

Word order constraints on event-internal modifiers

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Abstract Word order constraints on adverbials in German clauses have been subject to a long-standing debate. Regarding event-internal modifiers, such as comitatives and instrumentals, different, but class-based base positions have been proposed by Frey & Pittner (1998), and Maienborn (2001), among others. In this paper, we argue that serialization constraints on event-internal adverbials should not be formulated in terms of class-based (intrinsic) properties, but in terms of extrinsic properties, such as *Anaphoricity*, and *Thematic Integration*, which apply to the modifiers. In two experimental studies, we have been able to show that serializations of event-internal modifiers are more complex than envisaged in prior analyses, which do not take lexical variation into account. By relying on extrinsic properties to determine word order constraints, a more parsimonious analysis can be proposed. This analysis eliminates the need to postulate two different constraint systems for complements and adjuncts to determine word order regularities in the German *Mittelfeld* (at least for event-internal modifiers).

Keywords: German, adverbial modification, event-internal adverbials, syntax-semantics interface, experimental syntax

1 Introduction

Generative analyses have recognized early on that syntactic arguments of the verb as well as adjuncts can be arranged quite freely in German clause structure. Recognizably, word order *freedom* might not be the right term to describe (a subset of) the phenomena since different serializations lead to different constraints on interpretation, as e.g., serializations of quantifiers (Frey 1993; Kiss 2001) or focus projections (Höhle 1982). If the serialization of adjuncts is concerned, syntacticians have assumed that modifiers do not have to obey word order constraints (see Zwart (1993); Neeleman & Reinhart (1998), among others). This view has been challenged by various proposals in the past 25 years. Frey & Pittner (1998), Frey (2003; 2015), Ernst (1998), Haider (2000), Maienborn (2001; 2003), and Maienborn et al. (2016) share the view that word order constraints apply to adverbial modifiers as well. Despite their differences, all proposals present constraints that refer to different adverbial classes. Although not having been made explicit by the proposals, word order constraints on adverbial modifiers are claimed to differ from word order constraints on arguments in that the former can be determined by looking at intrinsic properties pertaining to modifiers alone – such as their modifier class membership – while order constraints on the latter employ extrinsic properties. Such extrinsic properties comprise of formal aspects, as, e.g., the length of a phrase, or its form (whether it is pronominal or not), determiner choice, quantification, as well as stress placement leading to focus.

Frey & Pittner (1998) propose that adverbials occupy designated base positions, determined by class membership alone. The pertinent classes are event-external adverbials (causals, temporals), event-internal adverbials (comitatives, instrumentals), and process-related adverbials (manner). The base position of event-external adverbials is to the left of the subject, while process-related adverbials are claimed to occupy their base position to the right of the direct object. The issue of event-internal modifiers is more complex and will be discussed in detail below. Maienborn (2001) assumes a distinction between event-external and event-internal modifiers: the base position of event-internal modifiers is to the right of the direct object (see also Maienborn 1995: 244), while different types of event-external modifiers may occupy different positions. Ernst (1998), Haider (2000), and Maienborn et al. (2016) do not assume fixed base positions for adverbials but propose relative constraints: These proposals share the assumption that the placement of adverbials of one class has repercussions for placements of adverbials of other classes. Using the distinction between event type and event instance modifiers developed in Landman & Morzycki (2003), Maienborn et al. (2016) provide a formal explication of word order constraints between event-external and process-related adverbials already discussed in Haider (2000: 130): an event-external modifier is an instance modifier. If such a modifier is combined with a verbal projection, the event type variable will be bound and hence blocked. But process-related adverbials as event type modifiers need access to the event type variable. Haider (2000) and Maienborn et al. (2016) thus conclude that the order *process-related* > *event-external* is clearly marked.

To conclude, from assuming base positions (as in Frey & Pittner (1998) and Maienborn (2001; 2003)), it follows that absolute word order constraints can be proposed for classes of adverbials. Ernst (1998) and Haider (2000) only provide relative constraints that apply if more than one adverbial type is found in a clause. The proposals by Ernst (1998), Haider (2000) and Maienborn et al. (2016) make the same predictions as the earlier proposals that assumed freedom of placement for adverbials if only a single modifier is found in a clause.

Looking into the syntax of event-internal modifiers in detail by employing experimental studies, the present paper will show that event-internal modifiers are not allowed to occupy arbitrary positions in German clause structure if they are realized as sole modifiers in the clause. The

placement of event-internal modifiers should not be accounted for by assuming that they belong to a specific adverbial class, but by considering extrinsic properties (which may appear within or across adverbial classes). Hence, we consider it misleading to speak of unique base positions of event-internal modifiers. Instead, we assume that they may appear in positions compliant with extrinsic constraints that influence serialization. We take the following characterization of event-internal modifiers as a starting point:

- (1) “Event-internal modifiers are [...] related to the verb’s eventuality argument, [but do] not express [an adverbial modification] for the whole [...] event, but only for one of its parts [...] internal modifiers are linked up to a referent that is related to the verb’s eventuality argument” (Maienborn 2001: 191, 198) “[They] elaborate [the event’s] internal structure [...]” (Maienborn 1995: 238)

Event-internal modifiers are anaphoric.¹ They require a syntactic argument which they modify semantically (although they are syntactic modifiers of verbal projections, hence true adverbials).² Event-internal modifiers may not only semantically modify an argument of the verb, but also the event variable introduced by the verb. Consequently, the thematic structure of the event is changed, leading to effects since thematic structure governs word order constraints. Therefore, we reject the homogeneous picture emerging from the assumption that adverbials occupy base positions depending on their adverbial class in favor of a more sophisticated picture of adverbial placement. Also, we reject the assumption that adverbials occurring in isolation can freely occupy positions in the German clause, which would follow from proposals that assume constraints on relative order only.

As an illustration of our analysis, consider the following two examples of subject-oriented comitatives in (2) and (3).

- (2) a. Ich habe gehört dass ein Virologe **zusammen**
 I have heard that a.NOM virologist.M.NOM together
mit einem Pharmakologen was getestet hat.
 with a.DAT pharmacist.M.DAT what.ACC tested has
- b. Ich habe gehört, dass ein Virologe was **zusammen mit einem Pharmakologen** getestet hat.
 ‘I’ve heard that a virologist tested something in tandem with a pharmacist.’

- (3) a. Ich habe gehört, dass ein Polizist was
 I have heard that a.NOM policeman.M.NOM what.ACC
ganz ohne einen Kollegen überprüft hat.
 entirely without a.ACC colleague.M.ACC sifted has
- b. Ich habe gehört, dass ein Polizist **ganz ohne einen Kollegen** was überprüft hat.
 ‘I have heard that a policeman sifted something without a colleague.’

¹ Maienborn (2003: 501f.) assumes that the relationship between an internal locative and the element toward which it is oriented is only weakly anaphoric in that it is possible that the antecedent is an entity, which might only be conceptually derived from the grammatically determined meaning representation of the clause. Internal locatives deem us to differ in this respect from comitatives and instrumentals, for which conceptual inference does not seem to be viable. The results of the first experimental study suggest that anaphoricity is at play for internal locatives as well.

² The anaphoric nature of event-internal adverbials can also be derived from Frey & Pittner’s (1998) analysis but is not made explicit.

Comitatives are event-internal modifiers. In (2), e.g., the comitative PP headed by *mit* ('with') modifies the verb syntactically. However, its main objective is to indicate that the agent of the event is accompanied by a secondary agent (hence the concept of comitativity). The internal argument of the comitative P is thus thematically integrated into the main event structure. Comitatives and internal locatives are genuinely ambiguous in allowing subject or object orientation. Given, however, that the object in (2) and (3) is inanimate, a comitative relation towards the object is not compatible with the event structure of the whole clause. Hence, the comitatives are unequivocally subject-oriented in (2) and (3).

The sentences in (2) and (3) utilize *wh*-indefinites (*was* ('something'/'what')) as a test environment. They are assumed to be scrambling-invariant if they receive an existential interpretation (cf. Haider 2010). Frey & Pittner (1998) assume that subject-oriented event-internal modifiers occupy a base position which is minimally c-commanded by the subject. Hence, the serializations MOD > OBJ in (2a) and (3b) should be acceptable and the ones in (2b) and (3a) (OBJ > MOD) should not. Haider (2000) would predict that both positions in (2) and (3) can be occupied by the comitatives since they are the sole modifiers in the clauses.

What we do observe experimentally, is something different: There is a strong preference for the serialization MOD > OBJ in the case of *mit* ('with') in (2a), and a weak preference for the serialization OBJ > MOD in the case of *ohne* ('without') in (3a). This observation is at odds with both groups of proposals.

We assume that two conditions are at work here, which determine the serialization together with lexical variation. Event-internal modifiers must be anaphoric, which places them to the right of their antecedents. And depending on the lexical head of a modifier, thematic integration may lead to the introduction of additional roles, which will then influence the order of the elements bearing them. Abessive or privative interpretations, i.e., interpretations involving negation (as illustrated in (3)), will not lead to the introduction of additional roles, and hence more elementary ordering conditions come into play, such as placing NPs to the left of PPs (Speyer 2018: 156), or pronouns to the left of non-pronouns (Uszkoreit 1986).

This basic analysis carries over to other event-internal modifiers, such as instrumentals, and internal locatives. We differ from previous analyses in assuming that the pertinent conditions are not specific to classes of modifiers. Anaphoric elements are governed by command relationships (such as c-command), and event-internal modifiers, if understood as anaphoric, follow this lead. Similarly, thematic relations are known to govern serializations in German clause structure (Uszkoreit 1986). If adverbials modify the thematic structure of a clause, it is expected that roles provided by the adverbials enter relationships leading to constraints on serialization.

Experimental studies show that we do not only find much more variation than predicted by prior approaches but also that including a broader empirical foundation leads to strikingly different patterns within a class, which can then be accounted for by the interplay of the conditions introduced here.

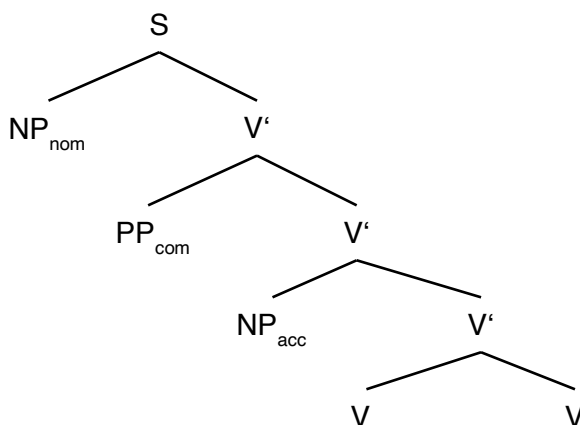
The remaining paper is structured as follows: Section 2 will discuss basic assumptions about German clause structure, event-internal modifiers, and constraints on the serialization of event-internal modifiers. Section 3 will review previous proposals, focusing on several problematic aspects. Section 4 will present the experimental studies, and their findings. Section 5 will discuss the ramifications of these findings and provide a proposal for serializations of event-internal modifiers governed by Anaphoricity and Thematic Integration.

2 Basic assumptions

2.1 German clause structure

We follow a long tradition in syntax and assume that German is basically SOV, exhibiting a binary clause structure. The derivation of verb second is not of relevance here. The binary structure of German clauses implies that arguments or adjuncts are combined with the verb, or a projection of the verb, one at a time. Consequently, an example like (2) receives the schematic structure provided in (4).³

- (4) Ich habe gehört, dass [_S [_{NP_{nom}} ein Virologe] [_{V'} [_{PP_{com}} zusammen mit einem Pharmakologen] [_{V'} [_{NP_{acc}} was] [_{V'} getestet hat]]]]]



If arguments and adjuncts are combined in binary fashion with the V(P), an order $X > Y$ can be translated into an asymmetric c-command relationship, where X c-commands Y, if X and Y are arguments or adjuncts belonging to the same verb. Thus, the subject (NP_{nom}) precedes the comitative (PP_{com}) in (4), and asymmetrically c-commands it.

2.2 Properties and instances of event-internal modifiers

The class of event-internal modifiers is discussed in Frey & Pittner (1998), Frey (2003), and Maienborn (1995; 2001). The authors refer to comitatives, instrumentals, internal locatives, mental attitude adverbials, and habitual adverbials as representative types of this class. Whether it should be conceived as an open or a closed class is not discussed.

Other proposals, such as Haider (2000) do not distinguish event-external and event-internal modifiers. Maienborn (2001: 191) provides the semantic characterization of event-internal adverbials in (1), while Frey & Pittner (1998: 511) implicitly acknowledge the anaphoric properties of event-internal adverbials in (5), but do not provide further characterizations.

- (5) Event-internal adverbials:

The base position of an event-internal adverbial is minimally c-commanded by the argument towards which the event-internal adverbial is oriented. (Frey and Pittner 1998: 511, our translation)

It is a common property of both characterizations that event-internal adverbials syntactically modify a verb, but semantically require an orientation towards one of the arguments of the

³ We are agnostic regarding the exact categorial status of the projections of V, and thus name each projection as V'. The S node describes a verbal projection that has realized all arguments of the verb.

verb. It should be noticed, though, that the actual compositional contribution of event-internal modifiers differs largely, as can be illustrated by the following examples in addition to the comitatives in (2) and (3).

- (6) internal locative, object-oriented (Maienborn 2001: 201)

Ich	glaube,	dass	die	Spieler	im	Stadion
I	believe	that	the	players.NOM	in.the	stadium
den	Torschützen	auf	den	Schultern	trugen.	
the	goal.scorer.M.ACC	on	the	shoulders	carried	

'I believe that the players carried the goal scorer on the shoulders in the stadium.'

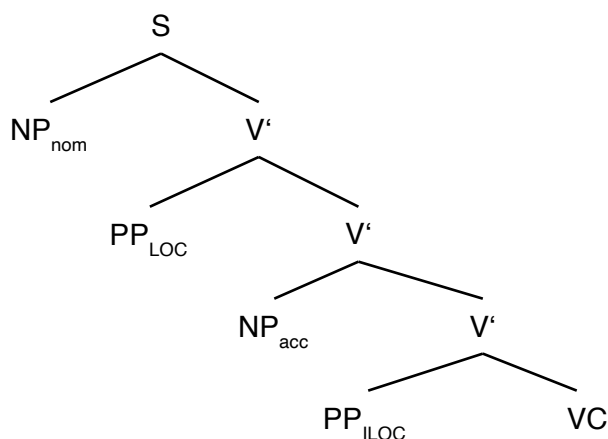
- (7) instrumental, subject-oriented

Ich	habe	gehört,	dass	ein	Angestellter	über
I	have	heard	that	a.NOM	employee.M.NOM	by.means.of
einen	Grafikeditor	ein	Schnittmuster	erstellt	hat.	
a.ACC	graphic.editor	a.ACC	pattern.ACC	created	has	

'I have heard that an employee created a pattern using a graphic editor.'

In (6), we find two locative modifiers: The first PP – [*im Stadion*] – provides a localization of the whole event and is classified as an event-external modifier. The second PP – [*auf den Schultern*] – does not localize the event, but the participant denoted by the object within the event. In the case of internal locatives, one could thus argue that their main function is the localization of a participant within the event, which also constitutes their only contribution. Maienborn (2001) provides evidence that internal locatives are placed to the immediate left of the verbal complex (VC), as is illustrated in (8).

- (8) Ich glaube, dass [_S [_{NPNom} die Spieler] [_{V'} [_{PP_{LOC}} im Stadion] [_{V'} [_{NPAcc} den Torschützen] [_{V'} [_{PP_{ILOC}} auf den Schultern] [_{VC} trugen]]]]]]



The semantic contribution of comitatives (as illustrated in (2) and (3)), and instrumentals (in (7)) to the main event is more pronounced than that of internal locatives: comitatives may change the thematic structure of the modified event: they adapt the thematic role of the element towards which they are oriented so that the internal argument of the comitative *may* be

integrated into the thematic structure of the modified event. A similar consideration applies to instrumentals, but here, the thematic contribution to the main event is fixed as instrumental.

Comitatives and internal locatives differ from other event-internal adverbials in that they are genuinely ambiguous: they may be oriented towards the subject *or* the object. Frey & Pittner (1998) propose that comitatives are minimally c-commanded by the element towards which they are oriented (cf. (5)). Consequently, subject-oriented comitatives should occupy a base position to the immediate right of the subject, while object-oriented comitatives should be found in the same base position as internal locatives in (8), i.e. to the immediate right of the object. Since instrumentals are always subject-oriented, they should occupy a base position to the immediate right of the subject as well.

3 Problems of previous accounts

Previous accounts suffer from two groups of problems, emerging from empirical or conceptual issues. However, both have their origin in the definition of adverbial classes. On the empirical side, we notice a negligence towards possible microvariation within the proposed adverbial classes, which is particularly evident in the small set of prepositions or adverbials employed. In addition, we notice that the direction of argumentation remains unclear: Initially, adverbials are assigned to classes, and as elements of a specific class, are claimed to occupy specific base positions. This line of reasoning, however, is reversed in later stages: the occurrence of an adverbial in a given position is then used as evidence for class assignment. On the conceptual side, problems emerge from the (implicit) assumption that word order variation among adverbials can be accounted for by intrinsic properties of the adverbials instead of considering general constraints on word order (where applicable). It should be clear that a single system addressing word order variation among arguments *and* adjuncts is preferred over a system which employs two rather different constraint sets to determine word order separately for arguments and adjuncts.

Turning to the empirical problems, we notice that adverbial classes might be useful to determine word order variation, were it not for the following problematic aspects: First, microvariation, as e.g. emerging from lexical variation of the prepositions involved, within an adverbial class is either neglected or tacitly assumed to be non-existent. As has already been illustrated in (2) and (3) and will be further discussed in section 4, different lexical heads may lead to variation of preferred word orders within the class of event-internal modifiers. Of course, such contrasts can only be identified if a sufficiently large number of different members of a purported class are considered for investigation. While this strategy seems to be almost trivial, a single preposition – *mit* ('with') – is used in Frey & Pittner (1998) to illustrate instrumental *and* comitative readings. Lexical variation of the prepositions is also absent from Ernst (1998), while Maienborn (2001), using four different prepositions in her analysis of internal locatives, forms an exception to this pattern.

Even more problematic is a switch of argumentation. While initially deriving word order constraints from class membership, Frey & Pittner (1998) and Frey (2003) argue that putative base positions provide indications for class membership. Frey & Pittner's (1998) assignment of internal locatives to process-related adverbials is based on serializations: "The local adverbial occupies a base position which we assume for process-related adverbials" (Frey & Pittner 1998: 531, our translation). It is crucial to understand here that this conclusion hinges on the interaction of an empirical finding with an implicit theoretical assumption in Frey & Pittner's proposal, leading to a prohibition of subject-oriented event-internal modifiers in positions below a (fixed) object. The application of their test diagnostics points Frey & Pittner to assume that at least certain subject-oriented event-internal modifiers are found above a fixed object. As an observation for some subject-oriented event-internal adverbials, it is unproblematic. The

negligence of microvariation (see section 4), however, leads to an unwarranted generalization here. The empirical findings are combined with the implicit assumption that scrambling moves a phrase from a c-commanded into a c-commanding position (see e.g., Fanselow 1990). It follows that adverbials appearing below a fixed object must occupy a base position there. This contradiction could either be resolved by withdrawing the (incorrect, see section 4) assumption that subject-oriented event-internal modifiers occupy a unique base position above the object, or by withdrawing the class membership of the violating element – Frey & Pittner opt for the second solution. Following this strategy, Frey & Pittner (1998: 509f.) and Frey (2015) classify event-external locatives as event-internal modifiers. The same holds for temporal modifiers in Frey (2003; 2015).

Surprisingly, the conceptual implications of assuming that adverbial classes determine class membership have not been addressed yet. Instead, it is taken to be uncontroversial that class membership determines possible positions of adverbials. This may have a direct effect if base positions are assumed (Frey & Pittner 1998; Maienborn 2001; Frey 2003; 2015), or an indirect effect, as proposed in Haider (2000) and Maienborn et al. (2016). In the latter approaches, the realization of an adverbial A precludes the combination of the verbal projection with another adverbial B, thus blocking an order $B > A$, while the opposite order becomes possible. According to Haider (2000), an adverbial blocks the combination with another adverbial depending on the specificity of the adverbial classes, while Maienborn et al. (2016), addressing possible realizations of process-related adverbials, assume that they are event-type modifiers, while event-external adverbials are event-instance modifiers (as initially suggested in Landman & Morzyzcki 2003). The combination with an event-instance modifier blocks an access to the event-type variable, so that the configuration [process-related ... [event-related ... V]] becomes impossible, while the respective variables are accessible if the adverbials are combined in the opposite order [event-related ... [process-related ... V]].

While the approaches argue about the (non-)existence of base positions, the dependency of adverbial placement on adverbial classes is surprisingly uncontroversial. The majority of works on word order constraints on arguments has focused on identifying *extrinsic* properties (both for German and cross-linguistically). Among these extrinsic properties we find the weight of a phrase, including the distinction between heavy and light categories (Lenerz 1977; Hawkins 1994), whether the phrase in question is focused or not (Höhle 1982), whether the phrase should take scope over another phrase (Frey 1993; Kiss 2001). Also, the thematic role assumed by an argument is an extrinsic property and has as such been made responsible for constraints on serialization (Uszkoreit 1986; Müller 1999, among others). The properties can be considered extrinsic because they can be applied to any kind of syntactic complement. Class membership, on the other hand, must be considered as an *intrinsic* property. Proposals that make use of class membership thus assume (implicitly, at least) that grammars employ two different systems to determine word order: the extrinsic constraints that apply to arguments and the intrinsic constraints that apply to adjuncts.⁴ Of course, such a distinction also paves the way to assuming that there is a fundamental distinction between arguments and adjuncts. This leads to a second problematic aspect: while there is no denying that arguments and adjuncts show different properties, the distinction between both categories is often blurred, and in particular, has been suspended by the very same authors when discussing word order constraints: Haider (1996) discusses linearization constraints that affect clausal complements and

⁴ Frey & Pittner (1998: 497) seem to assume that two distinct components of word order constraints exist. They remark (our translation): “Today, one usually assumes that the basic order of arguments is imposed by the thematic hierarchy present in the argument structure of the verb.”

This comment is remarkable insofar as argument structure is closely linked to event structure in event semantics, which also assumes a breakdown (at the level of the semantic contribution) between arguments and adjuncts, as is discussed in Champollion (2015).

relative clauses, and Frey (1993), taken up in Frey & Pittner (1998), defines the principle governing scope assignment as explicitly including arguments *and* adjuncts. We propose that possible constraints on the linearization of modifiers in German should consider extrinsic constraints to a larger extent than granted by previous proposals. The following sections will show that the behavior of event-internal modifiers can better be captured by considering more general properties, such as anaphoricity, and thematic ranking, which do apply to event-internal modifiers, but to other elements as well.

4. Experimental studies

4.1 Hypotheses

We have investigated two hypotheses on word order constraints on event-internal modifiers by conducting experimental studies. First, we propose that event-internal modifiers are anaphoric, and hence can only be realized in the local c-command domain of the element towards which the modifiers are oriented, i.e., their antecedents. We thus examine whether the positions of event-internal modifiers can be determined by imposing the constraint *antecedent > modifier*. Adjacency (or minimal c-command), however, is not assumed to be at work. To determine the role of anaphoricity, we employ different types of event-internal modifiers: on the one hand, object-related internal locatives (ILOC(O)), and object-related comitatives (COM(O)), and instrumentals (INSTR), which are always subject-related, on the other hand. Given the difference in orientation, we expect the first two to pattern alike, while instrumentals, which are licensed in both positions by anaphoricity, should be governed by different constraints, as schematically illustrated in (9).

- (9) Predictions for Anaphoricity
- a. OBJ > ILOC(O)/COM(O) *clearly* preferred over ILOC(O)/COM(O) > OBJ
 - b. OBJ > INSTR preferred over INSTR > OBJ⁵

Secondly, we assume that event-internal modifiers that are higher ranked on a thematic hierarchy occupy positions to the left of lower ranked objects. To this end, we compare serialization preferences of subject-oriented comitatives (COM(S)), which introduce a role of (co-)agent, to those of subject-oriented instrumentals (INSTR), which introduce a role of instrument. Moreover, the introduction of the respective roles is dependent on the semantics of the prepositional head of the modifiers: semantic heads with abessive (privative) readings (employing the preposition *ohne* ('without')) do not introduce additional roles. Hence, we predict an interaction of the constraints originating in thematic hierarchy with the lexical semantics of the prepositional head. Modifiers with affirmative readings introducing (co-)agents (employing the preposition *mit* ('with')) are predicted to be found to the left of the object, while privative comitatives and instrumental modifiers are predicted to be found to the right of the object, either because a role is introduced that is located lower on the thematic hierarchy than the role of the object, or because no role is introduced at all in the case of privative readings.

- (10) Predictions for Thematic Integration
- a. preference for PP > OBJ, if PP introduces (co-)agent (COM(S) headed by *mit*)
 - b. preference for OBJ > PP, if PP does not introduce (co-)agent (COM(S) headed by *ohne*, INSTR irrespective of the preposition)

⁵ When being agnostic towards Thematic Integration, general constraints apply to determine the preference, which include the syntactic category of the phrases involved as well as the distinction between pronouns and full NPs.

The predictions in (9) and (10) are corroborated by the experimental studies, as will be made clear in the following sections, and further discussed in Section 5.

4.2 Test environment

Frey & Pittner (1998) introduce a variety of test environments, but most of them are problematic for theoretical reasons, or because they do not lend themselves to an experimental set-up. For instance, they introduce focus projections together with sets of questions (where different questions can be mapped to different answers depending on word order) but rely on isolated focused examples to justify their analysis. In an experimental setting, testing the hypotheses would not only require a multimodal data presentation, but in addition the presentation of sets of question/answer pairs.⁶ Topicalizations of partial VPs, another diagnostic, relies on controversial theoretical assumptions, in particular on the idea that preposed partial VPs and VPs in base position are structurally isomorphic. This assumption has been disputed by de Kuthy & Meurers (2001). Predictions on violations of Principle C of Binding Theory are not only problematic because judgments are less clear than proposed, but also because examples exhibiting such violations are prone to be semantically deviant, which will presumably confound participants in a judgment task, and hence will taint the judgments. We have thus decided to use scrambling-invariant *wh*-indefinites in both experiments. Considering the possible status of *wh*-indefinites as elements of oral communication, Schütze & Sprouse (2013: 36f.) suggest a presentation in written form if participants are directed towards oral modality. Participants were thus told to read the sentences thoroughly while imagining that they were uttered by a friend in actual conversation.

It is uncontroversial that *wh*-indefinites occupy fixed positions if they exhibit an existential reading. It is necessary, however, to ensure that the existential reading is forced, and hence that the sentence material is prepared accordingly. We have extended the examples by an addendum, which blocks a specific reading of the *wh*-indefinite (because it would have led to a contradiction), as illustrated in (11) for an instrumental modifier.

- (11) a. Ich habe gehört, dass ein Busfahrer **über**
 I have heard that a.NOM busdriver.M.NOM by.means.of
ein Mikrofon was angekündigt hat.
 a.ACC microphone.ACC what.ACC announced has
 Was es war, weiß ich aber nicht.
 what.NOM it was know I but not
- b. Ich habe gehört, dass ein Busfahrer was **über ein Mikrofon** angekündigt hat.
 Was es war, weiß ich aber nicht.
 'I have heard that a bus driver announced something using a microphone. But I don't know what it was.'

⁶ Frey & Pittner (1998: 492, our translation): „[The unmarked order with stressed object] is a possible answer to a variety of further questions [...] [the marked order] is not possible with any of the aforementioned contexts, it would require a different question context.”

Since the position of *wh*-indefinites is fixed, the experiments can determine the outcome of positional variation of the modifier. In (11a), the modifier is realized to the left of, and hence above the *wh*-indefinite. In (11b), its position is below, and to the right of the *wh*-indefinite.

4.3 Experimental methods and sentence material

We have decided to test the hypotheses in two separate experiments.⁷ This decision allows the inclusion of comitatives, instrumentals and internal locatives, as well as the treatment of affirmative and privative adverbials, and takes into account that this distinction is not given for internal locatives.

The first experimental study (Experiment 1 on Anaphoricity) has been designed as a Likert Scale study (LS). The target (i.e., the dependent variable) of an LS is a rating of an individual stimulus on a scale. The ratings allow a determination of the effect of changing the underlying conditions. In Experiment 1, these conditions were the type of adverbial (object-related internal locative and comitative, subject-related instrumental), and the position of the adverbial (OBJ > PP, PP > OBJ). The stimuli were presented in isolation – as is usual in an LS – and participants were instructed to rate the items according to naturalness on a 5-point scale. The scale was depicted with different colors and appropriately labelled (the numbers themselves were not shown). The concept *naturalness* was favored over *acceptability* since it is easier to grasp for naïve speakers (see Juzek 2016:162).

The second experimental study (Experiment 2 on Thematic Integration) has been designed as a Two-Alternative Forced Choice study (FC). An FC aims at detecting differences between conditions by direct comparison, and a choice of one example from a pair of examples forms the dependent variable. The factors for Experiment 2 were the type of adverbial (subject-related comitative, instrumental) and the interpretation of the prepositional head (affirmative, leading to thematic integration of the argument of the preposition, or abessive, blocking the thematic integration of the argument). Since the position of the adverbial PP with respect to the fixed object determined the choice, stimuli were presented as minimal pairs. Each pair was presented on an individual page, and the vertical arrangement of the elements of the pair was randomized. Participants were asked to choose the sentence which they considered more natural.

The prepositions used in the two experiments are summarized in in table 1.

Table 1: Overview of the prepositions used

Adverbial Type	Prepositions used
instrumental	<i>über</i> ('by means of'), <i>ohne</i> ('without'), <i>mit</i> ('with')
comitative	<i>mit</i> ('with'), <i>ohne</i> ('without')
internal locative	<i>auf</i> ('on'), <i>in</i> ('in')

In the resulting sentence materials, the adverbial PPs appeared in verb final clauses headed by transitive verbs in perfect tense. The sentences were embedded under verbs selecting propositional arguments such as *erzählen* ('tell') in perfect tense with a first person singular pronominal or proper name subject. Disambiguating addenda were realized as independent sentences (cf. (11)). The stimuli provided uniform values for formal features which may influence word order. All NPs (subject, object, prepositional complement) were realized in singular,

⁷ The experimental data are made available (see section Data Availability).

using an indefinite determiner to match the definiteness value of the *wh*-indefinite object. The NPs were unmodified since differences in weight again might influence their serialization (see Hawkins 1994). Finally, all objects were kept inanimate, following a pilot study indicating no influence of animacy.

Adverbial PPs realized to the right of an NP in a German clause might in principle attach to the NP or the VP, thus causing unwarranted ambiguities. To avoid these, we have used P-modification or discourse particles, depending on the form and interpretation of the preposition. In case of *mit* and *ohne*, we have used a left-peripheral internal modifier (*zusammen mit* ('together with'), *ganz ohne* ('completely without')), as was already illustrated in (2) and (3). For internal locatives, the object was separated from the PP by a discourse particle.

Both studies were implemented using web-based methods: the implementation used JATOS (Lange et al. 2015) as a solution for server-side tasks, and jsPsych (de Leeuw 2015) for the question design and implementation. Participants were recruited online via prolific (<https://prolific.ac/>), a research-friendly platform offering a diverse population. Uncooperative behavior of participants, common to crowdsourcing, was addressed by using control items, attention items, and by an analysis of the response times.

4.4 Results of the experimental studies

4.4.1 Experiment 1: Likert Scale study on Anaphoricity

In this study, we have tested object-oriented internal locative PPs (ILOC(O)), object-oriented comitative PPs (COM(O)), and instrumental PPs (INSTR) to the left and to the right of an object realized as a *wh*-indefinite. We predict that the first two adverbials pattern alike but differ from the behavior of instrumentals. The reason is the orientation of the adverbials: object-related PPs should be realized below the object, while a realization of subject-related PPs could be possible at any position below the subject, including a position between the subject and the object. This hypothesis differs from Frey & Pittner's (1998), who assume that ILOC(O) and COM(O) should be found to the right of the object, but INSTR to the immediate right of the subject.

The experimental study on Anaphoricity was designed as a 5-point Likert scale study. The PPs in this study were headed by the prepositions *über* and *ohne* for instrumentals, by the preposition *mit* for comitatives, and by the prepositions *auf* and *in* for internal locatives. Lexical variation requires that each adverbial type is presented in six different instantiations, yielding 18 different adverbial lexicalizations in two different positional variations, i.e., a total of 36 test items, randomized with 72 filler items. Illustrations of the stimuli (PP > OBJ) are provided in (11), repeated here as (12) for instrumentals and (13) for object-oriented comitatives.⁸

- (12) INSTR, PP > OBJ
- | | | | | | | | | |
|-------------|------------|-----------------|----------|-------------|-----------------|--|--|--|
| I | habe | gehört, | dass | ein | Busfahrer | | | |
| I | have | heard | that | a.NOM | busdriver.M.NOM | | | |
| über | ein | Mikrofon | was | angekündigt | hat. | | | |
| by.means.of | a.ACC | microphone.ACC | what.ACC | announced | has | | | |
- 'I have heard that a bus driver announced something using a microphone.'

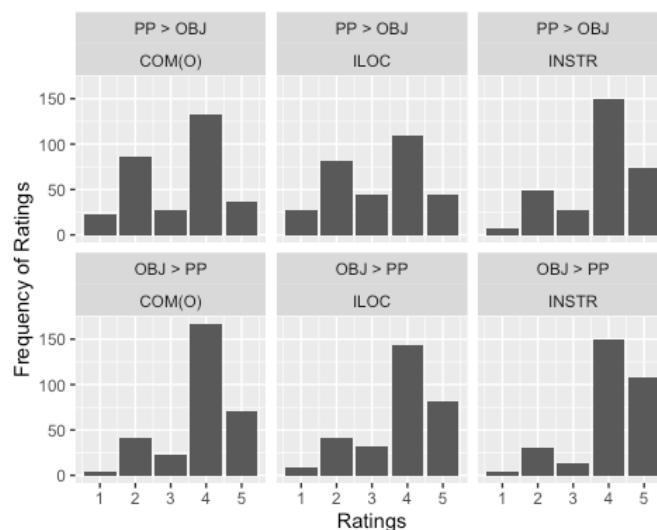
⁸ The disambiguating addendum (cf. (11)) is not depicted for every example due to space restrictions.

(13) COM(O), PP > OBJ

I habe gehört, dass eine Schuldirektorin **zusammen**
 I have heard that a.NOM headmistress.NOM together
mit einer Einladung was verschickt hat.
with a.DAT invitation.DAT what.ACC posted has
 'I have heard that a headmistress posted something along with an invitation.'

The ratings of 51 participants were included in the analysis of the experiment. The empirical results of the study, as illustrated in figure 1, indicate differences between the two serializations for comitatives and locatives with an almost bi-modal distribution of the judgments for the serialization PP > OBJ, which is much less pronounced for instrumentals, as indicated in the top line of figure 1. The distributions for the serialization OBJ > PP, on the other hand, are similar across the three adverbial types, as can be witnessed from the bottom line in figure 1.

Figure 1: Empirical distribution of judgments in Experiment 1



It should already be noticed that a positioning of INSTR below the object has received higher judgments than the realization above the object, a finding that is further corroborated by the model used to analyze the data, in which an effect of placing the adverbial below the object can be observed across all three adverbial types.

We applied a cumulative link random slope model, with subjects and items being random effects, using the function *clmm* from the library *ordinal* in R (Christensen 2019). Such a model takes the ordinal character of Likert scales into account, such that the results are not based on taking mean values of judgments. As with generalized linear mixed models, a CLMM is based on taking a certain set of features as reference values and determines the individual effects of changing reference values to other values. In our model, we took INSTR to be the reference value for the adverbial types, and PP > OBJ as reference value for the different serializations.

While adverbial types and serializations characterize the fixed factors of the model, we determined the influence of subjects and items by including them as *random factors*. In doing so, we determined the influence of both serializations individually for subjects as well as for items (the items as random factors abstract away from the actual serialization, and thus allow the

determination of random slopes). The model in table 2 does not presume an interaction of the two fixed factors, which means that the second fixed factor shows the same influence across all adverbial types. The complex random structure of the model will be discussed together with the random structure of the model for Experiment 2 in section 4.4.3.⁹

Table 2: Cumulative link mixed model for Experiment 1

Cumulative Link Mixed Model fitted with the Laplace approximation

formula: FCT_ANSWER ~ ADVERBIAL_TYPE + POSITION +
(0 + ADVERBIAL_TYPE × POSITION | subjects) + (0 + POSITION | items)

Model evaluation:

link	threshold	nobs	logLik	AIC	niter	max.grad	cond.H
logit	flexible	1836	-2107.63	4277.27	5104 (26313)	2.57e-03	4.5e+02

Random effects:

Groups	Name	s ²	s	Corr.				
subjects	INSTR	2.399	1.549					
	COM(O)	2.387	1.545	0.748				
	ILOC	2.180	1.477	0.898	0.561			
	OBJ > PP	0.884	0.940	-0.078	-0.109	-0.088		
	COM(O): OBJ > PP	0.716	0.846	0.240	-0.334	0.487	-0.178	
	ILOC: OBJ > PP	0.667	0.816	-0.430	0.083	-0.595	-0.386	-0.790
	items	PP > OBJ	0.542	0.736				
	OBJ > PP	0.610	0.781	0.781				
number of groups: subjects 51, items 36								

Coefficients:

	Estimate	Std.Error	z value	Pr(> z)	
COM(O)	-0.9571	0.3479	-2.751	0.00594	**
ILOC	-1.0353	0.3396	-3.049	0.00230	**
OBJ > PP	1.1916	0.1738	6.856	7.08e-12	***

Threshold Coefficients:

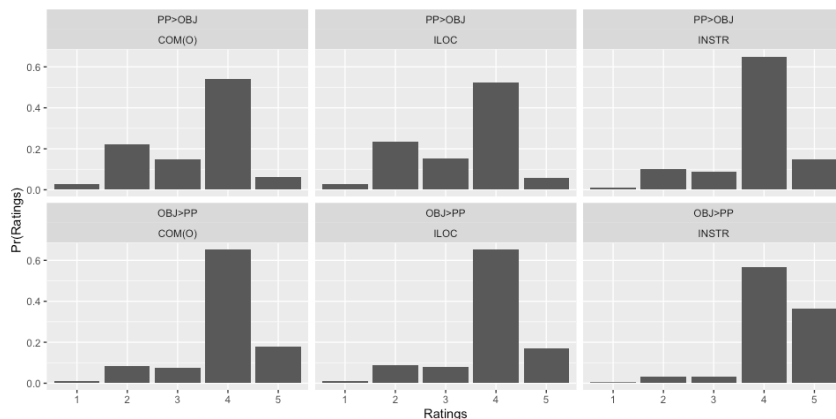
	Estimate	Std.Error	z value
112	-4.5321	0.3557	-12.740
213	-2.0566	0.3301	-6.231
314	-1.3708	0.3278	-4.182
415	1.7521	0.3286	5.333

The probabilities determined by a CLMM for four individual intercepts (cf. *Threshold Coefficients* in table 2) are thus cumulative probabilities (which can be determined by applying the inverse link function). The individual probabilities for judgments on the scale can be determined

⁹ A model with interaction between adverbial types and positions did not prove to be significantly different from the model used here ($p > 0.05$). The complex random structure is chosen to determine the by-subject variability for each of the six conditions individually, which allows the identification of a lower by-subject variability for the three conditions with serialization OBJ > PP.

by subtracting the cumulative probability of a judgment $n-1$ from the cumulative probability of the judgment n . The predicted probabilities for the judgments, given the combinations of adverbial type and serialization, are provided in figure 2.

Figure 2: Individual probabilities for judgments in Experiment 1



The graphical representation of the predictions in figure 2 shows that low ratings (≤ 3) are predicted for COM(O) and ILOC(O) in the serialization PP > OBJ, and are much rarer for INSTR. It should also be noticed that predictions of high ratings are found more often with INSTR in this serialization. The serialization OBJ > PP shows a drop of predictions of low ratings throughout, with very low probabilities for low ratings assigned to INSTR. The individual effects can be determined by calculating the odds ratios for the three predictors (cf. *Coefficients* in table 2): The general effect of moving from PP > OBJ to OBJ > PP is 3.29. This means that a higher rating becomes more than three times more likely under the serialization OBJ > PP. Regarding the effect of switching from INSTR to COM(O) or ILOC(O), we notice that both adverbial types make a higher rating about three times less likely under the serialization PP > OBJ (odds ratios: 0.30, and 0.31, respectively). Of course, these effect sizes mirror the coefficients for both adverbial types, which are very similar. In fact, their difference proves to be insignificant in a direct comparison.

The experimental results clearly indicate that COM(O) and ILOC(O) behave similarly, and differ from INSTR: lower, and almost identical, judgments are predicted for the former two in case of the serialization PP > OBJ. Over all three adverbial types, we also notice that the serialization OBJ > PP receives higher judgments. All findings are in line with the assumption that event-internal modifiers must obey a constraint on Anaphoricity, which allows INSTR greater positional freedom, since this constraint can be fulfilled in a position before or after the object. The high predictions for INSTR in a position to the right of (i.e. below) the object stand in stark theoretical contrast to the proposal by Frey & Pittner (1998), according to which this position should result in very low ratings. It must also be acknowledged that Anaphoricity, as proposed here, would preclude realizations of ILOC(O) and COM(O) to the left of the object. This is not the case and will give rise to further discussions in section 5.

4.4.2 Experiment 2: Forced Choice study on Thematic Integration

In this study, we tested subject-related comitatives (COM(S)) and instrumentals (INSTR). We assume that subject-oriented event-internal modifiers may occupy any position that is c-commanded by the subject if no further constraints apply. These further constraints are the subject matter of Experiment 2: we hypothesize that event-internal adverbials can modify the argument structure of the event by introducing further thematic roles. In the case of instrumentals, the

thematic role will uniquely be that of *instrument*, but comitatives are more flexible: the role depends on the antecedent of the comitative. We further assume that the introduction of new roles is constrained by the lexical semantics of the preposition: both comitatives and instrumentals allow affirmative and privative readings, which are indicated by different lexicalizations: prepositions like *mit* ('with') and *über* ('by means of') provide affirmative interpretations, including an existential presupposition of their object, the preposition *ohne* ('without') provides a privative interpretation. In addition, the preposition *ohne* does not provide an existential presupposition of its object (but neither a negated existential presupposition). We summarize these properties by the concept of Thematic Integration: For the prepositions *mit* ('with') and *über* ('by means of'), Thematic Integration results in the introduction of a thematic role, for the preposition *ohne* ('without'), non-integration precludes the introduction of a further thematic role. Thematic roles influence the ordering of the elements bearing them: phrases bearing highly ranked thematic roles are assumed to occupy positions on the left, phrases bearing lower thematic roles are assumed to occupy positions further on the right of the German *Mittelfeld*. Without Thematic Integration, the internal argument of the PP will not bear a role in the event structure of the modified verb. Subject-oriented comitatives *copy* the role of the subject in case of Thematic Integration, typically *agent*, subject-oriented instrumentals provide the role of *instrument*. *Agents*, of course, are highly ranked, while *instruments* are placed much lower on the hierarchy of thematic roles. We thus predict an interaction of the type of the modifier with the integration of thematic roles: highly ranked integrated roles lead to a positioning of the PP in the left of the *Mittelfeld*, lower ranked integrated roles lead to a positioning of the PP closer to the verb. If Thematic Integration does not apply (in the case of *ohne*), the position of the phrase is determined by other extrinsic factors, i.e., by its syntactic category and Anaphoricity.

The experimental study on Thematic Integration was designed as a Two-Alternative Forced Choice study (FC) with a 2 x 2 design (two adverbial types x two options for thematic integration). The study employed the same test environment as Experiment 1, i.e., the object was fixed as a *wh*-indefinite, and addenda were added enforcing the existential interpretation of the *wh*-indefinite. The prepositions in this study were *mit* and *ohne* for comitatives and *über* and *ohne* for instrumentals. Each adverbial type was presented in six different lexicalizations, yielding 12 different adverbial lexicalizations headed by affirmative and abessive prepositions, i.e., a total of 24 test items, randomized with 48 filler items.

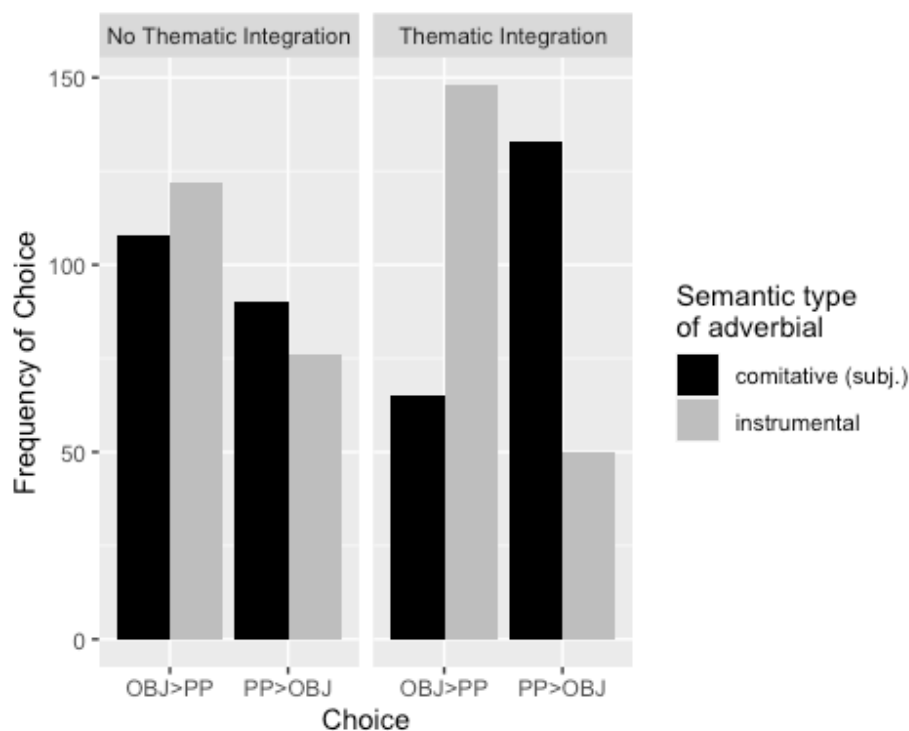
The participants in an FC study choose from two alternatives presented simultaneously, which form minimal pairs, only differing in the position of the adverbial PP. An illustration for subject-oriented comitatives with Thematic Integration has been provided in (2), an example for subject-oriented comitatives without Thematic Integration in (3), repeated here as (14) and (15).

- (14) a. Ich habe gehört, dass ein Virologe **zusammen**
 I have heard that a.NOM virologist.M.NOM together
mit einem Pharmakologen was getestet hat.
 with a.DAT pharmacologist.M.DAT what.ACC tested has
- b. Ich habe gehört, dass ein Virologe was **zusammen mit einem Pharmakologen** getestet hat.
 'I've heard that a virologist tested something in tandem with a pharmacologist.'

- (15) a. Ich habe gehört, dass ein Polizist was
 I have heard that a.NOM policeman.M.NOM what.ACC
ganz ohne einen Kollegen überprüft hat.
 entirely with- a.ACC col- sifted has
- b. Ich habe gehört, dass ein Polizist **ganz ohne einen Kollegen** was überprüft hat.
 'I have heard that a policeman sifted something without a colleague.'

The choices of 33 participants were included in the analysis of the experiment. The empirical results of the study, i.e., the number of choices depending on the relevant factors, are shown in figure 3.

Figure 3: Empirical distribution of choices in Experiment 2



The distribution in figure 3 indicates that the serialization OBJ > PP is preferred for both adverbial types in the absence of Thematic Integration. In case of Thematic Integration, a different picture emerges: while participants strongly prefer a position to the right of the object for instrumentals, the opposite is the case for comitatives.

We applied a binomial generalized linear mixed model (GLMM) using the function *glmer* from the library *lme4* in R (Bates et al. 2015). A binomial GLMM provides a linear prediction for the choice between two alternatives that can be mapped into a probability by employing an inverse logit link function. A GLMM takes a set of features as reference values and determines the individual effects of changing reference values to other values. In the analysis of Experiment 2, we took INSTR to be the reference value for the adverbial types, and the absence of thematic integration to be the reference value for thematic integration.

While adverbial types and thematic integration characterize the fixed factors of the model, we determined the influence of subjects by including them as *random factors*. For them, we determined the influence for each combination of adverbial type and Thematic Integration (*random slope model*). Since the items do not vary across adverbial types and Thematic

Integration, we did not include them in the random effect structure of the model. In contrast to the model for Experiment 1, the model for Experiment 2 assumes an interaction between adverbial types and Thematic Integration, corroborating the theoretical predictions and empirical findings. The resulting model is provided in table 3. The ramifications of the complex random structure will be discussed together with the random structure of Experiment 1 in section 4.4.3.

Table 3: Binomial generalized linear mixed model for Experiment 2

Generalized linear mixed model fit by maximum likelihood (Laplace Approximation) [‘glmer-Mod’]

Family: binomial (logit)

Formula: ANSWER ~ ADVERBIAL_TYPE × INTEGRATION +
(0 + ADVERBIAL_TYPE × INTEGRATION | subjects)

Control: glmerControl(optCtrl = list(maxfun = 20000))

Model evaluation:

AIC	BIC	logLik	deviance	df.resid
968.0	1033.5	-470.0	940.0	778

Scaled residuals:

Min	1Q	Median	3Q	Max
-2.2511	-0.6509	-0.3624	0.7382	2.5673

Random effects:

Groups	Name	s ²	s	Corr
subjects	INSTR	1.670	1.292	
	COM(S)	1.361	1.166	0.93
	INTEGRATION == yes	1.152	1.073	-0.75 -0.75
	COM(S):INTEGRATION == yes	0.235	0.485	0.55 0.57 -0.97
number of obs: 792, groups: subjects 33				

Fixed Effects:

	Estimate	Std.Error	z value	Pr(> z)
(Intercept)	-0.6312	0.2865	-2.203	0.0276 *
COM(S)	0.4088	0.2525	1.619	0.1055
INTEGRATION == yes	-0.6287	0.3266	-1.925	0.0542 .
COM(S):INTEGRATION == yes	1.6498	0.3632	4.542	5.58e-06 ***

The estimates of the fixed effects in table 3 provide values for the serialization PP > OBJ. If these values are negative, it means that this serialization is not preferred for the relevant condition. As the intercept term combines the setting *instrumental* for the adverbial type, and *no* for Thematic Integration, the model predicts that instrumentals headed by *ohne* prefer the order OBJ > PP ($p < 0.05$).

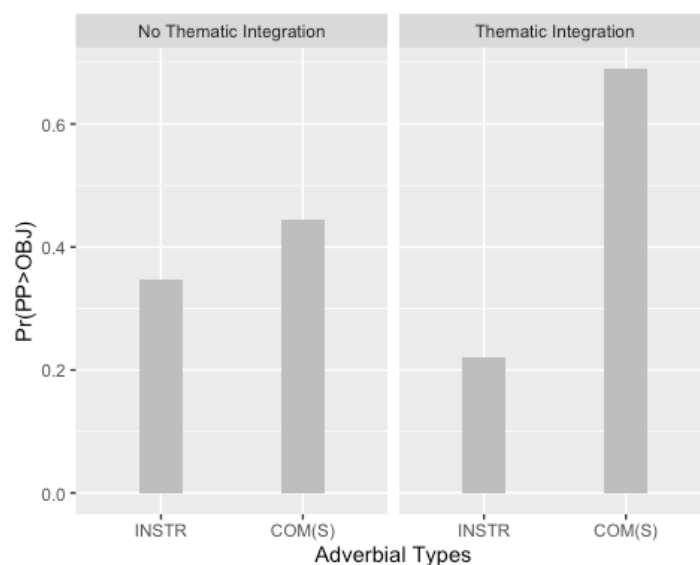
It is remarkable that the second and third coefficients are not classified as significant ($p > 0.5$). The coefficient for both COM(S) and INTEGRATION == yes has a comparatively high probability of being 0. The respective distributions in the sample suggest that moving from INSTR to

COM(S) makes the order PP > OBJ slightly more probable, and that moving from INTEGRATION == *no* to INTEGRATION == *yes* for instrumentals makes the order PP > OBJ even less probable. But these properties of the sample are not likely to carry over to the population. It is thus probable that the differences suggested in the sample for these two conditions will vanish if the experiment is repeated. This is by no means a negative result.

First, it simply means that the behavior of comitatives and instrumentals does not differ significantly if thematic integration does not take place. Secondly, it also suggests that Thematic Integration is not relevant for instrumentals.

This stands in contrast to the coefficient of the interaction of switching from instrumentals to comitatives and switching from no integration to integration. The highly significant estimate ($p < 0.001$) is positive, and hence will increase the likelihood for the serialization PP > OBJ. Given its comparatively high value, the increase will also be large. In other words: The model predicts that comitatives with thematic integration differ strongly from the other experimental conditions in that they prefer the serialization PP > OBJ over its alternative. A graphical representation of the predictions in terms of probabilities is provided in figure 4.

Figure 4: Predicted probabilities for the choice PP > OBJ in Experiment 2



The results of Experiment 2 show an interaction between the type of the event-internal modifier and thematic integration. The interaction between the two main effects thus results in a strong positive effect for comitatives, making the serialization PP > OBJ 4.18 times more likely. If Thematic Integration is absent, both modifiers prefer a position to the right of the object. As with the results for instrumentals in Experiment 1, these results cast strong doubts on the analysis of Frey & Pittner (1998), according to which this position should lead to ungrammaticality for instrumentals *and* subject-oriented comitatives. If Thematic Integration applies, comitatives prefer PP > OBJ, while instrumentals do not change their preference for OBJ > PP.

4.4.3 Ramifications of the complex random structures

Although this might not be apparent at first glance, the random structures of the models for Experiment 1 and 2 share common properties. The random slope models for both experiments provide information about by-subject variability, which is to be expected in the population of interest (i.e. an assumed homogeneous population of speakers of German). We notice from the effect sizes of the fixed structures of the models that the contrasts are not as clear-cut as

one would expect if one serialization turned out as grammatical, whereas the other emerged as ungrammatical. From this perspective, it is even more remarkable that certain conditions lead to a reduction of by-subject variability in both models. Let us begin with the model for Experiment 2: here, the by-subject variability for the combination of *comitative* and *Thematic Integration* is less than half the size of the variability (standard deviation) of the other three conditions (cf. *Random effects* in table 3). In other words, this means that speakers chose the order PP > OBJ much more uniformly given *comitatives* that induce Thematic Integration (compared to all other conditions). This is even more striking when considering the coefficients of the fixed structure in combination with the proposed by-subject variability. The condition *instrumental/no thematic integration* shows a coefficient of -0.63, but a by-subject variability of 1.29. In contrast, the condition *comitative/thematic integration* shows a much stronger coefficient of 1.65, with a much weaker by-subject variability of 0.49.

Similar considerations apply to Experiment 1. Here, we observe a drop of by-subject variability for the condition OBJ > PP (cf. *Random effects* in table 2). For this condition, the by-subject variability ranges between 0.82 and 0.94 (depending on the adverbial types, with the highest value for *instrumental*, which is not constrained in its position before or after the object by *Anaphoricity*), while the variability for PP > OBJ ranges between 1.48 and 1.55 (again, with the highest value for *instrumentals*).

Although future investigations are necessary, the models suggest that by-subject variability depends on syntactic configurations. Speakers are not generally uncertain in choices and ratings. Instead, it seems as if certain configurations lead to a broader bandwidth of choices and ratings, while other configurations impose stricter conditions. Chomsky (1957) famously stated that we should be prepared to let the grammar itself decide if speakers are uncertain. The present results indicate that uncertainty on the side of the speakers is not uniformly distributed.

5 Theoretical implications

Event-internal modifiers are anaphoric, and hence require a syntactic antecedent. Event-internal modifiers also differ with respect to Thematic Integration: depending on the semantics of the head of the modifier, they modify the thematic structure of the event by introducing additional thematic roles. The modifier may thus occupy a position on the left of the *Mittelfeld* if the introduced role occupies a high rank. Thematic Integration does not imply that all event-internal modifiers introduce thematic roles, as we have already seen with internal locatives. Thematic Integration only implies that if thematic roles are introduced by a modifier, the thematic roles will interact with the remaining thematic structure of an event. Conditions on the serialization of event-internal modifiers are thus neither limited to modifiers nor to a specific class of modifiers. Furthermore, they are not considered homogeneous echoes of class membership. We also assume that the ordering of modifiers is governed by general constraints. While the exact nature of the interaction of the constraints proposed here with general constraints such as NP > PP or pronoun > ¬pronoun is beyond the confines of the present paper, the interaction itself is not controversial (as is vividly illustrated in Frey (2015: 522)).

In the following sections, we will compare the present findings with prior proposals and address the question whether they support an analysis in terms of base positions and scrambling, or merely in terms of preferences for serializations (section 5.1). Finally, we provide a programmatic semantic analysis of Thematic Integration, and discuss the concept of event-internality (section 5.2).

5.1 Base positions and scrambling

The present results provide evidence against proposing that event-internal modifiers occupy a unique base position, as suggested in Frey & Pittner (1998) and Maienborn (2001).¹⁰ Instead of assuming that they behave homogeneously because of being event-internal modifiers, we have pointed to class-internal variation, for which the semantics of the modifiers as well as their anaphoric nature can be made responsible. Nevertheless, the present study indicates that event-internal modifiers preferred some positions over others. This preference, however, does not justify the assumption of unique base positions, which also implies a mechanism such as scrambling to arrive at alternative positions. The term *scrambling* – of course – is used ambiguously in theoretical syntax: to describe the phenomenon of word order variation, or to refer to the eponymous operation, developed within the Government-Binding framework, according to which word order variation is analyzed as movement (see Abels 2015). Analyzing scrambling in terms of movement, however, is more restrictive than employing linear precedence rules (Uszkoreit 1986), as scrambling is restricted to go upwards, i.e., from c-commanded positions to c-commanding positions. This assumption is also maintained within the Minimalist Program's Extension Condition (Chomsky 1995).

We assume that subject-oriented comitatives can occupy a position which is adjacent to the subject if Thematic Integration takes place. Frey & Pittner (1998) assume that all subject-oriented event-internal modifiers take this position as their base position. This conclusion has been defied by both experiments. Experiment 1 shows that instrumentals may occur in this position, but that their preferred position seems to be below (and to the right of) the object, i.e., in the same position that is occupied by object-related comitatives and internal locatives. In this position, all event-internal modifiers obey Anaphoricity, because their antecedents, be they subjects or objects, c-command the respective position. Subject-oriented comitatives headed by *mit* form an exception insofar as they prefer a position adjacent to the subject. We assume that this due to Thematic Integration taking place. Incidentally, it should be noted that all other approaches to event-internal modification only look at comitatives (and instrumentals) headed by *mit*, leading to the erroneous conclusion that their base position is actually adjacent to the subject. The inclusion of further lexical material, however, has revealed that comitatives do not behave uniformly. In any case, the position below the object, however, seems to be the preferred one for instrumentals and abessive comitatives, as is illustrated in (11b) for instrumentals and in (3a) for abessive subject-oriented comitatives, both are repeated under (16).

(16) a. INSTR, OBJ > PP

Ich	habe	gehört,	dass	ein	Busfahrer	was
I	have	heard	that	a.NOM	busdriver.M.NOM	what.ACC
über	ein	Mikrofon			angekündigt	hat.
by.means.of	a.ACC	microphone.ACC			announced	has

'I have heard that a bus driver announced something using a microphone.'

b. abessive COM(S), OBJ > PP

Ich	habe	gehört,	dass	ein	Polizist	was
I	have	heard	that	a.NOM	policeman.M.NOM	what.ACC
ganz	ohne	einen	Kollegen		überprüft	hat.
entirely	without	a.ACC	colleague.M.ACC		sifted	has

'I have heard that a policeman sifted something without a colleague.'

¹⁰ The criticism of Maienborn (2001) applies only insofar as her assumptions concerning internal locatives, which have been corroborated by the present study, cannot be extended to event-internal modifiers in general.

Both examples in (16) should be ungrammatical throughout if scrambling is assumed – as in Frey & Pittner (1998). To derive the examples, it would be necessary to move the PPs to the right, and hence into a c-commanded position, which would violate assumptions on movement, such as the Extension Condition. Further evidence against unique base positions can be provided by considering event-internal adverbial PPs whose complement is a *wh*-indefinite, as illustrated in (17).

- (17) affirmative COM(S), PP > OBJ
- | | | | | | | |
|------------|------------|---------|--------------|-------|-----------------|-----------------|
| Ich | habe | gehört, | dass | ein | Minister | zusammen |
| I | have | heard | that | a.NOM | secretary.M.NOM | together |
| mit | wem | einen | Vertrag | | unterzeichnet | hat. |
| with | whom.DAT | a.ACC | contract.ACC | | signed | has |
- ‘I have heard that a secretary signed a contract together with someone else.’

Following the logic sketched above, the acceptability of (17) shows that subject-oriented comitatives occupy an invariant position above (and to the left of) the object. Looking into the opposite serialization in (18), we must concede first that we cannot argue for a fixed position of COM(S) below the object because scrambling of the objects must be considered.

- (18) affirmative COM(S), OBJ > PP
- | | | | | | | |
|--------------|-----------------|------------|------------|-------|-----------------|-------|
| Ich | habe | gehört, | dass | ein | Minister | einen |
| I | have | heard | that | a.NOM | secretary.M.NOM | a.ACC |
| Vertrag | zusammen | mit | wem | | unterzeichnet | hat. |
| contract.ACC | together | with | whom.DAT | | signed | has |
- ‘I have heard that a secretary signed a contract together with someone else.’

A possible way of determining whether scrambling did not take place in structures like (18) would be to realize both the adverbial and the object as *wh*-indefinites, as illustrated in (19).

- (19) affirmative COM(S), OBJ > PP
- | | | | | | | |
|-----------------|------------|------------|----------|-------|-----------------|----------|
| Ich | habe | gehört, | dass | ein | Minister | was |
| I | have | heard | that | a.NOM | secretary.M.NOM | what.ACC |
| zusammen | mit | wem | | | unterzeichnet | hat. |
| together | with | whom.DAT | | | signed | has |
| was | und | mit | wem | es | war, | weiß |
| what.NOM | and | with | whom.DAT | it | was | know |
| | | | | | | ich |
| | | | | | | nicht. |
- ‘I have heard that a secretary signed something together with someone else.
But I neither know what it was, nor with whom.’

We have eschewed from experimentally testing examples like (19). To begin with, the addenda are required to assure a non-specific reading of the *wh*-indefinites, but may sound cumbersome. In addition, if more than one *wh*-indefinite is contained in an example, the order of picking up the *wh*-indefinites in the addenda may have unwarranted effects (the serialization inside the addendum in (19) could be switched). Example (19) nevertheless does not seem to be

particularly odd.¹¹ Hence, the positions of the subject-oriented comitative in (19) – and (18) – also must be considered ‘base’ positions. Given this observation, why not assume that event-internal modifiers can occupy any position which is compliant with the serialization constraints imposed on these kind of modifiers, Anaphoricity and Thematic Integration in particular?

Summing up, the examples in (16) clearly show that not all subject-oriented event-internal modifiers must occupy positions above and to the left of the object. The discussion around (17) to (19) has further shown that subject-oriented event-internal modifiers may occupy scrambling-invariant positions *below* the object. Hence the assumption of a unique base position for event-internal modifiers becomes highly dubious.

Turning to object-oriented comitatives, we have observed that they (as well as internal locatives) strongly prefer a position to the right of the object, which follows from Anaphoricity. Examples showing the opposite order were, however, not judged as unnatural by all participants, as has already been made apparent in the empirical distribution of judgments in figure 1 and can be further elaborated in (20).

(20) COM(O), PP > OBJ

- a. Ich habe gehört, dass ein Hobbykoch
 I have heard that a.NOM amateur.chef.M.NOM
zusammen mit einer Knoblauchzehe was püriert hat.
 together with a.DAT garlic.clove.DAT what.ACC mashed has
 ‘I have heard that an amateur chef mashed something together with a garlic clove.’
- b. Lea hat erzählt, dass ein Kleinkrimineller
 Lea has told that a.NOM petty.criminal.M.NOM
zusammen mit einer Stichwaffe was vergraben hat.
 together with a.DAT thrusting.DAT what.ACC buried has
 ‘Lea said that a petty criminal buried something along with a thrusting.’

Example (20a) has been rated as expected: mostly, it received low ratings (the mode on the Likert scale was 2). Surprisingly, example (20b) received high ratings (mode: 4) although being structurally identical to (20a). We cannot presently provide an explanation for this contrast. In addition to violating Anaphoricity, it should be noted that (20b) also violates a possible application of NP > PP, as well as pronoun > ¬pronoun, and yet received high ratings in judgments. We conjecture that this may be because the grammar of German must include a rule allowing phrases to appear in unusual positions, to make scope readings or restricted focus projections available.¹² Speakers may thus refer to this rule although neither scope nor focus is at stake in (20). This assumption gains plausibility if we compare the examples in (20) with similar examples in which the object of the preposition is realized as a *wh*-indefinite, illustrated in (21).

¹¹ Reservations against employing *wh*-indefinites as objects of event-internal modifiers do not apply to comitatives if the P modifier *zusammen* (‘together’) is used. We thus plan a follow-up study on this type, relying on a fixation of the PP itself, to analyze the critical ordering preferences of object-oriented comitatives in more detail.

¹² Of course, such a rule could be called scrambling. In this respect, the reader is reminded that the results of scrambling analyses to scope determination (such as Frey 1993) can be mirrored or even improved by analyses which do not employ movement in a strict sense (cf. Kiss 2001). Hence, we eschew from using the term scrambling here.

(21) COM(O), PP > OBJ

- a. * Ich habe gehört, dass ein Hobbykoch
 I have heard that a.NOM amateur.chef.M.NOM
zusammen mit was eine Knoblauchzehe püriert hat.
 together with what.DAT a.ACC garlic.clove.ACC mashed has
 'I have heard that an amateur chef mashed a garlic clove together with something else.'
- b. * Lea hat erzählt, dass ein Kleinkrimineller
 Lea has told that a.NOM petty.criminal.M.NOM
zusammen mit was eine Stichwaffe vergraben hat.
 together with what.DAT a.ACC thrusting.ACC buried has
 'Lea said that a petty criminal buried a thrusting together with something else.'

The examples in (21) appear strikingly odd.¹³ Existential *wh*-indefinites resist scrambling, which means that they resist dislocation, irrespective of the specific operation required for dislocation. Hence, the PPs would have to be assumed to occupy base positions in (21), as a rule for dislocation is prohibited to apply. The contrast between the disputed examples in (20) and

¹³ Hubert Haider (p.c.) has argued that the ungrammaticality of the examples in (21) may be attributed to other reasons, in particular, he points out that the *wh*-indefinite *was* may be parsed with a preference of accusative case, which stands in contrast to the required *dative* case in (21). What is more, he suggests that using pronominal adverbials (*wo(r)-P*) in such combinations is preferred and hence that using a full PP further adds to unacceptability. Presently, our arguments against this line of reasoning cannot be backed up experimentally, but we would like to mention the following aspects:

The examples in (21) show the order PP > OBJ. Although the reversed order (OBJ > PP) does not provide direct evidence for a base position, as discussed above, it must nevertheless be conceded that the reversed order appears to be more acceptable than the order in (21):

- (i) Ich habe gehört, dass ein Hobbykoch eine Knoblauchzehe zusammen mit was püriert hat. Mit was es war, weiß ich aber nicht.
 'I have heard that an amateur chef mashed a garlic clove together with something else. But I don't know, with what it was.'

Of course, Hubert Haider's argument does not presume a distinction between positions, so the contrast observed here remains unaccounted for.

A replacement of full PPs by pronominal adverbials (*wo(r)-P*) is not possible with *comitatives*, because this would lead to ambiguity between comitatives with subject and object orientation, and also may yield unwarranted instrumental interpretations. Such a replacement, however, is possible with *internal locatives*. It strikes us that pertinent examples with full PPs are as acceptable as pronominal adverbials, although the preposition governs dative case as well:

- (ii) Ich habe gehört, dass eine Schülerin ja ein Buch **in was**
 I have heard that a pupil.F.NOM DP a book.ACC in what.DAT
 versteckt hat. **In was** es war, weiß ich aber nicht.
 hidden has in what it was know I but not.
 'I have heard that a pupil has hidden a book in something. But I don't know, in what it was.'
- (ii) Ich habe gehört, dass eine Schülerin ja ein Buch **worin**
 I have heard that a pupil.F.NOM DP a book.ACC wherein
 versteckt hat. **Worin** es war, weiß ich aber nicht.
 hidden has wherein it was know I but not
 'I have heard that a pupil has hidden a book in something. But I don't know, wherein it was.'

The acceptability of (ii), which of course should be corroborated by further experimental studies, as well as the contrast between (21) and (i) casts doubts on the assumption that the examples in (21) are ungrammatical because of a perceived case mismatch or a preference for a pronominal adverbial. Further doubt can be raised since there are no pronominal adverbials for *ohne was*, where *ohne* also governs accusative case, but again, these considerations require experimental corroboration.

ungrammatical ones in (21) can thus be interpreted as providing evidence for the conjecture that the position occupied by the PPs in (20) (and (21)) cannot be a base position. So why are examples like (20b) rated highly in the experimental studies? Assuming that a specific rule is present in the grammar of German that allows phrases to appear outside of otherwise licensed positions to make scope (and focus) options available (see Kiss 2001), we conjecture that this rule seems to apply vacuously in the problematic cases. The contrast between (20a) and (20b), however, clearly indicated that further studies are required to establish the grammaticality status these examples.

5.2 Implications of thematic integration: an analysis of event-structure modifying event-internal modifiers

In this section, we will discuss, albeit programmatically, the semantics of Thematic Integration. Let us assume that comitatives can be characterized by a ternary predicate called *participate*, a relation between two individuals and an event, and to be interpreted so that the two individuals participated in the event. Similarly, the semantics of instrumentals introduce a ternary relation *using* between an individual, an instrument, and an event. Both predicates can be negated. If affirmative event-internal prepositions can be characterized by $relation(e, \underline{x}, y)$, then the privative event-internal preposition *ohne* is characterized by the respective negation: $\neg relation(e, \underline{x}, y)$, where *relation* is a variable over $\{participate, using\}$. We have underlined the second variable in the relation to indicate that it requires anaphoric identification (see below).

Restricting our view to comitatives for the moment, we notice that *mit* ('with') and *ohne* ('without') differ significantly regarding their existential presuppositions. While the first preposition carries an existential presupposition towards its internal argument, *ohne* ('without') neither carries an existential presupposition, nor its negation. This can be illustrated by looking at the examples in (22) (which depict the adverbials in their preferred position).

- (22) a. affirmative COM(S), PP > OBJ

Ich	habe	gehört,	[dass	ein	Minister	zusammen
I	have	heard	that	a.NOM	secretary.M.NOM	together
mit	einem	Berater	was		entschieden	hat].
with	a.DAT	counsellor.M.DAT	what.ACC		decided	has

'I have heard that a secretary decided something together with a counsellor.'

- b. privative COM(S), OBJ > PP

Ich	habe	gehört,	[dass	ein	Minister	was
I	have	heard	that	a.NOM	secretary.M.NOM	what.ACC
ganz	ohne	einen	Berater		entschieden	hat].
entirely	without	a.ACC	counsellor.M.ACC	decided	has	

'I have heard that a secretary decided something without a counsellor.'

The bracketed part of (22a) can be translated into a logical form as given in (23), boldface indicates the semantic relation introduced by *mit* ('with') as well as the thematic role which is introduced by *mit* ('with').

- (23) $\lambda e \exists x \exists y \exists z [\text{decide}(e) \wedge \text{secretary}(z) \wedge \text{agent}(e, z) \wedge \text{counsellor}(x) \wedge \text{agent}(e, x) \wedge \text{participate}(e, z, x) \wedge \text{theme}(e, y)]$

As for (22b), we can neither assume an existential quantification over the predicate *Berater* ('counsellor'), nor the negation of such an existential quantification. In fact, (22b) is best paraphrased as saying that if there are counsellors, they have not participated in the decision of the secretary, and hence should be translated as given in (24).

(24) $\lambda e\exists y\exists z[\text{decide}(e) \wedge \text{secretary}(z) \wedge \text{agent}(e, z) \wedge \text{theme}(e, y) \wedge \forall x[\text{counsellor}(x) \Rightarrow \neg\text{participate}(e, z, x)]]$

By the same line of reasoning, the sentences in (25), which contain instrumentals headed by *über* ('by means of') and *ohne* ('without') receive the representations in (26) and (27).

- (25) a. affirmative INSTR, OBJ > PP
 Ich habe gehört, dass ein Busfahrer
 I have heard that a.NOM busdriver.M.NOM
 was **über** ein **Mikrofon** angekündigt hat.
 what.ACC by.means.of a.ACC microphone.ACC announced has
 'I have heard that a bus driver announced something using a microphone.'
- b. privative INSTR, OBJ > PP
 Ich habe gehört, dass ein Techniker was
 I have heard that a.NOM technician.M.NOM what.ACC
ganz ohne ein Hilfsmittel angeschlossen hat.
 entirely without a.ACC utility.ACC installed has
 'I have heard that a technician installed something without using a means.'

(26) $\lambda e\exists x\exists y\exists z[\text{announce}(e) \wedge \text{bus driver}(z) \wedge \text{agent}(e, z) \wedge \text{microphone}(x) \wedge \text{instrument}(e, x) \wedge \text{using}(e, z, x) \wedge \text{theme}(e, y)]]$

(27) $\lambda e\exists y\exists z[\text{connect}(e) \wedge \text{technician}(z) \wedge \text{agent}(e, z) \wedge \text{theme}(e, y) \wedge \forall x[\text{utility}(x) \Rightarrow \neg\text{using}(e, z, x)]]$

The schematic analyses in (23), (24), (26), and (27) must be elucidated in various respects: First, we must account for the identification of the thematic role, which is introduced in (23) and (26), but not introduced in (24) and (27). In contrast to instrumentals, where the role is always the one of *instrument*, the role for comitatives can be the one borne by the subject or the object. We will not provide an analysis of the identification operation here, but only suggest how it must take place. The identification cannot take place between the modifier and the lexical specification of the modified verb. Given the syntax of German, this identification would be possible without an actual syntactic complement ever coming into play. Instead, the identification must be initiated by the syntactic complements bearing the roles, and in addition must be envisaged as an indirect operation, because the role is not present if the relation introduced by the predicate is negated, as in (24) and (27). These requirements can be met, if we assume that the modifiers provide an index (such as anaphoric reflexives in Kiss (2012)), which requires identification by another syntactic element. It follows that the element must be introduced to a phrase already including the modifier issuing the index, yielding the required configuration (and serialization). Of course, such a mechanism only applies if the relation introduced by the modifier is not negated.

Secondly, it may come as a surprise that we have analyzed the relevant relations as ternary. Consider *instrumentals*: if the pertinent relation, *using*, were binary, i.e., a relation between an individual and an event, then it would follow that the individual is being used, but it would be open by whom. But instrumentals are always subject-related, and this relation must be represented as well. Hence, we assume a ternary relation between the entity used, the one using the entity, and the event, in which the use takes place. The considerations also apply to comitatives. Here, it would neither be sufficient if individuals were parallelly related to an event, as comitative meanings extend temporal simultaneity, which is also apparent in Frey & Pittner's (1998: 506) conjecture that comitatives can always be paraphrased by coordination (see also Stolz 1998: 110f.). The coordination of the antecedent with the internal argument of the comitative PP suggests an aspect of interaction between the referents that necessarily goes beyond mere temporal overlap.

Finally, we must address the issue of a superficial existential quantifier ending up as a universal quantifier in (24) and (27). This is reminiscent to many prior observations, which have led to the development of Discourse Representation Theory (Kamp & Reyle 1993). Diesing (1992) assumes for German that universal interpretations of superficially existentially quantified expressions may only emerge in restricted syntactic environments. The present data, however, suggest that this does not hold for negated instrumentals and comitatives, as can be witnessed by comparing the examples in (28) with (22b) and (25b) – the interpretation of the instrumental and comitative does not depend on the serialization.

- (28) a. privative COM(S), PP > OBJ
 Ich habe gehört, dass ein Minister **ganz**
 I have heard that a.NOM secretary.M.NOM entirely
ohne einen Berater was entschieden hat.
 without a.ACC counsellor.M.ACC what.ACC decided has
 'I have heard that a secretary decided something without a counsellor.'
- b. privative INSTR, PP > OBJ
 Ich habe gehört, dass ein Techniker **ganz**
 I have heard that a.NOM technician.M.NOM entirely
ohne ein Hilfsmittel was angeschlossen hat.
 without a.ACC utility.ACC what.ACC installed has
 'I have heard that a technician installed something without using a means.'

Future research is required to provide a formal account of Thematic Integration, including the identification of thematic roles for comitatives. Moreover, the surprising ratings of object-oriented event-internal modifiers must be subjected to further analyses.

While many technical details of the present analysis await to be worked out in future work, the general lines of the analysis suggest that serializations of event-internal adverbials are much more dependent on extrinsic factors than proposed in prior analyses. The factors developed here show an interplay of syntactic and semantic constraints, which can be derived from more general constraints, such as the resolution of anaphoric dependencies, and orders mapping thematic hierarchies, thus assimilating pattern of serialization for modifiers to the pattern already established for complements.

6 Conclusion

Concerning the syntax of adverbial modifiers, some approaches assume freedom of placement while others assume word order constraints. The dependency of adverbial placement on adverbial classes is surprisingly uncontroversial across the approaches: it manifests itself by proclaiming absolute word order constraints (Frey & Pittner (1998); Maienborn (2001; 2003)), or rather by providing constraints concerning the order relative to other adverbials (Ernst (1998); Haider (2000); Maienborn et al. (2016)). Both groups of accounts suffer from empirical and conceptual issues. First, considering only a small subset of possible lexicalizations leads to unwarranted generalizations. Secondly, it is unclear whether putative base positions provide indications for class membership, or the other way round. Thirdly, word order constraints on adverbial modifiers are implicitly claimed to differ from those on arguments, suggesting two different constraint systems to determine serialization.

Addressing these issues, we assume that two extrinsic factors determine the serialization of event-internal adverbials. Event-internal modifiers are *anaphoric*, which requires placing them in the c-command domain of their antecedents, from which their order follows. *Depending* on the interpretation of a modifier (*affirmative* vs. *abessive*), *thematic integration* may lead to the introduction of additional roles, which will again influence the order of the elements bearing them. By conducting two experiments, we have shown that (isolated) event-internal modifiers are not allowed to occupy arbitrary positions in German clause structure. Even though event-internal modifiers do exhibit serialization preferences, these do not justify the assumption of unique base positions. Instead, we assume that they may appear in positions compliant with the extrinsic constraints proposed. Thus, the need to postulate two different constraint systems for complements and adjuncts to determine serialization is eliminated.

In the studies, we also notice obedience to more general constraints, such as a constraint placing NPs in front of PPs, or pronouns in front of non-pronouns. The exact nature of the interaction of Anaphoricity and Thematic Integration with these general constraints is subject to further research. Moreover, we notice that a violation of Anaphoricity does not necessarily lead to ungrammaticality, even if more general constraints are violated as well. These surprising findings must be subjected to further analyses.

We further provided a programmatic semantic analysis of *Thematic Integration* for which a formal account needs to be worked out in the future. It must especially account for the identification of the thematic role, which is introduced in affirmative, but not in privative contexts. Further, the issue of a superficial existential quantifier ending up as a universal quantifier in privative contexts must be accounted for.

Competing interests

The authors have no competing interests to declare.

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Abbreviations

ACC	accusative
DAT	dative
DP	discourse particle

F	female
M	masculine
NOM	nominative

Data Availability

The data and models discussed in the present paper can be found in https://github.com/Linguistic-Data-Science-Lab/Kiss_et_al_21_word-order-constraints-on-event-internal-modifiers (Release v2.0).

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