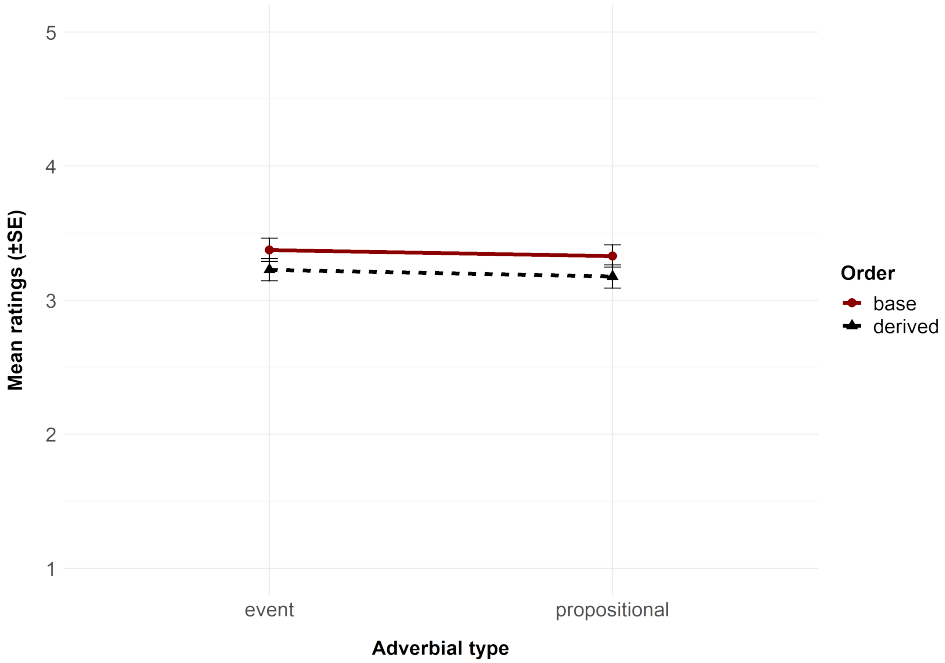

Figure 7.2: Exp. 7: Mean ratings (n = 36), including standard errors calculated on data aggregated across participants

7.3.3 Discussion

The results of the acceptability judgment experiment yield further evidence for the predicted base order of propositional adverbials and event-modifying adverbials. The preference can also be observed in main clause structures with topicalized subjects, hence a less marked structure. The base order is perceived as more acceptable in both cases. The small descriptive difference between base and derived order indicates that both orders are judged as grammatical (mean base = 3.34, SD = 1.3; derived mean 3.2, SD = 1.3 aggregated over adverbial category). In the previous experiments, adverbials were presented in embedded sentences to ensure the base order of the adverbials and the complements. Especially for the propositional adverbials, these structures (Experiment 4) caused low ratings. The main clause structure of this experiment with an auxiliary in verb-second position led to higher ratings (Experiment 4: mean 'base' 2.37, SD = 1.07; 'derived': 2.63, SD = 1.13). Nevertheless, the preference for the base order was judged significantly higher. Moreover, in Experiment 7, there was no difference between propositional and event-modifying adverbials. In the following, I will relate the results of the self-paced reading and the acceptability judgment experiment reported in this chapter.

7.4 General Discussion

In the experiments conducted in this chapter, I found an offline preference for the base order of two adjacent propositional and two event-modifying adverbials respectively, thus hypothesis 9 was confirmed. However, the online experiment only provided evidence for hypothesis 7, with an immediate penalty for the derived order of propositional adverbials. Event-modifying adverbials did not yield a difference in reading times at any point, thus hypothesis 8 was not confirmed. This finding differs from the previous findings reported in Chapter 5. In Experiment 1, slower reading times were observed for event-modifying adverbials in the derived order in the spill-over region. In Experiment 3, I attested a significant offline preference for the base order of event-modifying adverbials. So far, I have argued that event-

modifying adverbials are processed with delay, However, in Experiment 6, manner adverbials did not cause higher reading times when moved. As this finding is at odds with my interim explanation, which is that event-modifying adverbials lead to a delayed reading time penalty when moved, I will mainly focus on why manner adverbials might differ in this regard from other event-modifying adverbials.

Primarily, the findings concerning the manner adverbials are in line with Gauza's (2018) findings for manner adverbials and the direct object. He did not observe an online effect for order variations of adverbials and the direct object, but found an offline preference for the base order. The lack of costs observed for manner adverbials thus seems to be quite robust and distinguishes them from other adverbials investigated in this thesis, as well as from the frame adverbials investigated in Störzer (2017). I will discuss manner adverbials in more detail in the following.

Frazier and Clifton (2021) argued that in case of a potential ambiguity, there seems to be an underlying preference for a manner reading. They investigated ambiguous adverbial phrases (cf. Example (89)). The as-clause is ambiguous between a manner and a propositional reading, the paraphrase for the propositional reading is given in (89a) and the paraphrase for the event-modifying reading in (89b).

(89) Mix the dough as a baker would.

a. Mix the dough; a baker would.

b. Mix the dough in the manner of a baker.

(Frazier & Clifton, 2021, 17)

They observed a default preference for a manner reading, which can be overridden by a guiding context, they captured this preference with the *Event-internal Modification principle*, which states that in the absence of evidence favoring alternatives, the manner interpretation will be favored over other interpretations, but this default can be overridden. At first glance, the preference for event modification resembles the syntactic preference for low attachment. Given the findings attested for adjunct

attachment, which does not seem to be governed by purely syntactic preferences (see the discussion in 4.2 and Frazier & Clifton, 1997), it is unlikely that the Event-internal Modification principle is a purely syntactic principle. Frazier and Clifton (2021) argue that the preference for event-internal modification is due to a compositional preference for local composition. However, their items involved action verbs and the corresponding agents describing professions or stereotypical executors of the action described by the verb, which suggests that this might have caused a bias towards an event reading over a propositional reading. Crucially, assuming that the manner interpretation is assigned by default cannot explain why no base order effects are attested for manner adverbials (but for other event-modifying adverbials). If a manner interpretation is assigned, it should follow that the base position assigned to a manner adverbial can be identified, and a deviation from the base order should lead to a reading time penalty. This is, however, not the case.

An alternative explanation refers to the fact that adverbials are notoriously ambiguous. In Section 2.2.4, I discussed that adverbial interpretation is correlated with adverbial position (e.g., Maienborn, 2001; Schäfer, 2013; Stolterfoht, 2012, 2015). Furthermore, I introduced *Immediate partial interpretation* as suggested by Frazier (1999), here repeated as (90).

(90) **Immediate partial interpretation:**

Perceivers must choose between grammatically incompatible meanings of a word or constituent immediately, by the end of the word or constituent.

(Frazier, 1999, 50)

By comparing potential ambiguities of the adverbials in question, it becomes apparent that manner adverbials differ in this regard from the other adverbials for which I attested immediate or delayed order effects. Sentence adverbial show in general a very low potential of ambiguities and no ambiguity resolution is required. Domain and locative adverbials reveal ambiguities with at least one additional reading. However, the relations between these readings differ qualitatively from the ambiguity found in manner adverbials. For domain and locative adverbials respective readings differ in semantic adverbial category, syntactic position, and resulting base

position. In Chapter 1, I illustrated the three-way distinctions of locative adverbials suggested by Maienborn (2001). Locative adverbials can have a frame reading, an event-external, and an event-internal reading. However, these readings are not compatible, because frame and external readings obey distinct licensing conditions, i.e., whether they require an event argument. They overlap conceptually in the sense that they provide a locative meaning component but the exact semantic specifications differ profoundly. Similarly, external and internal locatives are not compatible as they result in different event descriptions which makes a commitment necessary. This becomes apparent in cases where an ambiguity between an internal and external reading arises. Consider Example (91), an external interpretation of the locative *im Museum* 'in the museum' specifies that the arranged appointment will happen in a museum, whereas an internal locative reading locates the event of arranging the appointment that is described in the sentences. These readings are not compatible and one meaning must be chosen.

(91) Angela hat sich mit Bardo im Museum verabredet.
Angela has REFL with Bardo in.the Museum arranged-to-meet
(Maienborn, 2001, 218)

In contrast, different readings of ambiguous manner adverbials (e.g., agent-oriented and method-oriented readings) are normally compatible and result in similar event descriptions. In German, unlike in English, manner adverbials are rarely ambiguous across adverbial categories (i.e., a propositional and event-modifying reading), which would necessarily result in a structurally larger distance of the respective base positions in the clause structure. Only very few cases of manner adverbials in German reveal an ambiguity of this kind, one such example is Stolterfoht's (2015) analysis of *sicher* 'certainly'/ 'confidently'. In German, adjectival 'manner' roots of sentence adverbials are unambiguously marked with a *-weise*-suffix ('-wise'). However, manner adverbials can be ambiguous and have an agent-oriented or a pure manner meaning (Schäfer, 2013). This difference is very subtle. Example (92) presents an adverbial which can be read as a pure manner adverbial and an agent-oriented adverbial. The agent-oriented meaning can

be paraphrased with: *Peter defended himself as an intelligent person would have done it*, without recourse to the actual manner of the defense act, whereas the pure manner reading only refers to the manner of defending but not the evaluation of the subject's decision to defend himself. Conceptually, it is barely possible to pinpoint this meaning difference. I thus assume that a commitment, which might be subject to a potential costly revision, is avoided, when the readings are not incompatible. A definite decision only has a minor effect on the overall sentence meaning and thus underspecification of the adverbial is the most efficient choice.

(92) Peter hat sich intelligent/geschickt verteidigt.
Peter has himself intelliently/skilfully defended
'Peter defended himself intelligently/skilfully.'

(Schäfer, 2013, 60)

In this discussion, I mainly focused on manner adverbials and not on the results attested for propositional adverbials. This is because the experimental results for propositional adverbials were successfully replicated: two adjacent propositional adverbials in a derived order led to an immediate increase in reading time. This seems to hold for embedded clauses and main clauses. Manner adverbials, on the contrary, do not seem to behave like other adverbials. Nonetheless, the results attested here are compatible with Gauza's (2018) results for manner adverbials and the direct object which did not lead to an increase in reading times, but to an offline preference. I argued that the exact nature of the ambiguity of the adverbials plays a crucial role. As for manner adverbials, differences in meaning between the readings are subtle and different readings are compatible. This is not necessarily the case for locative or temporal adverbials, as locative and temporal adverbials are ambiguous between a propositional interpretation and an event interpretation. This results in structural differences with regard to the assigned base position within the clause structure, but also has semantic consequences as the latter unlike the former require an event argument. As a consequence, manner adverbials remain underspecified, which has the consequence that no base position can be identified and thus no online base order effects are attested.

7.5 Summary and outlook

This chapter reported findings of one self-paced reading experiment and one acceptability judgment experiment. The findings can be summarized as follows: Movement of propositional adverbials such as domain adverbials across sentence adverbials generated an immediate processing cost. The case for event-modifying adverbials seems to be more complicated. In Chapter 5, a delayed reading time penalty was reported for an external locative that moved across a temporal adverbial and also for an internal locative that moved across a manner adverbial. However, movement of a manner adverbial across an external locative did not cause any observable movement cost. The modulating factor for processing seems to be an interplay of semantic adverbial type and its licensing conditions. Furthermore, adverbial ambiguity affects processing and the time course of adverbial order processing. In case of ambiguity, a semantic commitment to a certain reading is only made when required, i.e., when the readings are not compatible. For the propositional adverbials under investigation it was shown that they are interpreted immediately. As a consequence, they are assigned a base position, and a deviation from the base order thus taxes the processing system immediately. Event-modifying adverbials (except for manner adverbials) are processed with delay once the event-description is complete and the event argument provided by the verb is encountered. Manner adverbials, however, remain underspecified as, at least for the manner adverbials in my studies, different readings are compatible and no commitment is required.

8 General discussion and outlook

This chapter has the aim to summarize the experimental results of the studies reported throughout Chapters 5, 6, and 7. I will briefly give an overview of the online processing data I acquired utilizing the self-paced reading paradigm, and also discuss the offline acceptability judgment data. Furthermore, I will evaluate and discuss the findings in the light of the theoretical discussion on adverbial position and semantic adverbial types in Chapters 2 and 3 and word order and adverbial processing in Chapter 4 and answer the research questions raised in Section 1.2. Finally, I will give an outlook for future research.

8.1 Summary of experimental results

In this section, I will answer the research questions raised in Chapter 1.1. I will begin with answering the three sub-questions, and finally answer the global question that guided this dissertation.

Sub-question 1:

• Does the position of the adverbials at LF and their relation to the modified domain determine the time course of adverbial order processing?

This research question was derived from the pattern of results for adverbial order processing of different adverbials types. On the one hand, Störzer (2017) found immediate effects for the derived order of frame and sentence adverbials. On the

other hand, delayed effects, i.e., offline effects were attested for manner adverbials and the direct object (Gauza, 2018). In Chapter 5, which consists of the article Specht and Stolterfoht (2022), two self-paced reading experiments were reported that investigated whether the time course of processing is determined by the position of the adverbials at LF. In **Experiment 1**, this explanation was tested with a set of materials with two event-modifying adverbials (temporal and external locative), which were located outside of the domain they modify, in this case, the VP, and resembled Störzer's (2017) adverbial configuration, and a second condition with two event-modifying adverbials (manner adverbial and internal locative) located within the domain they modify. This configuration resembled Gauza's (2018) configuration with the manner adverbial and the direct object. This hypothesis did not find support. Both combinations of event-modifying adverbials were processed with delay, and a processing difficulty for the derived order was attested only in the spill-over region. More precisely, in the region that contained the main verb of the embedded clause. We argued that event-modifying adverbials require the event information provided by the verb to be processed.

Experiment 2 followed the same hypothesis, namely that the location of the adverbials at LF modulates the time course of processing. This experiment had the purpose not only to test whether the location within or outside an LF domain would affect the degree of incrementality in processing, but to complete the possible configuration with regard to LF. We, therefore, included a configuration where adverbials are scattered across an LF boundary, and the lower adverbial would move across an LF boundary. Moreover, this configuration had the purpose to resemble the configuration of frame adverbials and subject, for which Störzer (2017) attested immediate order effects. Again, no evidence was found that the configurations at LF affect processing. Instead an immediate effect for the derived order of sentence and domain adverbials, and domain and temporal adverbials was attested. Even though the interaction did not reach the level of significance, the effect seemed, at least descriptively, to be larger for the two propositional adverbials than for the com-

bination of domain adverbial and temporal adverbial. In Experiment 2, no spill-over effects were observed.

The experimental data reported in Chapter 5 do not provide evidence for the assumption underlying sub-question 1. In this chapter, different types of adverbials which resembled the configurations at LF of previous studies were tested. The findings suggest that the mere fact that an adverbial is located outside of the LF domain it modifies does not affect the time course of processing. However, as suggested by Stolterfoht et al. (2019), the time course of adverbial order processing seems to be modulated by the fact that an adverbial needs access to a specific element within the modified domain. Propositional adverbials operate on the proposition as a whole and do not need access to a specific element. They can be integrated immediately before the proposition unfolds. Event-modifying adverbials, however, depend on an event argument provided by the verb, i.e., composition starts when the event description is complete. For these adverbials types, a delayed effects was observed. The position at LF did not affect the time course.

Sub-question 2:

• How does information structure affect the time course of adverbial processing and their positional preferences?

In Chapter 6, it was investigated whether the status of domain adverbials as so-called delimitators (Krifka, 2008a) affects processing. Two acceptability judgment experiments were conducted to test ordering preferences of propositional adverbials. In the acceptability judgment in **Experiment 4**, the same materials as in the self-paced reading study in Experiment 2 were used, because, so far, there has been no evidence that the predicted base order for sentence adverbial and domain adverbial is in fact judged as more acceptable. For this reason, in Experiment 4, the domain adverbial and the sentence adverbial were presented in the predicted base and derived order. A syntactic hypothesis was derived, arguing for a preference for the base order and an alternative information-structural hypothesis

according to which the derived order, i.e., the domain adverbial above the sentence adverbial, is more acceptable. This hypothesis was motivated by previous experimental work reported in Störzer and Stolterfoht (2018) and theoretical work in Frey (2004), where it has been argued that German is discourse-configurational with regard to topics, with a topic position in the middlefield above the sentence adverbial. Störzer and Stolterfoht (2018) reported experimental evidence that referential frame adverbials can move across the sentence adverbial to serve as an aboutness topic in the sense of Reinhart (1981). Even though domain adverbials are non-referential and thus do not qualify as aboutness topics, we argued that domain adverbials can fulfill information-structural purposes and thus move above the sentence adverbial. The information-structural relevance of domain adverbials has been mentioned e.g., by Ernst (2004b). Furthermore, Krifka (2008a) argues that different linguistic elements, such as adverbials, can function as delimitators. Delimitators are not required to be referential. They signal that the assertion that is about to follow only provides a partial answer to a question under discussion.

Chapter 6 provided evidence for the alternative information-structural hypothesis: Domain adverbials are preferred above sentence adverbials. However, ratings were comparably low in general. We argued that the low ratings were due to a violation of the *Address First!* principle (Krifka, 2008b), and that the preference for the derived order was a consequence of the need to fill the medial topic position with an information-structural marker. These explanations were tested in **Experiment 5**. A new set of materials was created with sentence adverbials and domain adverbials but varied the position of the two adjacent adverbials relative to the subject. The logic behind this manipulation was that the referential subject DPs (proper names) are highly referential and thus prototypical aboutness topics, and therefore are preferred in the medial topic position over delimitators. An aboutness topic in the medial topic position above the sentence adverbial prevents the domain adverbial from moving into the topic position. Consequently, the domain adverbial remains in its base position below the sentence adverbial. In fact, an interaction of adverbial ORDER and subject POSITION was attested, which was interpreted as

evidence for the assumed base order (sentence adverbial > domain adverbial). However, domain adverbials as delimitators can move out of their base position to meet information-structural constraints, just like frame adverbials. Furthermore, the results were interpreted as evidence for the *Address First!* principle according to which address-centered information packaging is favored, i.e., the aboutness topic as the address is preferred in its designated syntactic position. Importantly, these preferences do not affect online reading times but only offline data. Thus, online processing is only affected by semantic type, and syntactic position. Information structure does not guide processing on the sentence level. In this respect, adverbial order processing resembles complement DP processing (e.g., Meng et al., 1999; Stolterfoht, 2005).

Sub-question 3:

• Is the time course of adverbial order processing modulated by the adverbial category?

This question can be answered positively. The experimental data suggest that in fact the time course of adverbial order processing is mainly modulated by the semantic category of the adverbials. More precisely, adverbials can be grouped into *propositional* and *event-modifying adverbials*. This dichotomy affects the time course of processing. Propositional adverbials can be integrated immediately, while event-modifying adverbials require information about the event and are thus processed with delay.

Finally, Chapter 7 had the purpose of combining the findings of the previous experimental sections and test the explanation that the time course of adverbial order processing is modulated by the semantic category of the adverbial. I laid out in the theoretical part in chapters 2 to 4 why I assume the semantic categories propositional and event-modifying adverbial to be relevant for the time course of processing. In the experimental chapters 5 and 6, I approached this explanation step-wise. To test this explanation statistically, I constructed a new set of materials where the adverbial category was entered as a factor. Again, two adjacent

adverbials were presented either in the assumed base or in the derived order. Adverbials were either two adjacent propositional adverbials (sentence adverbial and domain adverbial) or two adjacent event-modifying adverbials (external locative and manner adverbial). Similar to Exp. 1 and 2, I expected the two event-modifying adverbials to show a delayed effect on the spill-over region, and the two propositional adverbials to cause an immediate increase in reading times in the derived order. The results showed again an immediate increase in reading times for propositional adverbials in the derived order. The statistical results showed an interaction of the two factors CATEGORY and ORDER on the two adverbials. The interaction was carried by longer reading times for the derived order of the propositional adverbials. The event-modifying adverbials, however, did not show an effect of order in reading times at any point. I offered a potential explanation for this behavior referring to the ambiguity of adverbials. I have referred to Frazier's (1999) principle of immediate partial interpretation, and argued that manner adverbials remain unspecified because a semantic commitment is not necessary since different readings are compatible and a structural and semantic commitment would be unnecessarily costly. Moreover, I argued that the ambiguity that manner adverbials reveal differs qualitatively from ambiguity e.g., in locative adverbials. The results of all experiments can shortly be summarized as propositional adverbials lead to an immediate cost, some event-modifying adverbials lead to a delayed cost, and manner adverbials do not seem costly in processing at all. Table 8.1 summarizes the findings.

Exp.	Adverbial combination (in base order)	Modfied domain	Online effects	Offline effects
1 & 3	temp > loc.ext	event	delayed penalty for derived order (in spill-over)	preference for base order
1 & 3	manner > loc.int	event	delayed penalty for derived order (in spill-over)	preference for base order
2 & 4	Sadv > domain > *subject*	proposition	immediate penalty for derived order	preference for derived order
2, 3 & 4	domain > temp	proposition + event	depends on type of temp	depends on type of temp
5, 6 & 7	*subject* > Sadv > domain	proposition	immediate penalty for derived order	preference for base order
6 & 7	loc.ext > manner	event	no effect	preference for base order

Table 8.1: Overview of experimental results

8.2 Towards a model of adverbial order processing

The experimental findings obtained in this dissertation provided insights into the processing of adverbials. Partly, their processing differs from the processing of complements. Tutunjian and Boland (2008) discuss psycholinguistic findings on the differences in processing arguments and adjuncts and argue that the argument knowledge is encoded in the lexical entry of the verbal head while adjunct knowledge is not and rather depends on world knowledge and extra-linguistic sources and about how typical it is that a certain participant is part of an event. Boland (2005) found in a visual world experiment, that for adjuncts, if competing objects could function as both instrument or a location, looks are guided by typicality of a certain object to be part of the event described. In contrast, if a potential argument or an adjunct was depicted, participants looked at the argument regardless of its typicality. This shows that arguments play a privileged role in processing. Moreover,

these data suggest that different cognitive mechanisms apply for the processing of arguments and adjuncts. In fact, as shown in this dissertation, the mechanisms within the group of adverbials differ, and the semantic adverbial type determines whether the syntactic adverbial position affects processing immediately or with delay or, like for manner adverbials, does not show online processing effects at all. I will first lay out assumptions for adverbial order processing and then discuss the relevance of the dichotomy propositional adverbials and event-modifying adverbials in more detail .

According to the Garden-Path Theory, complements are integrated immediately, and potential (syntactic) ambiguities are resolved immediately. Moreover, complement processing is guided by syntactic information. Processing of non-canonical complement order in German provided strong evidence for the syntax-first processing mechanisms of the Garden-Path Theory. Ambiguous subject/ object DPs which do not give any morphological cue (i.e., case marking) are parsed via syntactic heuristics, e.g., subject before object preference. Adjuncts, however, are neither subcategorized by the verbal head, nor do they provide morphological cues that help to identify the attachment site. Moreover, most adverbials are notoriously ambiguous. The parser should resolve ambiguities as fast as possible without running in danger to assign an erroneous interpretation that must be revised later on. Revision is a costly operation and has to be avoided (Frazier & Clifton, 1995). These two demands lead to a conflict and the architecture of the parser has to be designed in a way that it is cost-efficient, and that an interpretation is assigned to a structure as soon as possible, without having to revise it. Adverbial meaning is construed of combinatorial mechanisms between lexical meaning, position, and interaction with other linguistic elements within the sentence or the discourse.

I propose that in order to interpret an adverbial, the parser requires information about the semantic adverbial type, and syntactic information about the position. These two sources of information are crucial ingredients in interpreting adverbial meaning and integrating them into the sentence structure built during parsing. Nonetheless, syntax and semantics are highly intertwined. The seman-

tic adverbial type is necessary in order to identify an adverbial's base or preferred position. In cases where adverbials are ambiguous, the structural adverbial position is needed for disambiguation. Even though adverbial distribution seems to be comparably unrestricted, it has been shown that adverbial linearization obeys systematic constraints (e.g., Frey, 2000b). The preference for the proposed adverbial base serializations was very robust across my experiments. Experimental evidence showed that the interaction of adverbial position and its interpretation are correlated (Stolterfoht, 2012, 2015), and it suggests that positional information is indeed an important source to interpret adverbials. However, across adverbial types, the demand for additional information in order to interpret adverbials differs. Propositional and event-modifying adverbial differ with regard to their semantic makeup, and these differences are visible in the time course of adverbial order processing. Furthermore, potential ambiguities of the adverbials modulate the time course of processing, and it depends on the relation of the potential readings, whether a given ambiguity has to be resolved immediately or an adverbial can remain underspecified.

Nonetheless, based on the results obtained in my studies, the localization of the delay effect cannot be answered. Since my studies were an attempt to answer questions raised by previous research on adverbial order processing. The studies focused on syntactic order effects, whereas the semantic manipulations were not controlled enough to allow for analysis about the underlying processing mechanisms. It will have to be subject to future research to investigate how the semantic differences between the adverbials affect processing. Possible ways towards a better understanding of a) the syntactic costs involved in adverbial order processing could be by manipulating syntactic dependency length as given in (93). With increased distance between base position and moved position of the adverbial, syntactic costs should increase (Gibson, 2000). As for a more comprehensive investigation of b) the semantic nature of the delay effect, sentences as given in (94) could be insightful. I argued, that composition of event-modifying adverbials is delayed because necessary information i.e., verbal information is required in order

to start composition. Main clause constructions as given in (94) should favor immediate composition as verbal information is available by the time the event-modifying adverbials are encountered; assuming that the nature of the delay is purely semantic in nature, immediate composition should be possible.

(93) Peter sagt, dass [laut$_i$]$_{MR}$ Hans [auf der Straße]$_{eLoc}$ ein Lied t$_i$ singt.
Peter says that loudly Hans on the street a song sings

(94) Peter singt ein Lied [laut]$_{MR}$ [auf der Straße]$_{eLoc}$
Peter sings a song loudly (on the street)
'Elisabeth says that Björn recited the poem loudly.'

The findings reported in this dissertation suggest that order variations of propositional adverbials such as sentence adverbials, frame and domain adverbials are processed highly incrementally while event-modifying adverbials are processed with delay, or do not lead to measurable processing costs. How can these differences between propositional and event-modifying adverbials be explained and integrated into models of sentence processing? First, as discussed in Chapter 4 and suggested by Katz (2003), there is an asymmetry between syntactically high and low adverbials. High adverbials can modify events and also operate on propositions, low adverbials can only modify events. Furthermore, Ernst (2004b) observed that higher adverbials can appear basically everywhere in the clause but lower adverbials are restricted to the lower part of the clause[1]. Thus it can be assumed that the adverbial position serves as a cue for semantic interpretation. For example, domain adverbials are potentially ambiguous and can also be interpreted as method-oriented, i.e., event-modifying adverbials, a high position in the clause structure is evaluated as a cue for a propositional reading, as event-modifying adverbials are marked in high positions. With regard to my experimental items, it can be assumed that a potential ambiguity of domain adverbials can be ruled out immediately as there were sufficient structural cues (i.e., adjacency to both the complementizer

[1] As *Low Range*, Ernst (2004b, 756) understands, in verb-initial languages, the part of the clause below the pre-verbal position extending all the way to the right

dass ('that') and unambiguous sentence adverbials), which suggest a high position and thus ruled out an event-modifying reading. Consequently, order violations can be detected immediately.

The mechanisms I assume to hold for event-modifying adverbials are different. One such difference concerns stricter licensing conditions that hold for event-modifying adverbials with regard to the verb. Event-modifying adverbial types depend at least on an event argument that is provided by the verb. In verb-final sentences in German, the information is provided only at the end of the sentence. Furthermore, as discussed in Chapter 3, it seems to generalize that the lower the adverbial, the stricter the licensing conditions with respect to the event description. For example, manner adverbials, which are assumed to be base-generated very low in the structure, require an eventive and agentive verb while event-external adverbials only require an event argument. The exact semantic specification of these lower types of adverbials is normally not possible without the information provided by the verb. This process requires storing the adverbial in memory until lexical information is provided that allows interpretation and composition can start. Accordingly, order violations are only detected when the event if fully specified and adverbials are finally attached.

From a memory perspective, it thus makes sense that lower adverbials are very marked at sentence-initial position as it can be assumed that they need to be stored in memory until the verbal head is processed and longer dependencies are more taxing in terms of memory cost (e.g., Gibson, 2000). My experiments showed that order effects for event-modifying adverbials appeared with a delay or are only visible as offline preferences. Manner adverbials do not lead to a delay in reading times, this findings was attested in different studies (also see Gauza, 2018). The comparison of Exp. 1 and Exp. 6 shows that movement of an internal locative across a manner adverbial leads to processing cost, but the movement of a manner adverbial across an external locative adverbial does not. I offered an analysis referring to the qualtitative differences in ambiguities between the adverbials in question. Locative adverbials, as discussed by Maienborn (2001), reveal a three-

way ambiguity between frame adverbials, external, and internal locatives. These readings are not compatible, and a commitment is required to solve the ambiguity. The internal locative in its derived position above the manner adverbial might at first glance be analyzed as an external locative in its base position, when encountering the verb, this analysis has to be revised and the respective processing costs are observable on the verb. In contrast, manner adverbials can be ambiguous between pure manner adverbials and agent-oriented manner adverbials (Schäfer, 2013). Semantically, the differences in meaning between the two readings are minor and result in a very similar event description. Syntactically, this corresponds to both adverbial types being base-generated within the VP. This structural difference is not as severe compared to the three-way distinction between the locative adverbials which are assumed to be base-generated either above TP, above VP, or within VP. A potential structural revision does not require a revision of an entire domain already fully specified.

For propositional adverbials, immediate integration should be the more cost-efficient strategy, i.e., interpretation of the propositional adverbial before the proposition unfolds, should be less costly. First, because propositional adverbials do not require access to proposition-internal information, as they operate on the entire proposition and do not need to await specific information in order to be composed. It is thus not necessary to carry the information given by the adverbial. Processing the inner proposition first and applying the operator in a second stage, as Carpenter and Just (1975) suggested for negation, seems inefficient because the negation (or the adverbial) need to be stored in memory until the end of the clause. For sentence adverbials and frame adverbials, this would mean that in a first step, the proposition is assumed to hold, and later on it will be revised or restricted to the information given by the respective operator. In Chapter 4, I gave an overview of findings that suggested that operators are interpreted highly incremental. Regarding incremental processing, I assume that propositional adverbials pattern with other operators.

Adverbial order processing is probably best described as such: the time course of adverbial processing depends on semantic adverbial type and most adverbials

are preferred to be interpreted, in their base position. This preference, however, is not equally strong for all adverbial types. Furthermore, semantic adverbial type and syntactic base position are processed very early, and information structure affected only offline preferences.

This dissertation provided some answers to the quesiton of how adverbials order variations are processed. Nonetheless, many questions remain open. One question concerns the dependency length of moved adverbials, in my experiments dependency lengths were minimal, as the adverbials in derived position only moved across the next highest constituent. If, as I argued for event-modifying adverbials, memory storage plays a role, longer movements should lead to higher processing costs. Furthermore, I argued that event-modifying adverbials depend on event-internal information, and composition can start once this information is available. A potential test case could be a mismatch paradigm that compares when and how mismatch effects are observed if licensing conditions of adverbials are not met. Finally, the main aim of this dissertation was to explain the heterogeneity in the processing of adverbial order variations. As I focused on an overview and an across adverbial comparison, the discussion of the different adverbial types under investigation is rather limited. The task for future research is to test these given explanations in more detail, by investigating other adverbial types. Furthermore, the dichotomy between propositional and event-modifying adverbials, which I argued to affect the time course of processing requires further investigation. In my studies, I investigated two types of propositional adverbials and only chose a reduced sample of sentence adverbials because some instances of sentence adverbials (evaluative adverbials) behaved different than other types of sentence adverbials in previous studies (Störzer, 2017). It is subject to future research to understand the factors at play in the processing of order variations of different types of sentence adverbials and propositional adverbials.

A crucial piece to the puzzle of adverbial order processing seems to be ambiguity in adverbials. In my studies, I tried to eliminate the ambiguity of adverbials in the best way possible, as it would have been a confounding factor. However, ambi-

guity resolution is a fundamental part of adverbial processing and future studies in online adverbial processing have to investigate the online time course of adverbial ambiguity resolution in more detail. I observed that manner adverbials can remain underspecified, even though the lack of online order effects for manner adverbials was robust across studies, the explanation that manner adverbials can remain underspecified is preliminary and has to be tested more thoroughly.

References

Alexiadou, A. (1994). *Issues in the syntax of adverbs*. University of Potsdam, dissertation.

Alexiadou, A. (2000). On the syntax of temporal adverbs and the nature of Spec, TP. *Italian Journal of Linguistics*, *12*(1), 55–76.

Alexiadou, A. (2004). Adverbs across frameworks. *Lingua*, *114*(6), 677–682. doi: 10.1016/S0024-3841(03)00047-0

Altmann, G., & Kamide, Y. (1999). Incremental interpretation at verbs: Restricting the domain of subsequent reference. *Cognition*, *73*(3), 247–264. doi: 10 .1016/S0010-0277(99)00059-1

Arkhipova, Y., Sostarics, T., Law, R., Xiang, M., & Yee, W. (2019). *'Nonetheless' can reverse predictions immediately: Evidence from ERPs.*

Axel-Tober, K., & Müller, K. (2017). Evidential adverbs in German: Diachronic development and present-day meaning. *Journal of Historical Linguistics*, *7*(1-2), 9–47. doi: 10.1075/jhl.7.1-2.02axe

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

Bader, M., & Meng, M. (1999). Subject-object ambiguities in German embedded clauses: An across-the-board comparison. *Journal of Psycholinguistic Research*, *28*(2), 121–143. doi: 10.1023/A:1023206208142

Barton, S. B., & Sanford, A. J. (1993). A case study of anomaly detection: Shallow semantic processing and cohesion establishment. *Memory & Cognition*, *21*(4), 477–487. doi: 10.3758/BF03197179

Bates, D., Mächler, M., Bolker, B., & Walker, S. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software*, *67*(1). doi: 10.18637/jss.v067.i01

Beck, S., & Tiemann, S. (2019). Towards a model of incremental composition. *Proceedings of Sinn und Bedeutung*, *21*(1), 143–162. doi: 10.18148/sub/2018.v21i1.129

Bellert, I. (1977). On semantic and distributional properties of sentential adverbs. *Linguistic Inquiry*, *8*(2), 337–351. doi: http://www.jstor.org/stable/4177988

Biondo, N. (2017). *The syntactic side of time: Processing adverb-verb temporal agreement*. Trento: Doctoral dissertation, University of Trento.

Boland, J. E. (2005). Visual arguments. *Cognition*, *95*(3), 237–274. doi: 10.1016/j.cognition.2004.01.008

Bornkessel, I., & Schlesewsky, M. (2006). The role of contrast in the local licensing of scrambling in German: Evidence from online comprehension. *Journal of Germanic Linguistics*, *18*(1). doi: 10.1017/S1470542706000018

Bornkessel, I., Schlesewsky, M., & Friederici, A. D. (2002). Grammar overrides frequency: Evidence from the online processing of flexible word order. *Cognition*, *85*(2), B21-B30. doi: 10.1016/S0010-0277(02)00076-8

Bornkessel, I., Schlesewsky, M., & Friederici, A. D. (2003). Eliciting thematic reanalysis effects: The role of syntax-independent information during parsing. *Language and Cognitive Processes*, *18*(3), 269–298. doi: 10.1080/01690960244000018

Bott, O. (2013). The processing domain of aspectual interpretation. In B. Arsenijević, B. Gehrke, & R. Marín (Eds.), *Studies in the composition and decomposition of event predicates* (Vol. 93, pp. 195–229). Dordrecht: Springer. doi: 10.1007/978-94-007-5983-1_8

Bott, O., & Gattnar, A. (2015). The cross-linguistic processing of aspect – An eyetracking study on the time course of aspectual interpretation in Russian and German. *Language, Cognition and Neuroscience*, *30*(7), 877–898. doi: 10.1080/23273798.2015.1029499

Carpenter, P. A., & Just, M. A. (1975). Sentence comprehension: A psycholinguistic processing model of verification. *Psychological Review*, *82*(1), 45–73. doi: 10.1037/h0076248

Chafe, W. L. (1976). Givenness, contrastiveness, definiteness, subjects, topics, and point of view. In C. N. Li & S. A. Thompson (Eds.), *Subject and topic: A new typology of language* (pp. 27–55). New York: Academic Press.

Chomsky, N. (1993). *Lectures on government and binding: The Pisa lectures* (Seventh ed.) (No. 9). Berlin: Walter de Gruyter.

Chomsky, N. (1995). *The minimalist program* (No. 28). Cambridge, Mass.: MIT Press.

Chomsky, N. (2014). *The minimalist program*. Cambridge, Mass.: MIT press.

Cinque, G. (1993). A null theory of phrase and compound stress. *Linguistic Inquiry*, *24*(2), 239–297.

Cinque, G. (1999). *Adverbs and functional heads: A cross-linguistic perspective*. New York: Oxford University Press.

Cinque, G. (2004). Issues in adverbial syntax. *Lingua*, *114*(6), 683–710. doi: 10.1016/S0024-3841(03)00048-2

Clifton, C. J., Frazier, L., & Rayner, K. (Eds.). (1994). *Perspectives on sentence processing*. Hillsdale, N.J.: Erlbaum.

Clifton, C. J., Speer, S., & Abney, S. P. (1991). Parsing arguments: Phrase structure and argument structure as determinants of initial parsing decisions. *Journal of Memory and Language*, *30*(2), 251–271. doi: 10.1016/0749-596X(91)90006-6

Davidson, D. (1967). The logical form of action sentences. In N. Rescher (Ed.), *The logic of decision and action* (pp. 81–95). Pittsburgh, P.A.: University of Pittsburgh Press.

De Vincenzi, M., & Job, R. (1993). Some observations on the universality of the late-closure strategy. *Journal of Psycholinguistic Research*, *22*(2), 189–206. doi: 10.1007/BF01067830

Dickey, M. W. (2001). *The processing of tense: Psycholinguistic studies on the interpretation of tense and temporal relations* (Vol. 28; L. Frazier, T. Roeper, & K. Wexler, Eds.). Dordrecht: Springer. doi: 10.1007/978-94-010-0568-5

Duffy, S. A., Morris, R. K., & Rayner, K. (1988). Lexical ambiguity and fixation times in reading. *Journal of Memory and Language*, *27*(4), 429–446. doi: 10.1016/0749-596X(88)90066-6

Enç, M. (1987). Anchoring conditions for tense. *Linguistic Inquiry*, *18*(4), 633–657.

Erickson, T. D., & Mattson, M. E. (1981, October). From words to meaning: A semantic illusion. *Journal of Verbal Learning and Verbal Behavior*, *20*(5), 540–551. doi: 10.1016/S0022-5371(81)90165-1

Ernst, T. (2004a). Domain adverbs and the syntax of adjuncts. In J. R. Austin, S. Engelberg, & G. Rauh (Eds.), *Adverbials: The interplay between meaning, context, and syntactic structure* (Vol. 70, pp. 103–130). Amsterdam: Benjamins.

Ernst, T. (2004b). Principles of adverbial distribution in the lower clause. *Lingua*, *114*(6), 755–777. doi: 10.1016/S0024-3841(03)00050-0

Ernst, T. (2007). On the role of semantics in a theory of adverb syntax. *Lingua*, *117*(6), 1008–1033. doi: 10.1016/j.lingua.2005.03.015

Ernst, T. (2009). Speaker-oriented adverbs. *Natural Language & Linguistic Theory*, *27*(3), 497–544. doi: 10.1007/s11049-009-9069-1

Ernst, T. (2020). The syntax of adverbials. *Annual Review of Linguistics*, *6*(1), 89–109. doi: 10.1146/annurev-linguistics-011619-030334

Ernst, T., Fabricius-Hansen, C., Lang, E., & Maienborn, C. (2000). Semantic features and the distribution of adverbs. In *Approaching the Grammar of Adjuncts: Proceedings of the Oslo Conference* (Vol. 17, pp. 79–97). Berlin: ZAS.

Fanselow, G. (2001). Features, Theta-roles, and free constituent order. *Linguistic inquiry*, *32*(3), 405–437.

Ferreira, F. (2003). The misinterpretation of noncanonical sentences. *Cognitive Psychology*, *47*(2), 164–203. doi: 10.1016/S0010-0285(03)00005-7

Fiebach, C. J., Schlesewsky, M., & Friederici, A. D. (2001). Syntactic working memory and the establishment of filler-gap dependencies: Insights from ERPs and fMRI. *Journal of Psycholinguistic Research*, *30*(3), 321–338. doi: 10.1023/A:1010447102554

Fodor, J. A. (1983). *The modularity of mind*. MIT press.

Frazier, L. (1987). Sentence processing: A tutorial review. In M. Coltheart (Ed.), *Attention and performance 12: The psychology of reading* (pp. 559–586). Hillsdale, N.J.: Erlbaum.

Frazier, L. (1999). *On sentence interpretation* (Vol. 22). Dordrecht: Kluwer.

Frazier, L., & Clifton, C. J. (1995). Attachment versus association: Adverbial clauses. In *Construal* (pp. 53–68). Cambridge, Mass.: MIT Press.

Frazier, L., & Clifton, C. J. (1997). Construal: Overview, motivation, and some new evidence. *Journal of Psycholinguistic Research*, *26*(3), 277–295. doi: 10.1023/A:1025024524133

Frazier, L., & Clifton, C. J. (2018). Topic situations: Coherence by inclusion. *Journal of Memory and Language*, *103*, 176–190.

Frazier, L., & Clifton, C. J. (2021). Interpreting adjuncts: Processing English *As*-clauses. *Language and Speech*, 1–23. doi: 10.1177/00238309211000801

Frazier, L., & Flores d'Arcais, G. B. (1989). Filler driven parsing: A study of gap filling in Dutch. *Journal of Memory and Language*, *28*(3), 331–344. doi: 10.1016/0749-596X(89)90037-5

Frazier, L., & Rayner, K. (1990). Taking on semantic commitments: Processing multiple meanings vs. multiple senses. *Journal of Memory and Language*, *29*(2), 181–200. doi: 10.1016/0749-596X(90)90071-7

Freunberger, D., & Nieuwland, M. S. (2016). Incremental comprehension of spoken quantifier sentences: Evidence from brain potentials. *Brain Research*, *1646*, 475–481. doi: 10.1016/j.brainres.2016.06.035

Frey, W. (2000a). Syntactic requirements on adjuncts. In C. Fabricius-Hansen, E. Lang, & C. Maienborn (Eds.), *Approaching the Grammer of Adjuncts: Proceedings of the Oslo Conference* (Vol. 17, pp. 107–134). Berlin: ZAS.

Frey, W. (2000b). Über die syntaktische Position des Satztopiks im Deutschen. In K. Schwabe, A. Meinunger, & D. Gasde (Eds.), *Issues on topics* (Vol. 20, pp. 137–172). Berlin: ZAS.

Frey, W. (2001). About the whereabouts of indefinites. *Theoretical Linguistics*, *27*(2-3), 137–161. doi: 10.1515/thli.2001.27.2-3.137

Frey, W. (2003). Syntactic conditions on adjunct classes. In E. Lang, C. Maienborn, & C. Fabricius-Hansen (Eds.), *Modifying adjuncts* (pp. 163–209). Berlin: De Gruyter. doi: 10.1515/9783110894646.163

Frey, W. (2004). A medial topic position for German. *Linguistische Berichte*, *198*, 153–190.

Frey, W., & Pittner, K. (1998a). Adverbialpositionen im deutsch-englischen Vergleich. In M. Bierwisch & M. Doherty (Eds.), *Sprachspezifische Aspekte der Informationsverteilung* (Vol. 47, pp. 14–40). Berlin: Akademie Verlag.

Frey, W., & Pittner, K. (1998b). Zur Positionierung der Adverbiale im deutschen Mittelfeld. *Linguistische Berichte*, *176*, 489–534. doi: http://homepage.ruhr-uni-bochum.de/Karin.Pittner/ FreyPittner98.pdf

Friederici, A. D. (1995). The time course of syntactic activation during language processing: A model based on neuropsychological and neurophysiological data. *Brain and Language*, *50*(3), 259–281. doi: 10.1006/brln.1995.1048

Frisson, S. (2009). Semantic Underspecification in Language Processing. *Language and Linguistics Compass*, *3*(1), 111–127. doi: 10.1111/j.1749-818X.2008.00104.x

Frisson, S., & Pickering, M. J. (1999). The processing of metonymy: Evidence from eye movements. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *25*(6), 1366–1383. doi: 10.1037/0278-7393.25.6.1366

Garrod, S. C., & Sanford, A. J. (1994). Resolving sentences in a discourse context: How discourse representation affects language understanding.

Gauza, H. (2018). *Position und Verarbeitung VP-interner Adjunkte*. Doctoral dissertation, University of Tübingen.

Gennari, S., & Poeppel, D. (2003). Processing correlates of lexical semantic complexity. *Cognition*, *89*(1), B27-B41. doi: 10.1016/S0010-0277(03)00069-6

Gibson, E. (2000). The dependency locality theory: A distance-based theory of linguistic complexity. In A. Marantz, Y. Miyashita, & W. O'Neil (Eds.), *Image, language, brain: Papers from the First Mind Articulation Project Symposium* (pp. 95–126). Cambridge, Mass.: MIT Press.

Gilboy, E., Sopena, J.-M., Clifton, C. J., & Frazier, L. (1995). Argument structure and association preferences in Spanish and English complex NPs. *Cognition*, *54*(2), 131–167. doi: 10.1016/0010-0277(94)00636-Y

Haftka, B. (2003). Möglicherweise tatsächlich nicht immer. Beobachtungen zur Adverbialreihenfolge an der Spitze des Rhemas. *Folia Linguistica*, *37*(1-2). doi: 10.1515/flin.2003.37.1-2.103

Haider, H. (1993). *Deutsche Syntax - generativ: Vorstudien zur Theorie einer projektiven Grammatik* (Vol. 325). Tübingen: Narr.

Haider, H. (2000). Adverb placement - Convergence of structure and licensing. *Theoretical Linguistics*, *26*(1-2), 95–134. doi: 10.1515/thli.2000.26.1-2.95

Haider, H. (2012). Adverb positions in VO and OV. In *Symmetry breaking in syntax* (Vol. 136, pp. 136–172). Cambridge: Cambridge University Press.

Haider, H., & Rosengren, I. (2003). Scrambling: Nontriggered chain formation in OV languages. *Journal of Germanic Linguistics*, *15*(3). doi: 10.1017/S1470542703000291

Häussler, J., & Juzek, T. (2017). Hot topics surrounding acceptability judgement tasks. In S. Featherston, R. Hörnig, R. Steinberg, B. Umbreit, & J. Wallis (Eds.), *Proceedings of Linguistic Evidence 2016: Empirical, Theoretical, and Computational Perspectives.* Tübingen: Universität Tübingen.

Heim, I., & Kratzer, A. (1998). *Semantics in generative grammar*. Malden, Mass.: Blackwell.

Hemforth, B., Fernandez, S., Clifton, C. J., Frazier, L., Konieczny, L., & Walter, M. (2015). Relative clause attachment in German, English, Spanish and

French: Effects of position and length. *Lingua*, *166*, 43–64. doi: 10.1016/j.lingua.2015.08.010

Hohaus, V. (2015). *Context and composition: How presuppositions restrict the interpretation of free variables*. Tübingen: Doctoral dissertation, University of Tübingen.

Höhle, T. N. (1982). Explikationen für "normale Betonung" und "normale Wortstellung". In A. Werner (Ed.), *Satzglieder im Deutschen: Vorschläge zur syntaktischen, semantischen und pragmatischen Fundierung* (Vol. 15, pp. 75–153). Tübingen: Narr.

Jackendoff, R. S. (1974). *Semantic interpretation in generative grammar* (J. Keyser, Ed.). Cambridge, Mass.: MIT Press.

Jacobs, J. (2001). The dimensions of topiccomment. *Linguistics*, *39*(4). doi: 10.1515/ling.2001.027

Jegerski, J. (2014). Self-paced reading. In J. Jegerski & B. VanPatten (Eds.), *Research methods in second language psycholinguistics* (pp. 20–49). New York, N.Y.: Routledge.

Kaiser, E., & Trueswell, J. C. (2004). The role of discourse context in the processing of a flexible word-order language. *Cognition*, *94*(2), 113–147. doi: 10.1016/j.cognition.2004.01.002

Karimi, H., & Ferreira, F. (2016). Good-enough linguistic representations and online cognitive equilibrium in language processing. *Quarterly Journal of Experimental Psychology*, *69*(5), 1013–1040. doi: 10.1080/17470218.2015.1053951

Katz, G. (2003). Event arguments, adverb selection, and the Stative Adverb Gap. In E. Lang, C. Maienborn, & C. Fabricius-Hansen (Eds.), *Modifying adjuncts* (Vol. 4, pp. 455–474). Berlin: De Gruyter. doi: 10.1515/9783110894646.455

Konieczny, L., Hemforth, B., Scheepers, C., & Strube, G. (1997). The role of lexical heads in parsing: Evidence from German. *Language and Cognitive Processes*, *12*(2), 307–348. doi: 10.1080/016909697386871

Kounios, J., & Holcomb, P. J. (1992). Structure and process in semantic memory: Evidence from event-related brain potentials and reaction times. *Journal of Experimental Psychology. General*, *121*.

Krifka, M. (2008a). Basic notions of information structure. *Acta Linguistica Hungarica*, *55*(3-4), 243–276. doi: 10.1556/aling.55.2008.3-4.2

Krifka, M. (2008b). *What do contrastive topics and frame setters have in common? The role of addressing and delimitation in information structure.Talk presented at the Conference on Contrastive Information Structure Analysis (CISA) 2008, University of Wuppertal, March 18–19, 2008.* University of Wuppertal.

Krifka, M. (2019). Layers of assertive clauses: Propositions, judgements, commitments, acts. In J. M. Hartmann & A. Wöllstein (Eds.), *Propositionale Argumente im Sprachvergleich: Theorie und Empirie. /Propositional Arguments in Cross-Linguistic Research: Theoretical and Empirical Issues.* (pp. 1–45). Tübingen: Narr.

Kuznetsova, A., Brockhoff, P. B., & Christensen, R. H. B. (2017). lmerTest package: Tests in Linear Mixed Effects Models. *Journal of Statistical Software*, *82*(13). doi: 10.18637/jss.v082.i13

Lang, E. (1979). Zum Status der Satzadverbiale. *Slovo a Slovesnost*, *40*(3), 200–213.

Lenerz, J. (1977). *Zur Abfolge nominaler Satzglieder im Deutschen* (Vol. 5). Tübingen: Narr.

MacDonald, M. C., Pearlmutter, N. J., & Seidenberg, M. S. (1994). The lexical nature of syntactic ambiguity resolution. *Psychological Review*, *101*(4), 676–703. doi: 10.1037//0033-295X.101.4.676

Maienborn, C. (2001). On the position and interpretation of locative modifiers. *Natural Language Semantics*, *9*(2), 191–240. doi: 10.1023/A:1012405607146

Maienborn, C. (2003). *Die logische Form von Kopula-Sätzen* (Vol. 56). Berlin: Akademie-Verlag.

Maienborn, C., & Schäfer, M. (2011). Adverbs and adverbials. In C. Maienborn, K. von Heusinger, & P. Portner (Eds.), *Semantics: An international handbook of natural language meaning* (Vol. 1, pp. 1390–1420). Berlin: De Gruyter.

Marslen-Wilson, W. D. (1973). Linguistic structure and speech shadowing at very short latencies. *Nature*, *244*(5417), 522–523. doi: 10.1038/244522a0

McConnell-Ginet, S. (1982). Adverbs and logical form: A linguistically realistic theory. *Language*, *58*(1), 144–184. doi: 10.2307/413534

McKoon, G., & Macfarland, T. (2000). Externally and internally caused change of state verbs. *Language*, *76*(4), 833–858. doi: 10.2307/417201

McKoon, G., & Macfarland, T. (2002). Event templates in the lexical representations of verbs. *Cognitive Psychology*, *45*, 1–44.

Meng, M., Bader, M., & Bayer, J. (1999). Sprachverstehen im Kontext: Zur Rolle struktureller und semantisch-pragmatischer Information bei der Auflösung von Subjekt-Objekt-Ambiguitäten im Deutschen. In I. Wachsmuth & B. Jung (Eds.), *Proceedings der 4. Fachtagung der Gesellschaft der Kognitionswissenschaft* (pp. 244–249). St. Augustin: Infix.

Nieuwland, M. S., & Kuperberg, G. R. (2008). When the truth is not too hard to handle: An event-related potential study on the pragmatics of negation. *Psychological Science*, *19*(12), 1213–1218. doi: 10.1111/j.1467-9280.2008.02226.x

Nieuwland, M. S., & Martin, A. E. (2012). If the real world were irrelevant, so to speak: The role of propositional truth-value in counterfactual sentence comprehension. *Cognition*, *122*(1), 102–109. doi: 10.1016/j.cognition.2011.09.001

Parsons, T. (1990). *Events in the semantics of English: A study in subatomic semantics* (Vol. 34; S. J. Keyser, Ed.). Cambridge, Mass.: MIT Press.

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 Section A*, *52*(3), 717–737. doi: 10.1080/713755827

Peirce, J., Gray, J. R., Simpson, S., MacAskill, M., Höchenberger, R., Sogo, H., … Lindeløv, J. K. (2019). PsychoPy2: Experiments in behavior made easy. *Behavior Research Methods*, *51*(1), 195–203. doi: 10.3758/s13428-018-01193-y

Pickering, M. J., & van Gompel, R. P. G. (2006). Syntactic parsing. In M. J. Traxler & M. A. Gernsbacher (Eds.), *Handbook of psycholinguistics* (pp. 455–502). Boston: Elsevier.

Pittner, K. (1999). Nicht-sententiale Adverbiale. In *Adverbiale im Deutschen: Untersuchungen zu ihrer Stellung und Interpretation* (Vol. 60, pp. 46–121). Tübingen: Stauffenburg.

Pittner, K. (2000). Position and interpretation of adjuncts: Process, event and wieder 'again'. In C. Fabricius-Hansen, E. Lang, & C. Maienborn (Eds.), *Approaching the grammar of adjuncts* (Vol. 17, pp. 203–216). Berlin: ZAS.

Pittner, K. (2004). Where syntax and semantics meet: Adverbial positions in the German middle field. In J. R. Austin, S. Engelberg, & G. Rauh (Eds.), *Adverbials: The interplay between meaning, context, and syntactic structure* (Vol. 70, pp. 253–287). Amsterdam: Benjamins.

R Core Team. (2021). *R: A Language and Environment for Statistical Computing.* R Foundation for Statistical Computing. Vienna, Austria.

Rayner, K. (1998). Eye movements in reading and information processing: 20 years of research. *Psychological Bulletin*, *124*(3), 372–422.

Reinhart, T. (1981). Pragmatics and linguistics: An analysis of sentence topics. *Philosophica*, *27*, 53–94. doi: 10.21825/philosophica.82606

Repp, S. (2017). Structural topic marking: Evidence from the processing of grammatical and ungrammatical sentences with adverbs. *Lingua*, *188*, 53–90. doi: 10.1016/j.lingua.2016.09.002

Roberts, C. (1996). Information structure in discourse: Towards a unified theory of formal pragmatics. *Ohio State University Working Papers in Linguistics*, *49*, 91–136.

Rodd, J., Gaskell, G., & Marslen-Wilson, W. (2002). Making Sense of Semantic Ambiguity: Semantic Competition in Lexical Access. *Journal of Memory and Language*, *46*(2), 245–266. doi: 10.1006/jmla.2001.2810

Rösler, F., Pechmann, T., Streb, J., Röder, B., & Hennighausen, E. (1998). Parsing of sentences in a language with varying word order: Word-by-word variations of processing demands are revealed by event-related brain potentials. *Journal of Memory and Language*, *38*(2), 150–176. doi: 10.1006/jmla.1997.2551

Ross, J. R. (1967). *Constraints on variables in syntax*. Cambridge: Doctoral dissertation, Massachusetts Institute of Technology.

Salfner, F. (2014). *Bedeutung und informationsstrukturelle Funktion von Adverbialen auf -mäßig*. Berlin: Humboldt-Universität dissertation.

Sanford, A. J., & Graesser, A. C. (2006). Shallow Processing and Underspecification. In M. A. Gernsbacher (Ed.), *Handbook of psycholinguistics* (Vol. 42, pp. 675–698). New York: Academic Press.

Schäfer, M. (2013). *Positions and interpretations: German adverbial adjectives at the syntaxsemantics interface* (No. 245). Berlin, Boston: De Gruyter. doi: 10.1515/9783110278286

Shaer, B. (2000). Syntactic position and the readings of "manner" adverbs. *ZAS Papers in Linguistics*, *17*, 265–286. doi: 10.21248/zaspil.17.2000.50

Smith, C. (1978). Temporal aspects of English speech production: A developmental perspective. *Journal of Phonetics*, *6*(1), 37–67. doi: 10.1016/S0095-4470(19)31084-8

Specht, L., & Stolterfoht, B. (2022). Incrementality in the processing of adverbial order variation in German. In S. Featherston, R. Hörnig, A. Konietzko, & S. von Wietersheim (Eds.), *Proceedings of Linguistic Evidence 2020: Linguistic Theory Enriched by Experimental Data.* Tübingen: Universität Tübingen.

Specht, L., & Stolterfoht, B. (2023). Processing word order variations with frame and sentence adjuncts in German: Syntactic and information-structural constraints. *Glossa: a journal of general linguistics*, *8*(1). doi: 10.16995/glossa.8514

Steube, A. (2014). Satzadverbien, Satznegation und die sie umgebenden Kontextpositionen. In A. Assmann, S. Bank, D. Georgi, T. Klein, P. Welsser, & E. Zimmermann (Eds.), *Topics at InfL* (Vol. 92, pp. 561–580). Leipzig: Institut für Linguistik, Universität Leipzig.

Stolterfoht, B. (2005). *Processing word order and ellipses*. Leipzig: Doctoral dissertation, Max Planck Institute for Human Cognitive and Brain Sciences Leipzig.

Stolterfoht, B. (2012, March). *Processing temporality: Syntactic position determines interpretation.* New York.

Stolterfoht, B. (2015). Ambiguity and sentence position: An experimental case study on manner adverbs. In S. Winkler (Ed.), *Ambiguity: Language and communication* (pp. 171–183). Berlin: De Gruyter.

Stolterfoht, B., & Bader, M. (2004). Focus structure and the processing of word order variations in German. In (pp. 259–276). Berlin: De Gruyter. doi: 10 .1515/9783110905892.259

Stolterfoht, B., Frazier, L., & Clifton, C. J. (2007). Adverbs and sentence topics in processing English. In S. Featherston & W. Sternefeld (Eds.), *Roots* (Vol. 96, pp. 361–374). Berlin: De Gruyter.

Stolterfoht, B., Gauza, H., & Störzer, M. (2019). Incrementality in processing complements and adjuncts: Construal revisited. In K. Carlson, C. J. Clifton, & J. D. Fodor (Eds.), *Grammatical approaches to language processing: Essays in honor of Lyn Frazier* (Vol. 48, pp. 225–240). Cham: Springer. doi: 10.1007/978-3-030-01563-3_12

Störzer, M. (2017). *Weshalb auf Mallorca wahrscheinlich alle Urlauber betrunken sind: Zur syntaktischen Position von Frameadverbialen und der Rolle der Informationsstruktur bei ihrer Verarbeitung*. Tübingen: Doctoral dissertation, University of Tübingen.

Störzer, M., & Stolterfoht, B. (2013). Syntactic base positions for adjuncts: Psycholinguistic studies on frame and sentence adverbials. *Questions and Answers in Linguistics*, *1*(2), 57–72. doi: 10.1515/qal-2015-0004

Störzer, M., & Stolterfoht, B. (2018). Is German discourse-configurational? Experimental evidence for a topic position. *Glossa: A Journal of General Linguistics*, *3*(1), 1–24. doi: 10.5334/gjgl.122

Swinney, D. A. (1979). Lexical access during sentence comprehension: (Re)consideration of context effects. *Journal of Verbal Learning and Verbal Behavior*, 546–659.

Tanenhaus, M., Spivey-Knowlton, M., Eberhard, K., & Sedivy, J. (1995). Integration of visual and linguistic information in spoken language comprehension. *Science*, *268*(5217), 1632–1634. doi: 10.1126/science.7777863

Thomason, R. H., & Stalnaker, R. C. (1973). A semantic theory of adverbs. *Linguistic Inquiry*, *4*(2), 195–220.

Tiemann, S., Schmid, M., Bade, N., Rolke, B., Hertrich, I., Ackermann, H., … Beck, S. (2011). Psycholinguistic Evidence for Presuppositions: On-line and Off-line Data. *Proceedings of Sinn und Bedeutung*, *15*, 581–596.

Traxler, M. J., Morris, R. K., & Seely, R. E. (2002). Processing subject and object relative clauses: Evidence from eye movements. *Journal of Memory and Language*, *47*(1), 69–90. doi: 10.1006/jmla.2001.2836

Tutunjian, D., & Boland, J. E. (2008). Do we need a distinction between arguments and adjuncts? Evidence from psycholinguistic studies of comprehension. *Language and Linguistics Compass*, *2*(4), 631–646. doi: 10.1111/j.1749-818X.2008.00071.x

Urbach, T. P., DeLong, K. A., & Kutas, M. (2015). Quantifiers are incrementally interpreted in context, more than less. *Journal of Memory and Language*, *83*, 79–96. doi: 10.1016/j.jml.2015.03.010

Urbach, T. P., & Kutas, M. (2010). Quantifiers more or less quantify on-line: ERP evidence for partial incremental interpretation. *Journal of Memory and Language*, *63*(2), 158–179. doi: 10.1016/j.jml.2010.03.008

Vendler, Z. (1957). Verbs and times. *The Philosophical Review*, *66*(2), 143–160. doi: 10.2307/2182371

von Stechow, A., & Beck, S. (2015). Events, times and worlds: An LF architecture. In C. Fortmann, A. Lübbe, & I. Rapp (Eds.), *Situationsargumente im Nominalbereich.* Berlin, München, Boston: De Gruyter. doi: 10.1515/9783110432893-002

Appendix

Materials Set 1: Self-paced reading experiment reported as Experiment 1 (5.2)

(1) a. Petra sagt,/ dass/ die Chefin/ mit Schwung auf dem Papier/ unterzeichnet hat/ und danach/ ins Sekretariat/ gegangen ist.

b. Petra sagt,/ dass/ die Chefin/ auf dem Papier mit Schwung/ unterzeichnet hat/ und danach/ ins Sekretariat/ gegangen ist.

c. Petra sagt,/ dass/ die Chefin/ vor Feierabend in der Firma/ unterzeichnet hat/ und danach/ ins Sekretariat/ gegangen ist.

d. Petra sagt,/ dass/ die Chefin/ in der Firma vor Feierabend/ unterzeichnet hat/ und danach/ ins Sekretariat/ gegangen ist.

(2) a. Klaus sagt,/ dass/ der Schreiner/ mit Sorgfalt auf der Werkbank/ gesägt hat/ und danach/ zum Kunden/ gefahren ist.

b. Klaus sagt,/ dass/ der Schreiner/ auf der Werkbank mit Sorgfalt/ gesägt hat/ und danach/ zum Kunden/ gefahren ist.

c. Klaus sagt,/ dass/ der Schreiner/ am Donnerstag auf dem Flur/ gesägt hat/ und danach/ zum Kunden/ gefahren ist.

d. Klaus sagt,/ dass/ der Schreiner/ auf dem Flur am Donnerstag/ gesägt hat/ und danach/ zum Kunden/ gefahren ist.

(3) a. Helga erzählt,/ dass/ der Junge/ mit Elan in der Pfütze/ geangelt hat/ und danach/ zur Schule/ gegangen ist.

b. Helga erzählt,/ dass/ der Junge/ in der Pfütze mit Elan/ geangelt hat/ und danach/ zur Schule/ gegangen ist.

c. Helga erzählt,/ dass/ der Junge/ vor Sonnenaufgang in der Schlucht/ geangelt hat/ und danach/ zur Schule/ gegangen ist.

d. Helga erzählt,/ dass/ der Junge/ in der Schlucht vor Sonnenaufgang/ geangelt hat/ und danach/ zur Schule/ gegangen ist.

(4) a. Tom berichtet,/ dass/ der Erstklässler/ mit Sorgfalt auf dem Küchentisch/ gebastelt hat/ und danach/ ins Freibad/ gegangen ist.

b. Tom berichtet,/ dass/ der Erstklässler/ auf dem Küchentisch mit Sorgfalt/ gebastelt hat/ und danach/ ins Freibad/ gegangen ist.

c. Tom berichtet,/ dass/ der Erstklässler/ am Feiertag im Garten/ gebastelt hat/ und danach/ ins Freibad/ gegangen ist.

d. Tom berichtet,/ dass/ der Erstklässler/ im Garten am Feiertag/ gebastelt hat/ und danach/ ins Freibad/ gegangen ist.

(5) a. Lena erzählt,/ dass/ der Lehrer/ mit Mühe an der Tafel/ geschrieben hat/ und danach/ zur Tür/ gegangen ist.

b. Lena erzählt,/ dass/ der Lehrer/ an der Tafel mit Mühe/ geschrieben hat/ und danach/ zur Tür/ gegangen ist.

c. Lena erzählt,/ dass/ der Lehrer/ nach der Pause in der Mensa/ geschrieben hat/ und danach/ zur Tür/ gegangen ist.

d. Lena erzählt,/ dass/ der Lehrer/ in der Mensa nach der Pause/ geschrieben hat/ und danach/ zur Tür/ gegangen ist.

(6) a. Bernhard sagt,/ dass/ der Zahnarzt/ mit Kraft in der Wurzel/ gebohrt hat/ und danach/ vom Stuhl/ aufgestanden ist.

b. Bernhard sagt,/ dass/ der Zahnarzt/ in der Wurzel mit Kraft/ gebohrt hat/ und danach/ vom Stuhl/ aufgestanden ist.

c. Bernhard sagt,/ dass/ der Zahnarzt/ am Nachmittag in der Praxis/ gebohrt hat/ und danach/ vom Stuhl/ aufgestanden ist.

d. Bernhard sagt,/ dass/ der Zahnarzt/ in der Praxis am Nachmittag/ gebohrt hat/ und danach/ vom Stuhl/ aufgestanden ist.

(7) a. Klara sagt,/ dass/ der Waschbär/ mit Elan in der Blumenerde/ gebuddelt hat/ und danach/ ins Nachbarhaus/ gelaufen ist.

b. Klara sagt,/ dass/ der Waschbär/ in der Blumenerde mit Elan/ gebuddelt hat/ und danach/ ins Nachbarhaus/ gelaufen ist.

c. Klara sagt,/ dass/ der Waschbär/ am Morgen auf der Pferdekoppel/ gebuddelt hat/ und danach/ ins Nachbarhaus/ gelaufen ist.

d. Klara sagt,/ dass/ der Waschbär/ auf der Pferdekoppel am Morgen/ gebuddelt hat/ und danach/ ins Nachbarhaus/ gelaufen ist.

(8) a. Ben berichtet,/ dass/ der Clown/ mit Geschick auf dem Einrad/ jongliert hat/ und danach/ im Kreis/ gefahren ist.

b. Ben berichtet,/ dass/ der Clown/ auf dem Einrad mit Geschick/ jongliert hat/ und danach/ im Kreis/ gefahren ist.

c. Ben berichtet,/ dass/ der Clown/ an Himmelfahrt auf dem Marktplatz/ jongliert hat/ und danach/ im Kreis/ gefahren ist.

d. Ben berichtet,/ dass/ der Clown/ auf dem Marktplatz an Himmelfahrt/ jongliert hat/ und danach/ im Kreis/ gefahren ist.

(9) a. Maren sagt,/ dass/ die Mutter/ mit Routine auf dem Herd/ gekocht hat/ und danach/ Lebensmittel einkaufen/ gegangen ist.

b. Maren sagt,/ dass/ die Mutter/ auf dem Herd mit Routine/ gekocht hat/ und danach/ Lebensmittel einkaufen/ gegangen ist.

c. Maren sagt,/ dass/ die Mutter/ am Vortag in der Küche/ gekocht hat/ und danach/ Lebensmittel einkaufen/ gegangen ist.

d. Maren sagt,/ dass/ die Mutter/ in der Küche am Vortag/ gekocht hat/ und danach/ Lebensmittel einkaufen/ gegangen ist.

(10) a. Holger erzählt,/ dass/ das Kind/ mit Geschick auf dem Geländer/ herumgeturnt ist/ und danach/ ein Rad/ geschlagen hat.

b. Holger erzählt,/ dass/ das Kind/ auf dem Geländer mit Geschick/ herumgeturnt ist/ und danach/ ein Rad/ geschlagen hat.

c. Holger erzählt,/ dass/ das Kind/ am Vormittag auf dem Spielplatz/ herumgeturnt ist/ und danach/ ein Rad/ geschlagen hat.

d. Holger erzählt,/ dass/ das Kind/ auf dem Spielplatz am Vormittag/ herumgeturnt ist/ und danach/ ein Rad/ geschlagen hat.

(11) a. Stefanie berichtet,/ dass/ der Zirkusartist/ mit Vorsicht auf dem Esel/ geritten ist/ und danach/ einige Kunststücke/ vorgeführt hat.

b. Stefanie berichtet,/ dass/ der Zirkusartist/ auf dem Esel mit Vorsicht/ geritten ist/ und danach/ einige Kunststücke/ vorgeführt hat.

c. Stefanie berichtet,/ dass/ der Zirkusartist/ am Samstag in der Manege/ geritten ist/ und danach/ einige Kunststücke/ vorgeführt hat.

d. Stefanie berichtet,/ dass/ der Zirkusartist/ in der Manege am Samstag/ geritten ist/ und danach/ einige Kunststücke/ vorgeführt hat.

(12) a. Mark erzählt,/ dass/ der Künstler/ mit Elan auf dem Block/ gezeichnet hat/ und danach/ ins Atelier/ gegangen ist.

b. Mark erzählt,/ dass/ der Künstler/ auf dem Block mit Elan/ gezeichnet hat/ und danach/ ins Atelier/ gegangen ist.

c. Mark erzählt,/ dass/ der Künstler/ am Montag auf der Terrasse/ gezeichnet hat/ und danach/ ins Atelier/ gegangen ist.

d. Mark erzählt,/ dass/ der Künstler/ auf der Terrasse am Montag/ gezeichnet hat/ und danach/ ins Atelier/ gegangen ist.

(13) a. Susanne sagt,/ dass/ der Vogel/ mit Vorsicht in der Nussschale/ herumgepickt hat/ und danach/ ins Gebüsch/ geflattert ist.

b. Susanne sagt,/ dass/ der Vogel/ in der Nussschale mit Vorsicht/ herumgepickt hat/ und danach/ ins Gebüsch/ geflattert ist.

c. Susanne sagt,/ dass/ der Vogel/ in der Dämmerung auf dem Hof/ herumgepickt hat/ und danach/ ins Gebüsch/ geflattert ist.

d. Susanne sagt,/ dass/ der Vogel/ auf dem Hof in der Dämmerung/ herumgepickt hat/ und danach/ ins Gebüsch/ geflattert ist.

(14) a. Frank berichtet,/ dass/ der Bernhardiner/ mit Vorsicht unter der Eckbank/ herumgeschnüffelt hat/ und danach/ ins Wohnzimmer/ gelaufen ist.

b. Frank berichtet,/ dass/ der Bernhardiner/ unter der Eckbank mit Vorsicht/ herumgeschnüffelt hat/ und danach/ ins Wohnzimmer/ gelaufen ist.

c. Frank berichtet,/ dass/ der Bernhardiner/ am Abend in der Abstellkammer/ herumgeschnüffelt hat/ und danach/ ins Wohnzimmer/ gelaufen ist.

d. Frank berichtet,/ dass/ der Bernhardiner/ in der Abstellkammer am Abend/ herumgeschnüffelt hat/ und danach/ ins Wohnzimmer/ gelaufen ist.

(15) a. Annika erzählt,/ dass/ der Mechatroniker/ mit Sorgfalt unter der Kühlerhaube/ herumgewerkelt hat/ und danach/ nach draußen/ gegangen ist.

b. Annika erzählt,/ dass/ der Mechatroniker/ unter der Kühlerhaube mit Sorgfalt/ herumgewerkelt hat/ und danach/ nach draußen/ gegangen ist.

c. Annika erzählt,/ dass/ der Mechatroniker/ am Dienstag in der Werkstatt/ herumgewerkelt hat/ und danach/ nach draußen/ gegangen ist.

d. Annika erzählt,/ dass/ der Mechatroniker/ in der Werkstatt am Dienstag/ herumgewerkelt hat/ und danach/ nach draußen/ gegangen ist.

(16) a. Arnold erzählt,/ dass/ der Einbrecher/ mit Mühe unter der Couch/ herumgewühlt hat/ und danach/ zum Fenster/ hinausgeklettert ist.

b. Arnold erzählt,/ dass/ der Einbrecher/ unter der Couch mit Mühe/ herumgewühlt hat/ und danach/ zum Fenster/ hinausgeklettert ist.

c. Arnold erzählt,/ dass/ der Einbrecher/ um Mitternacht in der Hütte/ herumgewühlt hat/ und danach/ zum Fenster/ hinausgeklettert ist.

d. Arnold erzählt,/ dass/ der Einbrecher/ in der Hütte um Mitternacht/ herumgewühlt hat/ und danach/ zum Fenster/ hinausgeklettert ist.

(17) a. Beate erzählt,/ dass/ der Athlet/ mit Routine auf dem Drahtseil/ herumstolziert ist/ und danach/ einen Salto/ gemacht hat.

b. Beate erzählt,/ dass/ der Athlet/ auf dem Drahtseil mit Routine/ herumstolziert ist/ und danach/ einen Salto/ gemacht hat.

c. Beate erzählt,/ dass/ der Athlet/ vor Anpfiff in der Sporthalle/ herumstolziert ist/ und danach/ einen Salto/ gemacht hat.

d. Beate erzählt,/ dass/ der Athlet/ in der Sporthalle vor Anpfiff/ herumstolziert ist/ und danach/ einen Salto/ gemacht hat.

(18) a. Christina berichtet,/ dass/ der Handwerker/ mit Geschick in der Regenrinne/ herumhantiert hat/ und danach/ die Leiter/ hinabgestiegen ist.

b. Christina berichtet,/ dass/ der Handwerker/ in der Regenrinne mit Geschick/ herumhantiert hat/ und danach/ die Leiter/ hinabgestiegen ist.

c. Christina berichtet,/ dass/ der Handwerker/ am Mittwoch auf dem Dachboden/ herumhantiert hat/ und danach/ die Leiter/ hinabgestiegen ist.

d. Christina berichtet,/ dass/ der Handwerker/ auf dem Dachboden am Mittwoch/ herumhantiert hat/ und danach/ die Leiter/ hinabgestiegen ist.

(19) a. Gerda sagt,/ dass/ der Schüler/ mit Mühe auf dem Schwebebalken/ balanciert ist/ und danach/ den Lehrer/ befragt hat.

b. Gerda sagt,/ dass/ der Schüler/ auf dem Schwebebalken mit Mühe/ balanciert ist/ und danach/ den Lehrer/ befragt hat.

c. Gerda sagt,/ dass/ der Schüler/ nach Schulschluss auf dem Hof/ balanciert ist/ und danach/ den Lehrer/ befragt hat.

d. Gerda sagt,/ dass/ der Schüler/ auf dem Hof nach Schulschluss/ balanciert ist/ und danach/ den Lehrer/ befragt hat.

(20) a. Erik berichtet,/ dass/ das Mädchen/ mit Routine an der Ballettstange/ herumgetanzt ist/ und danach/ eine Pirouette/ gedreht hat.

b. Erik berichtet,/ dass/ das Mädchen/ an der Ballettstange mit Routine/ herumgetanzt ist/ und danach/ eine Pirouette/ gedreht hat.

c. Erik berichtet,/ dass/ das Mädchen/ vor Schulbeginn auf dem Pausenhof/ herumgetanzt ist/ und danach/ eine Pirouette/ gedreht hat.

d. Erik berichtet,/ dass/ das Mädchen/ auf dem Pausenhof vor Schulbeginn/ herumgetanzt ist/ und danach/ eine Pirouette/ gedreht hat.

(21) a. Paula berichtet,/ dass/ das Pferd/ mit Kraft auf dem Boden/ herumgescharrt hat/ und danach/ zum Wassertrog/ gestapft ist.

b. Paula berichtet,/ dass/ das Pferd/ auf dem Boden mit Kraft/ herumgescharrt hat/ und danach/ zum Wassertrog/ gestapft ist.

c. Paula berichtet,/ dass/ das Pferd/ nach Sonnenuntergang in der Box/ herumgescharrt hat/ und danach/ zum Wassertrog/ gestapft ist.

d. Paula berichtet,/ dass/ das Pferd/ in der Box nach Sonnenuntergang/ herumgescharrt hat/ und danach/ zum Wassertrog/ gestapft ist.

(22) a. Rita sagt,/ dass/ der Heimwerker/ mit Kraft auf dem Holzstück/ herumgehämmert hat/ und danach/ zum Baumarkt/ gefahren ist.

b. Rita sagt,/ dass/ der Heimwerker/ auf dem Holzstück mit Kraft/ herumgehämmert hat/ und danach/ zum Baumarkt/ gefahren ist.

c. Rita sagt,/ dass/ der Heimwerker/ am Vorabend in der Garage/ herumgehämmert hat/ und danach/ zum Baumarkt/ gefahren ist.

d. Rita sagt,/ dass/ der Heimwerker/ in der Garage am Vorabend/ herumgehämmert hat/ und danach/ zum Baumarkt/ gefahren ist.

(23) a. Thilo berichtet,/ dass/ der Skater/ mit Schwung auf dem Skateboard/ herumgeflitzt ist/ und danach/ eine Vollbremsung/ gemacht hat.

b. Thilo berichtet,/ dass/ der Skater/ auf dem Skateboard mit Schwung/ herumgeflitzt ist/ und danach/ eine Vollbremsung/ gemacht hat.

c. Thilo berichtet,/ dass/ der Skater/ am Abend auf dem Parcours/ herumgeflitzt ist/ und danach/ eine Vollbremsung/ gemacht hat.

d. Thilo berichtet,/ dass/ der Skater/ auf dem Parcours am Abend/ herumgeflitzt ist/ und danach/ eine Vollbremsung/ gemacht hat.

(24) a. Vera erzählt,/ dass/ der Fahrer/ mit Schwung in der Limousine/ herumgefahren ist/ und danach/ den Motor/ abgestellt hat.

b. Vera erzählt,/ dass/ der Fahrer/ in der Limousine mit Schwung/ herumgefahren ist/ und danach/ den Motor/ abgestellt hat.

c. Vera erzählt,/ dass/ der Fahrer/ nach Feierabend auf dem Parkplatz/ herumgefahren ist/ und danach/ den Motor/ abgestellt hat.

d. Vera erzählt,/ dass/ der Fahrer/ auf dem Parkplatz nach Feierabend/ herumgefahren ist/ und danach/ den Motor/ abgestellt hat.

Materials Set 2: Self-paced reading experiment reported as Experiment 2 (5.3)

(1) a. Rita berichtet,/ dass/ gesundheitlich vielleicht/ Monika einiges/ vorgetäuscht hat/ und sich deshalb entschuldigt.

b. Rita berichtet,/ dass/ vielleicht gesundheitlich/ Monika einiges/ vorgetäuscht hat/ und sich deshalb entschuldigt.

c. Rita berichtet,/ dass/ gesundheitlich vorhin/ Monika einiges/ vorgetäuscht hat/ und sich deshalb entschuldigt.

d. Rita berichtet,/ dass/ vorhin gesundheitlich/ Monika einiges/ vorgetäuscht hat/ und sich deshalb entschuldigt.

(2) a. Saskia berichtet,/ dass/ thematisch zweifellos/ Laura etwas/ kritisiert hat/ und sich deswegen beschwert.

b. Saskia berichtet,/ dass/ zweifellos thematisch/ Laura etwas/ kritisiert hat/ und sich deswegen beschwert.

c. Saskia berichtet,/ dass/ thematisch gestern/ Laura etwas/ kritisiert hat/ und sich deswegen beschwert.

d. Saskia berichtet,/ dass/ gestern thematisch/ Laura etwas/ kritisiert hat/ und sich deswegen beschwert.

(3) a. Felix sagt,/ dass/ orthografisch sicherlich/ Rebekka einiges/ verwechselt hat/ und sich deshalb schämt.

b. Felix sagt,/ dass/ sicherlich orthografisch/ Rebekka einiges/ verwechselt hat/ und sich deshalb schämt.

c. Felix sagt,/ dass/ orthografisch soeben/ Rebekka einiges/ verwechselt hat/ und sich deshalb schämt.

d. Felix sagt,/ dass/ soeben orthografisch/ Rebekka einiges/ verwechselt hat/ und sich deshalb schämt.

(4) a. Jens berichtet,/ dass/ nervlich wahrscheinlich/ Albert etwas/ verarbeitet hat/ und sich deshalb ausruht.

b. Jens berichtet,/ dass/ wahrscheinlich nervlich/ Albert etwas/ verarbeitet hat/ und sich deshalb ausruht.

c. Jens berichtet,/ dass/ nervlich heute/ Albert etwas/ verarbeitet hat/ und sich deshalb ausruht.

d. Jens berichtet,/ dass/ heute nervlich/ Albert etwas/ verarbeitet hat/ und sich deshalb ausruht.

(5) a. Sabine sagt,/ dass/ zwischenmenschlich vielleicht/ Marion einiges/ missverstanden hat/ und sich deswegen zurückzieht.

b. Sabine sagt,/ dass/ vielleicht zwischenmenschlich/ Marion einiges/ missverstanden hat/ und sich deswegen zurückzieht.

c. Sabine sagt,/ dass/ zwischenmenschlich vorgestern/ Marion einiges/ missverstanden hat/ und sich deswegen zurückzieht.

d. Sabine sagt,/ dass/ vorgestern zwischenmenschlich/ Marion einiges/ missverstanden hat/ und sich deswegen zurückzieht.

(6) a. Ralf erzählt,/ dass/ gehaltlich zweifellos/ Johanna etwas/ erkämpft hat/ und sich deshalb freut.

b. Ralf erzählt,/ dass/ zweifellos gehaltlich/ Johanna etwas/ erkämpft hat/ und sich deshalb freut.

c. Ralf erzählt,/ dass/ gehaltlich zuvor/ Johanna etwas/ erkämpft hat/ und sich deshalb freut.

d. Ralf erzählt,/ dass/ zuvor gehaltlich/ Johanna etwas/ erkämpft hat/ und sich deshalb freut.

(7) a. Tina berichtet,/ dass/ strukturell vermutlich/ Doris einiges/ umgestaltet hat/ und sich deshalb verspätet.

b. Tina berichtet,/ dass/ vermutlich strukturell/ Doris einiges/ umgestaltet hat/ und sich deshalb verspätet.

c. Tina berichtet,/ dass/ strukturell vorhin/ Doris einiges/ umgestaltet hat/ und sich deshalb verspätet.

d. Tina berichtet,/ dass/ vorhin strukturell/ Doris einiges/ umgestaltet hat/ und sich deshalb verspätet.

(8) a. Svea sagt,/ dass/ inhaltlich sicherlich/ Oskar etwas/ abgeändert hat/ und sich deswegen informiert.

b. Svea sagt,/ dass/ sicherlich inhaltlich/ Oskar etwas/ abgeändert hat/ und sich deswegen informiert.

c. Svea sagt,/ dass/ inhaltlich gestern/ Oskar etwas/ abgeändert hat/ und sich deswegen informiert.

d. Svea sagt,/ dass/ gestern inhaltlich/ Oskar etwas/ abgeändert hat/ und sich deswegen informiert.

(9) a. Tim erzählt,/ dass/ geschmacklich angeblich/ Julian etwas/ ruiniert hat/ und sich deswegen ärgert.

b. Tim erzählt,/ dass/ angeblich geschmacklich/ Julian etwas/ ruiniert hat/ und sich deswegen ärgert.

c. Tim erzählt,/ dass/ geschmacklich soeben/ Julian etwas/ ruiniert hat/ und sich deswegen ärgert.

d. Tim erzählt,/ dass/ soeben geschmacklich/ Julian etwas/ ruiniert hat/ und sich deswegen ärgert.

(10) a. Sarah sagt,/ dass/ körperlich offenbar/ Dirk etwas/ überstanden hat/ und sich darum zurückzieht.

b. Sarah sagt,/ dass/ offenbar körperlich/ Dirk etwas/ überstanden hat/ und sich darum zurückzieht.

c. Sarah sagt,/ dass/ körperlich heute/ Dirk etwas/ überstanden hat/ und sich darum zurückzieht.

d. Sarah sagt,/ dass/ heute körperlich/ Dirk etwas/ überstanden hat/ und sich darum zurückzieht.

(11) a. Pierre erzählt,/ dass/ sprachlich anscheinend/ Martin jemanden/ korrigiert hat/ und sich deswegen amüsiert.

b. Pierre erzählt,/ dass/ anscheinend sprachlich/ Martin jemanden/ korrigiert hat/ und sich deswegen amüsiert.

c. Pierre erzählt,/ dass/ sprachlich vorgestern/ Martin jemanden/ korrigiert hat/ und sich deswegen amüsiert.

d. Pierre erzählt,/ dass/ vorgestern sprachlich/ Martin jemanden/ korrigiert hat/ und sich deswegen amüsiert.

(12) a. Sina sagt,/ dass/ schulisch bekanntlich/ Sibylle jemanden/ abgehängt hat/ und sich deshalb langweilt.

b. Sina sagt,/ dass/ bekanntlich schulisch/ Sibylle jemanden/ abgehängt hat/ und sich deshalb langweilt.

c. Sina sagt,/ dass/ schulisch vorhin/ Sibylle jemanden/ abgehängt hat/ und sich deshalb langweilt.

d. Sina sagt,/ dass/ vorhin schulisch/ Sibylle jemanden/ abgehängt hat/ und sich deshalb langweilt.

(13) a. Hanna erzählt,/ dass/ nervlich möglicherweise/ Niklas einiges/ gepackt hat/ und sich darum schont.

b. Hanna erzählt,/ dass/ möglicherweise nervlich/ Niklas einiges/ gepackt hat/ und sich darum schont.

c. Hanna erzählt,/ dass/ nervlich vorhin/ Niklas einiges/ gepackt hat/ und sich darum schont.

d. Hanna erzählt,/ dass/ vorhin nervlich/ Niklas einiges/ gepackt hat/ und sich darum schont.

(14) a. Annika erzählt,/ dass/ gehaltlich vermutlich/ Viktoria etwas/ geboten hat/ und sich darum wundert.

b. Annika erzählt,/ dass/ vermutlich gehaltlich/ Viktoria etwas/ geboten hat/ und sich darum wundert.

c. Annika erzählt,/ dass/ gehaltlich gestern/ Viktoria etwas/ geboten hat/ und sich darum wundert.

d. Annika erzählt,/ dass/ gestern gehaltlich/ Viktoria etwas/ geboten hat/ und sich darum wundert.

(15) a. Dirk erzählt,/ dass/ körperlich möglicherweise/ Stefanie jemanden/ vernachlässigt hat/ und sich deshalb bemüht.

b. Dirk erzählt,/ dass/ möglicherweise körperlich/ Stefanie jemanden/ vernachlässigt hat/ und sich deshalb bemüht.

c. Dirk erzählt,/ dass/ körperlich zuvor/ Stefanie jemanden/ vernachlässigt hat/ und sich deshalb bemüht.

d. Dirk erzählt,/ dass/ soeben körperlich/ Stefanie jemanden/ vernachlässigt hat/ und sich deshalb bemüht.

(16) a. Annette berichtet,/ dass/ zwischenmenschlich anscheinend/ Judith einiges/ gefährdet hat/ und sich darum ändert.

b. Annette berichtet,/ dass/ anscheinend zwischenmenschlich/ Judith einiges/ gefährdet hat/ und sich darum ändert.

c. Annette berichtet,/ dass/ zwischenmenschlich heute/ Judith einiges/ gefährdet hat/ und sich darum ändert.

d. Annette berichtet,/ dass/ heute zwischenmenschlich/ Judith einiges/ gefährdet hat/ und sich darum ändert.

(17) a. Dario berichtet,/ dass/ inhaltlich bekanntlich/ Andreas einiges/ beanstandet hat/ und sich deswegen brüskiert.

b. Dario berichtet,/ dass/ bekanntlich inhaltlich/ Andreas einiges/ beanstandet hat/ und sich deswegen brüskiert.

c. Dario berichtet,/ dass/ inhaltlich vorgestern/ Andreas einiges/ beanstandet hat/ und sich deswegen brüskiert.

d. Dario berichtet,/ dass/ vorgestern inhaltlich/ Andreas einiges/ beanstandet hat/ und sich deswegen brüskiert.

(18) a. Irene erzählt,/ dass/ gesundheitlich tatsächlich/ Bruno jemanden/ aufgeklärt hat/ und sich deshalb erkundigt.

b. Irene erzählt,/ dass/ tatsächlich gesundheitlich/ Bruno jemanden/ aufgeklärt hat/ und sich deshalb erkundigt.

c. Irene erzählt,/ dass/ gesundheitlich soeben/ Bruno jemanden/ aufgeklärt hat/ und sich deshalb erkundigt.

d. Irene erzählt,/ dass/ soeben gesundheitlich/ Bruno jemanden/ aufgeklärt hat/ und sich deshalb erkundigt.

(19) a. Arthur berichtet,/ dass/ schulisch offensichtlich/ Gabi jemanden/ integriert hat/ und sich darum fortbildet.

b. Arthur berichtet,/ dass/ offensichtlich schulisch/ Gabi jemanden/ integriert hat/ und sich darum fortbildet.

c. Arthur berichtet,/ dass/ schulisch zuvor/ Gabi jemanden/ integriert hat/ und sich darum fortbildet.

d. Arthur berichtet,/ dass/ zuvor schulisch/ Gabi jemanden/ integriert hat/ und sich darum fortbildet.

(20) a. Fritz sagt,/ dass/ strukturell offensichtlich/ Tom etwas/ analysiert hat/ und sich deswegen auskennt.

b. Fritz sagt,/ dass/ offensichtlich strukturell/ Tom etwas/ analysiert hat/ und sich deswegen auskennt.

c. Fritz sagt,/ dass/ strukturell gestern/ Tom etwas/ analysiert hat/ und sich deswegen auskennt.

d. Fritz sagt,/ dass/ gestern strukturell/ Tom etwas/ analysiert hat/ und sich deswegen auskennt.

(21) a. Franco berichtet,/ dass/ geschmacklich offenbar/ Pia jemanden/ überzeugt hat/ und sich darum bewirbt.

b. Franco berichtet,/ dass/ offenbar geschmacklich/ Pia jemanden/ überzeugt hat/ und sich darum bewirbt.

c. Franco berichtet,/ dass/ geschmacklich soeben/ Pia jemanden/ überzeugt hat/ und sich darum bewirbt.

d. Franco berichtet,/ dass/ soeben geschmacklich/ Pia jemanden/ überzeugt hat/ und sich darum bewirbt.

(22) a. Brigitte erzählt,/ dass/ sprachlich tatsächlich/ Jan einiges/ abgeändert hat/ und sich deswegen meldet.

b. Brigitte erzählt,/ dass/ tatsächlich sprachlich/ Jan einiges/ abgeändert hat/ und sich deswegen meldet.

c. Brigitte erzählt,/ dass/ sprachlich heute/ Jan einiges/ abgeändert hat/ und sich deswegen meldet.

d. Brigitte erzählt,/ dass/ heute sprachlich/ Jan einiges/ abgeändert hat/ und sich deswegen meldet.

(23) a. Peter sagt,/ dass/ orthografisch wahrscheinlich/ Jennifer jemanden/ verbessert hat/ und sich darum rechtfertigt.

b. Peter sagt,/ dass/ wahrscheinlich orthografisch/ Jennifer jemanden/ verbessert hat/ und sich darum rechtfertigt.

c. Peter sagt,/ dass/ orthografisch vorgestern/ Jennifer jemanden/ verbessert hat/ und sich darum rechtfertigt.

d. Peter sagt,/ dass/ vorgestern orthografisch/ Jennifer jemanden/ verbessert hat/ und sich darum rechtfertigt.

(24) a. Silvia sagt,/ dass/ thematisch angeblich/ Tina jemanden/ beeinflusst hat/ und sich darum aufregt.

b. Silvia sagt,/ dass/ angeblich thematisch/ Tina jemanden/ beeinflusst hat/ und sich darum aufregt.

c. Silvia sagt,/ dass/ thematisch zuvor/ Tina jemanden/ beeinflusst hat/ und sich darum aufregt.

d. Silvia sagt,/ dass/ zuvor thematisch/ Tina jemanden/ beeinflusst hat/ und sich darum aufregt.

Materials Set 3: Acceptability judgment experiment reported as Experiment 3 (5.5)

(1) a. Petra sagt, dass die Chefin mit Schwung auf dem Papier unterzeichnet hat.

b. Petra sagt, dass die Chefin auf dem Papier mit Schwung unterzeichnet hat.

c. Petra sagt, dass die Chefin vor Feierabend in der Firma unterzeichnet hat.

d. Petra sagt, dass die Chefin in der Firma vor Feierabend unterzeichnet hat.

(2) a. Klaus sagt, dass der Schreiner mit Sorgfalt auf der Werkbank gesägt hat.

b. Klaus sagt, dass der Schreiner auf der Werkbank mit Sorgfalt gesägt hat.

c. Klaus sagt, dass der Schreiner am Donnerstag auf dem Flur gesägt hat.

d. Klaus sagt, dass der Schreiner auf dem Flur am Donnerstag gesägt hat.

(3) a. Helga erzählt, dass der Junge mit Elan in der Pfütze geangelt hat.

b. Helga erzählt, dass der Junge in der Pfütze mit Elan geangelt hat.

c. Helga erzählt, dass der Junge vor Sonnenaufgang in der Schlucht geangelt hat.

d. Helga erzählt, dass der Junge in der Schlucht vor Sonnenaufgang geangelt hat.

(4) a. Tom berichtet, dass der Erstklässler mit Sorgfalt auf dem Küchentisch gebastelt hat.

b. Tom berichtet, dass der Erstklässler auf dem Küchentisch mit Sorgfalt gebastelt hat.

c. Tom berichtet, dass der Erstklässler am Feiertag im Garten gebastelt hat.

d. Tom berichtet, dass der Erstklässler im Garten am Feiertag gebastelt.

(5) a. Lena erzählt, dass der Lehrer mit Mühe an der Tafel geschrieben hat.

b. Lena erzählt, dass der Lehrer an der Tafel mit Mühe geschrieben hat.

c. Lena erzählt, dass der Lehrer nach der Pause in der Mensa geschrieben hat.

d. Lena erzählt, dass der Lehrer in der Mensa nach der Pause geschrieben hat.

(6) a. Bernhard sagt, dass der Zahnarzt mit Kraft in der Wurzel gebohrt hat.

b. Bernhard sagt, dass der Zahnarzt in der Wurzel mit Kraft gebohrt hat.

c. Bernhard sagt, dass der Zahnarzt am Nachmittag in der Praxis gebohrt hat.

d. Bernhard sagt, dass der Zahnarzt in der Praxis am Nachmittag gebohrt hat.

(7) a. Klara sagt, dass der Waschbär mit Elan in der Blumenerde gebuddelt hat.

b. Klara sagt, dass der Waschbär in der Blumenerde mit Elan gebuddelt hat.

c. Klara sagt, dass der Waschbär am Morgen auf der Pferdekoppel gebuddelt hat.

d. Klara sagt, dass der Waschbär auf der Pferdekoppel am Morgen gebuddelt hat.

(8) a. Ben berichtet, dass der Clown mit Geschick auf dem Einrad jongliert hat.

b. Ben berichtet, dass der Clown auf dem Einrad mit Geschick jongliert hat.

c. Ben berichtet, dass der Clown an Himmelfahrt auf dem Marktplatz jongliert hat.

d. Ben berichtet, dass der Clown auf dem Marktplatz an Himmelfahrt jongliert hat.

(9) a. Maren sagt, dass die Mutter mit Routine auf dem Herd gekocht hat.

b. Maren sagt, dass die Mutter auf dem Herd mit Routine gekocht hat.

c. Maren sagt, dass die Mutter am Vortag in der Küche gekocht hat.

d. Maren sagt, dass die Mutter in der Küche am Vortag gekocht hat.

(10) a. Holger erzählt, dass das Kind mit Geschick auf dem Geländer herumgeturnt ist.

b. Holger erzählt, dass das Kind auf dem Geländer mit Geschick herumgeturnt ist.

c. Holger erzählt, dass das Kind am Vormittag auf dem Spielplatz herumgeturnt ist.

d. Holger erzählt, dass das Kind auf dem Spielplatz am Vormittag herumgeturnt ist.

(11) a. Stefanie berichtet, dass der Zirkusartist mit Vorsicht auf dem Esel geritten ist.

b. Stefanie berichtet, dass der Zirkusartist auf dem Esel mit Vorsicht geritten ist.

c. Stefanie berichtet, dass der Zirkusartist am Samstag in der Manege geritten ist.

d. Stefanie berichtet, dass der Zirkusartist in der Manege am Samstag geritten ist.

(12) a. Mark erzählt, dass der Künstler mit Elan auf dem Block gezeichnet hat.

b. Mark erzählt, dass der Künstler auf dem Block mit Elan gezeichnet hat.

c. Mark erzählt, dass der Künstler am Montag auf der Terrasse gezeichnet hat.

d. Mark erzählt, dass der Künstler auf der Terrasse am Montag gezeichnet hat.

(13) a. Susanne sagt, dass der Vogel mit Vorsicht in der Nussschale herumgepickt hat.

b. Susanne sagt, dass der Vogel in der Nussschale mit Vorsicht herumgepickt hat.

c. Susanne sagt, dass der Vogel in der Dämmerung auf dem Hof herumgepickt hat.

d. Susanne sagt, dass der Vogel auf dem Hof in der Dämmerung herumgepickt hat.

(14) a. Frank berichtet, dass der Bernhardiner mit Vorsicht unter der Eckbank herumgeschnüffelt hat.

b. Frank berichtet, dass der Bernhardiner unter der Eckbank mit Vorsicht herumgeschnüffelt hat.

c. Frank berichtet, dass der Bernhardiner am Abend in der Abstellkammer herumgeschnüffelt hat.

d. Frank berichtet, dass der Bernhardiner in der Abstellkammer am Abend herumgeschnüffelt hat.

(15) a. Annika erzählt, dass der Mechatroniker mit Sorgfalt unter der Kühlerhaube herumgewerkelt hat.

b. Annika erzählt, dass der Mechatroniker unter der Kühlerhaube mit Sorgfalt herumgewerkelt hat.

c. Annika erzählt, dass der Mechatroniker am Dienstag in der Werkstatt herumgewerkelt hat.

d. Annika erzählt, dass der Mechatroniker in der Werkstatt am Dienstag herumgewerkelt hat.

(16) a. Arnold erzählt, dass der Einbrecher mit Mühe unter der Couch herumgewühlt hat.

b. Arnold erzählt, dass der Einbrecher unter der Couch mit Mühe herumgewühlt hat.

c. Arnold erzählt, dass der Einbrecher um Mitternacht in der Hütte herumgewühlt hat.

d. Arnold erzählt, dass der Einbrecher in der Hütte um Mitternacht herumgewühlt hat.

(17) a. Beate erzählt, dass der Athlet mit Routine auf dem Drahtseil herumstolziert ist.

b. Beate erzählt, dass der Athlet auf dem Drahtseil mit Routine herumstolziert ist.

c. Beate erzählt, dass der Athlet vor Anpfiff in der Sporthalle herumstolziert ist.

d. Beate erzählt, dass der Athlet in der Sporthalle vor Anpfiff herumstolziert ist.

(18) a. Christina berichtet, dass der Handwerker mit Geschick in der Regenrinne herumhantiert hat.

b. Christina berichtet, dass der Handwerker in der Regenrinne mit Geschick herumhantiert hat.

c. Christina berichtet, dass der Handwerker am Mittwoch auf dem Dachboden herumhantiert hat.

d. Christina berichtet, dass der Handwerker auf dem Dachboden am Mittwoch herumhantiert hat.

(19) a. Gerda sagt, dass der Schüler mit Mühe auf dem Schwebebalken balanciert ist.

b. Gerda sagt, dass der Schüler auf dem Schwebebalken mit Mühe balanciert ist.

c. Gerda sagt, dass der Schüler nach Schulschluss auf dem Hof balanciert ist.

d. Gerda sagt, dass der Schüler auf dem Hof nach Schulschluss balanciert ist.

(20) a. Erik berichtet, dass das Mädchen mit Routine an der Ballettstange herumgetanzt ist.

b. Erik berichtet, dass das Mädchen an der Ballettstange mit Routine herumgetanzt ist.

c. Erik berichtet, dass das Mädchen vor Schulbeginn auf dem Pausenhof herumgetanzt ist.

d. Erik berichtet, dass das Mädchen auf dem Pausenhof vor Schulbeginn herumgetanzt ist.

(21) a. Paula berichtet, dass das Pferd mit Kraft auf dem Boden herumgescharrt hat.

b. Paula berichtet, dass das Pferd auf dem Boden mit Kraft herumgescharrt hat.

c. Paula berichtet, dass das Pferd nach Sonnenuntergang in der Box herumgescharrt hat.

d. Paula berichtet, dass das Pferd in der Box nach Sonnenuntergang herumgescharrt hat.

(22) a. Rita sagt, dass der Heimwerker mit Kraft auf dem Holzstück herumgehämmert hat.

b. Rita sagt, dass der Heimwerker auf dem Holzstück mit Kraft herumgehämmert hat.

c. Rita sagt, dass der Heimwerker am Vorabend in der Garage herumgehämmert hat.

d. Rita sagt, dass der Heimwerker in der Garage am Vorabend herumgehämmert hat.

(23) a. Thilo berichtet, dass der Skater mit Schwung auf dem Skateboard herumgeflitzt ist.

b. Thilo berichtet, dass der Skater auf dem Skateboard mit Schwung herumgeflitzt ist.

c. Thilo berichtet, dass der Skater am Abend auf dem Parcours herumgeflitzt ist.

d. Thilo berichtet, dass der Skater auf dem Parcours am Abend herumgeflitzt ist.

(24) a. Vera erzählt, dass der Fahrer mit Schwung in der Limousine herumgefahren ist.

b. Vera erzählt, dass der Fahrer in der Limousine mit Schwung herumgefahren ist.

c. Vera erzählt, dass der Fahrer nach Feierabend auf dem Parkplatz herumgefahren ist.

d. Vera erzählt, dass der Fahrer auf dem Parkplatz nach Feierabend herumgefahren ist.

Materials Set 4: Acceptability judgment experiment reported as Experiment 4 (6.4)

(1) a. Rita berichtet, dass gesundheitlich vielleicht Monika einiges vorgetäuscht hat.
b. Rita berichtet, dass vielleicht gesundheitlich Monika einiges vorgetäuscht hat.
c. Rita berichtet, dass gesundheitlich vorhin Monika einiges vorgetäuscht hat.
d. Rita berichtet, dass vorhin gesundheitlich Monika einiges vorgetäuscht hat.

(2) a. Saskia berichtet, dass thematisch zweifellos Laura etwas kritisiert hat.
b. Saskia berichtet, dass zweifellos thematisch Laura etwas kritisiert hat.
c. Saskia berichtet, dass thematisch gestern Laura etwas kritisiert hat.
d. Saskia berichtet, dass gestern thematisch Laura etwas kritisiert hat.

(3) a. Felix sagt, dass orthografisch sicherlich Rebekka einiges verwechselt hat.
b. Felix sagt, dass sicherlich orthografisch Rebekka einiges verwechselt hat.
c. Felix sagt, dass orthografisch soeben Rebekka einiges verwechselt hat.
d. Felix sagt, dass soeben orthografisch Rebekka einiges verwechselt hat.

(4) a. Jens berichtet, dass nervlich wahrscheinlich Albert etwas verarbeitet hat.
b. Jens berichtet, dass wahrscheinlich nervlich Albert etwas verarbeitet hat.
c. Jens berichtet, dass nervlich heute Albert etwas verarbeitet hat.
d. Jens berichtet, dass heute nervlich Albert etwas verarbeitet hat.

(5) a. Sabine sagt, dass zwischenmenschlich vielleicht Marion einiges missverstanden hat.
b. Sabine sagt, dass vielleicht zwischenmenschlich Marion einiges missverstanden hat.
c. Sabine sagt, dass zwischenmenschlich vorgestern Marion einiges missverstanden hat.
d. Sabine sagt, dass vorgestern zwischenmenschlich Marion einiges missverstanden hat.

(6) a. Ralf erzählt, dass gehaltlich zweifellos Johanna etwas erkämpft hat.
b. Ralf erzählt, dass zweifellos gehaltlich Johanna etwas erkämpft hat.
c. Ralf erzählt, dass gehaltlich zuvor Johanna etwas erkämpft hat.
d. Ralf erzählt, dass zuvor gehaltlich Johanna etwas erkämpft hat.

(7) a. Tina berichtet, dass strukturell vermutlich Doris einiges umgestaltet hat.
b. Tina berichtet, dass vermutlich strukturell Doris einiges umgestaltet hat.
c. Tina berichtet, dass strukturell vorhin Doris einiges umgestaltet hat.
d. Tina berichtet, dass vorhin strukturell Doris einiges umgestaltet hat.

(8) a. Svea sagt, dass inhaltlich sicherlich Oskar etwas abgeändert hat.
b. Svea sagt, dass sicherlich inhaltlich Oskar etwas abgeändert hat.
c. Svea sagt, dass inhaltlich gestern Oskar etwas abgeändert hat.
d. Svea sagt, dass gestern inhaltlich Oskar etwas abgeändert hat.

(9) a. Tim erzählt, dass geschmacklich angeblich Julian etwas ruiniert hat.
b. Tim erzählt, dass angeblich geschmacklich Julian etwas ruiniert hat.
c. Tim erzählt, dass geschmacklich soeben Julian etwas ruiniert hat.
d. Tim erzählt, dass soeben geschmacklich Julian etwas ruiniert hat.

(10) a. Sarah sagt, dass körperlich offenbar Dirk etwas überstanden hat.
b. Sarah sagt, dass offenbar körperlich Dirk etwas überstanden hat.

c. Sarah sagt, dass körperlich heute Dirk etwas überstanden hat.

d. Sarah sagt, dass heute körperlich Dirk etwas überstanden hat.

(11) a. Pierre erzählt, dass sprachlich anscheinend Martin jemanden korrigiert hat.

b. Pierre erzählt, dass anscheinend sprachlich Martin jemanden korrigiert hat.

c. Pierre erzählt, dass sprachlich vorgestern Martin jemanden korrigiert hat.

d. Pierre erzählt, dass vorgestern sprachlich Martin jemanden korrigiert hat.

(12) a. Sina sagt, dass schulisch bekanntlich Sibylle jemanden abgehängt hat.

b. Sina sagt, dass bekanntlich schulisch Sibylle jemanden abgehängt hat.

c. Sina sagt, dass schulisch vorhin Sibylle jemanden abgehängt hat.

d. Sina sagt, dass vorhin schulisch Sibylle jemanden abgehängt hat.

(13) a. Hanna erzählt, dass nervlich möglicherweise Niklas einiges gepackt hat.

b. Hanna erzählt, dass möglicherweise nervlich Niklas einiges gepackt hat.

c. Hanna erzählt, dass nervlich vorhin Niklas einiges gepackt hat.

d. Hanna erzählt, dass vorhin nervlich Niklas einiges gepackt hat.

(14) a. Annika erzählt, dass gehaltlich vermutlich Viktoria etwas geboten hat.

b. Annika erzählt, dass vermutlich gehaltlich Viktoria etwas geboten hat.

c. Annika erzählt, dass gehaltlich gestern Viktoria etwas geboten hat.

d. Annika erzählt, dass gestern gehaltlich Viktoria etwas geboten hat.

(15) a. Dirk erzählt, dass körperlich möglicherweise Stefanie jemanden vernachlässigt hat.

b. Dirk erzählt, dass möglicherweise körperlich Stefanie jemanden vernachlässigt hat.

c. Dirk erzählt, dass körperlich zuvor Stefanie jemanden vernachlässigt hat.

d. Dirk erzählt, dass soeben körperlich Stefanie jemanden vernachlässigt hat.

(16) a. Annette berichtet, dass zwischenmenschlich anscheinend Judith einiges gefährdet hat.

b. Annette berichtet, dass anscheinend zwischenmenschlich Judith einiges gefährdet hat.

c. Annette berichtet, dass zwischenmenschlich heute Judith einiges gefährdet hat.

d. Annette berichtet, dass heute zwischenmenschlich Judith einiges gefährdet hat.

(17) a. Dario berichtet, dass inhaltlich bekanntlich Andreas einiges beanstandet hat.

b. Dario berichtet, dass bekanntlich inhaltlich Andreas einiges beanstandet hat.

c. Dario berichtet, dass inhaltlich vorgestern Andreas einiges beanstandet hat.

d. Dario berichtet, dass vorgestern inhaltlich Andreas einiges beanstandet hat.

(18) a. Irene erzählt, dass gesundheitlich tatsächlich Bruno jemanden aufgeklärt hat.

b. Irene erzählt, dass tatsächlich gesundheitlich Bruno jemanden aufgeklärt hat.

c. Irene erzählt, dass gesundheitlich soeben Bruno jemanden aufgeklärt hat.

d. Irene erzählt, dass soeben gesundheitlich Bruno jemanden aufgeklärt hat.

(19) a. Arthur berichtet, dass schulisch offensichtlich Gabi jemanden integriert hat.

b. Arthur berichtet, dass offensichtlich schulisch Gabi jemanden integriert hat.

c. Arthur berichtet, dass schulisch zuvor Gabi jemanden integriert hat.

d. Arthur berichtet, dass zuvor schulisch Gabi jemanden integriert hat.

(20) a. Fritz sagt, dass strukturell offensichtlich Tom etwas analysiert hat.

b. Fritz sagt, dass offensichtlich strukturell Tom etwas analysiert hat.

c. Fritz sagt, dass strukturell gestern Tom etwas analysiert hat.

d. Fritz sagt, dass gestern strukturell Tom etwas analysiert hat.

(21) a. Franco berichtet, dass geschmacklich offenbar Pia jemanden überzeugt hat.

b. Franco berichtet, dass offenbar geschmacklich Pia jemanden überzeugt hat.

c. Franco berichtet, dass geschmacklich soeben Pia jemanden überzeugt hat.

d. Franco berichtet, dass soeben geschmacklich Pia jemanden überzeugt hat.

(22) a. Brigitte erzählt, dass sprachlich tatsächlich Jan einiges abgeändert hat.

b. Brigitte erzählt, dass tatsächlich sprachlich Jan einiges abgeändert hat.

c. Brigitte erzählt, dass sprachlich heute Jan einiges abgeändert hat.

d. Brigitte erzählt, dass heute sprachlich Jan einiges abgeändert hat.

(23) a. Peter sagt, dass orthografisch wahrscheinlich Jennifer jemanden verbessert hat.

b. Peter sagt, dass wahrscheinlich orthografisch Jennifer jemanden verbessert hat.

c. Peter sagt, dass orthografisch vorgestern Jennifer jemanden verbessert hat.

d. Peter sagt, dass vorgestern orthografisch Jennifer jemanden verbessert hat.

(24) a. Silvia sagt, dass thematisch angeblich Tina jemanden beeinflusst hat.

b. Silvia sagt, dass angeblich thematisch Tina jemanden beeinflusst hat.

c. Silvia sagt, dass thematisch zuvor Tina jemanden beeinflusst hat.

d. Silvia sagt, dass zuvor thematisch Tina jemanden beeinflusst hat.

Materials Set 5: Acceptability judgment experiment reported as Experiment 5 (6.5)

(1) a. Fritz sagt, dass Moritz offensichtlich sozial kompliziert ist.

b. Fritz sagt, dass Moritz sozial offensichtlich kompliziert ist.

c. Fritz sagt, dass offensichtlich sozial Moritz kompliziert ist.

d. Fritz sagt, dass sozial offensichtlich Moritz kompliziert ist.

(2) a. Michael sagt, dass Helena offenbar politisch fragwürdig ist.

b. Michael sagt, dass Helena politisch offenbar engagiert ist.

c. Michael sagt, dass offenbar politisch Helena engagiert ist.

d. Michael sagt, dass politisch offenbar Helena engagiert ist.

(3) a. Frank sagt, dass Laura offensichtlich beruflich engagiert ist.

b. Frank sagt, dass Laura beruflich offensichtlich engagiert ist.

c. Frank sagt, dass offensichtlich beruflich Laura engagiert ist.

d. Frank sagt, dass beruflich offensichtlich Laura engagiert ist.

(4) a. Axel sagt, dass Susanne vermutlich sprachlich begabt ist.

b. Axel sagt, dass Susanne sprachlich vermutlich begabt ist.

c. Axel sagt, dass vermutlich sprachlich Susanne begabt ist.

d. Axel sagt, dass sprachlich vermutlich Susanne begabt ist.

(5) a. Harry sagt, dass Horst vermutlich politisch interessiert ist.

b. Harry sagt, dass Horst politisch vermutlich interessiert ist.

c. Harry sagt, dass vermutlich politisch Horst interessiert ist.

d. Harry sagt, dass politisch vermutlich Horst interessiert ist.

(6) a. Sarah sagt, dass Jule vielleicht mathematisch überdurchschnittlich ist.

b. Sarah sagt, dass Jule mathematisch vielleicht überdurchschnittlich ist.

c. Sarah sagt, dass vielleicht mathematisch Jule überdurchschnittlich ist.

d. Sarah sagt, dass mathematisch vielleicht Jule überdurchschnittlich ist.

(7) a. Brigitte erzählt, dass Albert scheinbar sportlich erfolgreich ist.

b. Brigitte erzählt, dass Albert sportlich scheinbar erfolgreich ist.

c. Brigitte erzählt, dass scheinbar sportlich Albert erfolgreich ist.

d. Brigitte erzählt, dass sportlich scheinbar Albert erfolgreich ist.

(8) a. Lilly erzählt, dass Berta angeblich psychisch angeschlagen ist.

b. Lilly erzählt, dass Berta psychisch angeblich angeschlagen ist.

c. Lilly erzählt, dass angeblich psychisch Berta angeschlagen ist.

d. Lilly erzählt, dass psychisch angeblich Berta angeschlagen ist.

(9) a. Monika erzählt, dass Christian offenbar geistig gesund ist.

b. Monika erzählt, dass Christian geistig offenbar gesund ist.

c. Monika erzählt, dass offenbar geistig Christian gesund ist.

d. Monika erzählt, dass geistig offenbar Christian gesund ist.

(10) a. Michaela erzählt, dass Daniel angeblich mathematisch kompetent ist.

b. Michaela erzählt, dass Daniel mathematisch angeblich kompetent ist.

c. Michaela erzählt, dass angeblich mathematisch Daniel kompetent ist.

d. Michaela erzählt, dass mathematisch angeblich Daniel kompetent ist.

(11) a. Tom erzählt, dass Ewald wahrscheinlich sportlich talentiert ist.

b. Tom erzählt, dass Ewald sportlich wahrscheinlich talentiert ist.

c. Tom erzählt, dass wahrscheinlich sportlich Ewald talentiert ist.

d. Tom erzählt, dass sportlich wahrscheinlich Ewald talentiert ist.

(12) a. Marie erzählt, dass Mike wahrscheinlich technisch erfahren ist.

b. Marie erzählt, dass Mike technisch wahrscheinlich erfahren ist.

c. Marie erzählt, dass wahrscheinlich technisch Mike erfahren ist.

d. Marie erzählt, dass technisch wahrscheinlich Mike erfahren ist.

(13) a. Tim meint, dass Hans sicherlich sozial isoliert ist.

b. Tim meint, dass Hans sozial sicherlich isoliert ist.

c. Tim meint, dass sicherlich sozial Hans isoliert ist.

d. Tim meint, dass sozial sicherlich Hans isoliert ist.

(14) a. Paul meint, dass Max vielleicht geistig flexibel ist.

b. Paul meint, dass Max geistig vielleicht flexibel ist.

c. Paul meint, dass vielleicht geistig Max flexibel ist.

d. Paul meint, dass geistig vielleicht Max flexibel ist.

(15) a. Mia meint, dass Verena scheinbar wirtschaftlich konkurrenzfähig ist.

b. Mia meint, dass Verena wirtschaftlich scheinbar konkurrenzfähig ist.

c. Mia meint, dass scheinbar wirtschaftlich Verena konkurrenzfähig ist.

d. Mia meint, dass wirtschaftlich scheinbar Verena konkurrenzfähig ist.

(16) a. Ben meint, dass Anna wahrscheinlich psychisch stabil ist.

b. Ben meint, dass Anna psychisch wahrscheinlich stabil ist.

c. Ben meint, dass wahrscheinlich psychisch Anna stabil ist.

d. Ben meint, dass psychisch wahrscheinlich Anna stabil ist.

(17) a. Jonas meint, dass Johannes scheinbar sprachlich überfordert ist.

b. Jonas meint, dass Johannes sprachlich scheinbar überfordert ist.

c. Jonas meint, dass scheinbar sprachlich Johannes überfordert ist.

d. Jonas meint, dass sprachlich scheinbar Johannes überfordert ist.

(18) a. Emma meint, dass Otto offensichtlich technisch unerfahren ist.

b. Emma meint, dass Otto technisch offensichtlich unerfahren ist.

c. Emma meint, dass offensichtlich technisch Otto unerfahren ist.

d. Emma meint, dass technisch offensichtlich Otto unerfahren ist.

(19) a. Simone berichtet, dass Maxima angeblich handwerklich beeindruckend ist.

b. Simone berichtet, dass Maxima handwerklich angeblich beeindruckend ist.

c. Simone berichtet, dass angeblich handwerklich Maxima beeindruckend ist.

d. Simone berichtet, dass handwerklich angeblich Maxima beeindruckend ist.

(20) a. Lukas berichtet, dass Clara vermutlich wirtschaftlich informiert ist.

b. Lukas berichtet, dass Clara wirtschaftlich vermutlich informiert ist.

c. Lukas berichtet, dass vermutlich wirtschaftlich Clara informiert ist.

d. Lukas berichtet, dass wirtschaftlich vermutlich Clara informiert ist.

(21) a. Manuela berichtet, dass Tobias sicherlich beruflich überlastet ist.

b. Manuela berichtet, dass Tobias beruflich sicherlich überlastet ist.

c. Manuela berichtet, dass sicherlich beruflich Tobias überlastet ist.

d. Manuela berichtet, dass beruflich sicherlich Tobias überlastet ist.

(22) a. Carl berichtet, dass Anne vielleicht finanziell abhängig ist.

b. Carl berichtet, dass Anne finanziell vielleicht abhängig ist.

c. Carl berichtet, dass vielleicht finanziell Anne abhängig ist.

d. Carl berichtet, dass finanziell vielleicht Anne abhängig ist.

(23) a. Werner berichtet, dass Claudia offenbar finanziell abgesichert ist.

b. Werner berichtet, dass Claudia finanziell offenbar abgesichert ist.

c. Werner berichtet, dass offenbar finanziell Claudia abgesichert ist.

d. Werner berichtet, dass finanziell offenbar Claudia abgesichert ist.

(24) a. Stefanie berichtet, dass Joachim sicherlich handwerklich ausgebildet ist.

b. Stefanie berichtet, dass Joachim handwerklich sicherlich ausgebildet ist.

c. Stefanie berichtet, dass sicherlich handwerklich Joachim ausgebildet ist.

d. Stefanie berichtet, dass handwerklich sicherlich Joachim ausgebildet ist.

Materials Set 6: Self-paced reading experiment reported as Experiment 6 (7.2)

(1) a. Petra hat / wahrscheinlich gesundheitlich / was abgeklärt, /meint Kalle.

b. Petra hat / gesundheitlich wahrscheinlich / was abgeklärt, /meint Kalle.

c. Petra hat / im Büro lautstark / was abgeklärt, /meint Kalle.

d. Petra hat / lautstark im Büro / was abgeklärt, /meint Kalle.

(2) a. Klaus hat / möglicherweise inhaltlich / was kritisiert, /meint Hanna.

b. Klaus hat / inhaltlich möglicherweise / was kritisiert, /meint Hanna.

c. Klaus hat / im Büro lautstark / was kritisiert, /meint Hanna.

d. Klaus hat / lautstark im Büro / was kritisiert, /meint Hanna.

(3) a. Helga hat / vielleicht sprachlich / was überarbeitet, /berichtet Sven.

b. Helga hat / sprachlich vielleicht / was überarbeitet, /berichtet Sven.

c. Helga hat / im Keller langsam / was überarbeitet, /berichtet Sven.

d. Helga hat / langsam im Keller / was überarbeitet, /berichtet Sven.

(4) a. Tom hat / vermutlich nervlich / was verarbeitet, /berichtet Lisa.

b. Tom hat / nervlich vermutlich / was verarbeitet, /berichtet Lisa.

c. Tom hat / im Heim mühevoll / was verarbeitet, /berichtet Lisa.

d. Tom hat / mühevoll im Heim / was verarbeitet, /berichtet Lisa.

(5) a. Lena hat / sicherlich zwischenmenschlich / was realisiert, /erzählt Martin.

b. Lena hat / zwischenmenschlich sicherlich / was realisiert, /erzählt Martin.

c. Lena hat / im Stadion langsam / was realisiert, /erzählt Martin.

d. Lena hat / langsam im Stadion / was realisiert, /erzählt Martin.

(6) a. Bernhard hat / zweifellos gehaltlich / was erkämpft, /erzählt Martina.

b. Bernhard hat / gehaltlich zweifellos / was erkämpft, /erzählt Martina.

c. Bernhard hat / im Betrieb mühevoll / was erkämpft, /erzählt Martina.

d. Bernhard hat / mühevoll im Betrieb / was erkämpft, /erzählt Martina.

(7) a. Klara hat / zweifellos inhaltlich / was verändert, /sagt Henri.

b. Klara hat / inhaltlich zweifellos / was verändert, /sagt Henri.

c. Klara hat / im Salon geschickt / was verändert, /sagt Henri.

d. Klara hat / geschickt im Salon / was verändert, /sagt Henri.

(8) a. Ben hat / sicherlich geschmacklich / was ruiniert, /sagt Jenny.

b. Ben hat / geschmacklich sicherlich / was ruiniert, /sagt Jenny.

c. Ben hat / im Haus lautstark / was ruiniert, /sagt Jenny.

d. Ben hat / lautstark im Haus / was ruiniert, /sagt Jenny.

(9) a. Maren hat / vermutlich körperlich / was überstanden, /sagt Jens.

b. Maren hat / körperlich vermutlich / was überstanden, /sagt Jens.

c. Maren hat / zu Hause mühevoll / was überstanden, /sagt Jens.

d. Maren hat / mühevoll zu Hause / was überstanden, /sagt Jens.

(10) a. Holger hat / vielleicht sprachlich / was korrigiert, /sagt Mia.

b. Holger hat / sprachlich vielleicht / was korrigiert, /sagt Mia.

c. Holger hat / im Flur sorgfältig / was korrigiert, /sagt Mia.

d. Holger hat / sorgfältig im Flur / was korrigiert, /sagt Mia.

(11) a. Stefanie hat / möglicherweise nervlich / was gepackt, /sagt Valentin.

b. Stefanie hat / nervlich möglicherweise / was gepackt, /sagt Valentin.

c. Stefanie hat / im Keller routiniert / was gepackt, /sagt Valentin.

d. Stefanie hat / routiniert im Keller / was gepackt, /sagt Valentin.

(12) a. Mark hat / wahrscheinlich gehaltlich / was verhandelt, /sagt Anja.

b. Mark hat / gehaltlich wahrscheinlich / was verhandelt, /sagt Anja.

c. Mark hat / im Salon vorsichtig / was verhandelt, /sagt Anja.

d. Mark hat / im Salon vorsichtig / was verhandelt, /sagt Anja.

(13) a. Susanne hat / vielleicht körperlich / was geleistet, /meint Robert.

b. Susanne hat / körperlich vielleicht / was geleistet, /meint Robert.

c. Susanne hat / im Stadion routiniert / was geleistet, /meint Robert.

d. Susanne hat / routiniert im Stadion / was geleistet, /meint Robert.

(14) a. Frank hat / vermutlich zwischenmenschlich / was zerstört, /meint Nina.

b. Frank hat / zwischenmenschlich vermutlich / was zerstört, /meint Nina.

c. Frank hat / im Wald sorgfältig / was zerstört, /meint Nina.

d. Frank hat / sorgfältig im Wald / was zerstört, /meint Nina.

(15) a. Annika hat / sicherlich inhaltlich / was beanstandet, /berichtet Karl.

b. Annika hat / inhaltlich sicherlich / was beanstandet, /berichtet Karl.

c. Annika hat / im Foyer lauthals / was beanstandet, /berichtet Karl.

d. Annika hat / lauthals im Foyer / was beanstandet, /berichtet Karl.

(16) a. Arnold hat / zweifellos sprachlich / was geändert, /berichtet Inge.

b. Arnold hat / sprachlich zweifellos / was geändert, /berichtet Inge.

c. Arnold hat / im Haus sorgfältig / was geändert, /berichtet Inge.

d. Arnold hat / sorgfältig im Haus / was geändert, /berichtet Inge.

(17) a. Beate hat / wahrscheinlich gehaltlich / was vereinbart, /berichtet Hannes.

b. Beate hat / gehaltlich wahrscheinlich / was vereinbart, /berichtet Hannes.

c. Beate hat / im Flur lauthals / was vereinbart, /berichtet Hannes.

d. Beate hat / lauthals im Flur / was vereinbart, /berichtet Hannes.

(18) a. Christina hat / möglicherweise gesundheitlich / was verbessert, /berichtet Laura.

b. Christina hat / gesundheitlich möglicherweise / was verbessert, /berichtet Laura.

c. Christina hat / im Foyer langsam / was verbessert, /berichtet Laura.

d. Christina hat / langsam im Foyer / was verbessert, /berichtet Laura.

(19) a. Gerda hat / möglicherweise gesundheitlich / was abgewendet, /meint Fabian.

b. Gerda hat / gesundheitlich möglicherweise / was abgewendet, /meint Fabian.

c. Gerda hat / im Betrieb geschickt / was abgewendet, /meint Fabian.

d. Gerda hat / geschickt im Betrieb / was abgewendet, /meint Fabian.

(20) a. Erik hat / vielleicht nervlich / was bewältigt, /meint Sandra.

b. Erik hat / nervlich vielleicht / was bewältigt, /meint Sandra.

c. Erik hat / im Heim routiniert / was bewältigt, /meint Sandra.

d. Erik hat / routiniert im Heim / was bewältigt, /meint Sandra.

(21) a. Paula hat / wahrscheinlich geschmacklich / was gewagt, /erzählt Kai.

b. Paula hat / geschmacklich wahrscheinlich / was gewagt, /erzählt Kai.

c. Paula hat / zu Hause vorsichtig / was gewagt, /erzählt Kai.

d. Paula hat / vorsichtig zu Hause / was gewagt, /erzählt Kai.

(22) a. Rita hat / sicherlich körperlich / was bezwungen, /erzählt Merle.

b. Rita hat / körperlich sicherlich / was bezwungen, /erzählt Merle.

c. Rita hat / im Wald geschickt / was bezwungen, /erzählt Merle.

d. Rita hat / geschickt im Wald / was bezwungen, /erzählt Merle.

(23) a. Thilo hat / zweifellos geschmacklich / was bezeugt, /erzählt Jan.

b. Thilo hat / geschmacklich zweifellos / was bezeugt, /erzählt Jan.

c. Thilo hat / vor Gericht lauthals / was bezeugt, /erzählt Jan.

d. Thilo hat / lauthals vor Gericht / was bezeugt, /erzählt Jan.

(24) a. Vera hat / vermutlich zwischenmenschlich / was riskiert, /erzählt Corinna.

b. Vera hat / zwischenmenschlich vermutlich / was riskiert, /erzählt Corinna.

c. Vera hat / vor Gericht vorsichtig / was riskiert, /erzählt Corinna.

d. Vera hat / vorsichtig vor Gericht / was riskiert, /erzählt Corinna.

Materials Set 7: Acceptability judgment experiment reported as Experiment 7 (7.3)

(1) a. Petra hat wahrscheinlich gesundheitlich was abgeklärt.

b. Petra hat gesundheitlich wahrscheinlich was abgeklärt.

c. Petra hat im Büro lautstark was abgeklärt.

d. Petra hat lautstark im Büro was abgeklärt.

(2) a. Klaus hat möglicherweise inhaltlich was kritisiert.

b. Klaus hat inhaltlich möglicherweise was kritisiert.

c. Klaus hat im Büro lautstark was kritisiert.

d. Klaus hat lautstark im Büro was kritisiert.

(3) a. Helga hat vielleicht sprachlich was überarbeitet.

b. Helga hat sprachlich vielleicht was überarbeitet.

c. Helga hat im Keller langsam was überarbeitet.

d. Helga hat langsam im Keller was überarbeitet.

(4) a. Tom hat vermutlich nervlich was verarbeitet.

b. Tom hat nervlich vermutlich was verarbeitet.

c. Tom hat im Heim mühevoll was verarbeitet.

d. Tom hat mühevoll im Heim was verarbeitet.

(5) a. Lena hat sicherlich zwischenmenschlich was realisiert.

b. Lena hat zwischenmenschlich sicherlich was realisiert.

c. Lena hat im Stadion langsam was realisiert.

d. Lena hat langsam im Stadion was realisiert.

(6) a. Bernhard hat zweifellos gehaltlich was erkämpft.

b. Bernhard hat gehaltlich zweifellos was erkämpft.

c. Bernhard hat im Betrieb mühevoll was erkämpft.

d. Bernhard hat mühevoll im Betrieb was erkämpft.

(7) a. Klara hat zweifellos inhaltlich was verändert.

b. Klara hat inhaltlich zweifellos was verändert.

c. Klara hat im Salon geschickt was verändert.

d. Klara hat geschickt im Salon was verändert.

(8) a. Ben hat sicherlich geschmacklich was ruiniert.

b. Ben hat geschmacklich sicherlich was ruiniert.

c. Ben hat im Haus lautstark was ruiniert.

d. Ben hat lautstark im Haus was ruiniert.

(9) a. Maren hat vermutlich körperlich was überstanden.

b. Maren hat körperlich vermutlich was überstanden.

c. Maren hat zu Hause mühevoll was überstanden.

d. Maren hat mühevoll zu Hause was überstanden.

(10) a. Holger hat vielleicht sprachlich was korrigiert.

b. Holger hat sprachlich vielleicht was korrigiert.

c. Holger hat im Flur sorgfältig was korrigiert.

d. Holger hat sorgfältig im Flur was korrigiert.

(11) a. Stefanie hat möglicherweise nervlich was gepackt.

b. Stefanie hat nervlich möglicherweise was gepackt.

c. Stefanie hat im Keller routiniert was gepackt.

d. Stefanie hat routiniert im Keller was gepackt.

(12) a. Mark hat wahrscheinlich gehaltlich was verhandelt.

b. Mark hat gehaltlich wahrscheinlich was verhandelt.

c. Mark hat im Salon vorsichtig was verhandelt.

d. Mark hat im Salon vorsichtig was verhandelt.

(13) a. Susanne hat vielleicht körperlich was geleistet.

b. Susanne hat körperlich vielleicht was geleistet.

c. Susanne hat im Stadion routiniert was geleistet.

d. Susanne hat routiniert im Stadion was geleistet.

(14) a. Frank hat vermutlich zwischenmenschlich was zerstört.

b. Frank hat zwischenmenschlich vermutlich was zerstört.

c. Frank hat im Wald sorgfältig was zerstört.

d. Frank hat sorgfältig im Wald was zerstört.

(15) a. Annika hat sicherlich inhaltlich was beanstandet.

b. Annika hat inhaltlich sicherlich was beanstandet.

c. Annika hat im Foyer lauthals was beanstandet.

d. Annika hat lauthals im Foyer was beanstandet.

(16) a. Arnold hat zweifellos sprachlich was geändert.

b. Arnold hat sprachlich zweifellos was geändert.

c. Arnold hat im Haus sorgfältig was geändert.

d. Arnold hat sorgfältig im Haus was geändert.

(17) a. Beate hat wahrscheinlich gehaltlich was vereinbart.

b. Beate hat gehaltlich wahrscheinlich was vereinbart.

c. Beate hat im Flur lauthals was vereinbart.

d. Beate hat lauthals im Flur was vereinbart.

(18) a. Christina hat möglicherweise gesundheitlich was verbessert.

b. Christina hat gesundheitlich möglicherweise was verbessert.

c. Christina hat im Foyer langsam was verbessert.

d. Christina hat langsam im Foyer was verbessert.

(19) a. Gerda hat möglicherweise gesundheitlich was abgewendet.

b. Gerda hat gesundheitlich möglicherweise was abgewendet.

c. Gerda hat im Betrieb geschickt was abgewendet.

d. Gerda hat geschickt im Betrieb was abgewendet.

(20) a. Erik hat vielleicht nervlich was bewältigt.

b. Erik hat nervlich vielleicht was bewältigt.

c. Erik hat im Heim routiniert was bewältigt.

d. Erik hat routiniert im Heim was bewältigt.

(21) a. Paula hat wahrscheinlich geschmacklich was gewagt.

b. Paula hat geschmacklich wahrscheinlich was gewagt.

c. Paula hat zu Hause vorsichtig was gewagt.

d. Paula hat vorsichtig zu Hause was gewagt.

(22) a. Rita hat sicherlich körperlich was bezwungen.

b. Rita hat körperlich sicherlich was bezwungen.

c. Rita hat im Wald geschickt was bezwungen.

d. Rita hat geschickt im Wald was bezwungen.

(23) a. Thilo hat zweifellos geschmacklich was bezeugt.

b. Thilo hat geschmacklich zweifellos was bezeugt.

c. Thilo hat vor Gericht lauthals was bezeugt.

d. Thilo hat lauthals vor Gericht was bezeugt.

(24) a. Vera hat vermutlich zwischenmenschlich was riskiert.

b. Vera hat zwischenmenschlich vermutlich was riskiert.

c. Vera hat vor Gericht vorsichtig was riskiert.

d. Vera hat vorsichtig vor Gericht was riskiert.