Incrementality in Processing Complements and Adjuncts: *Construal* Revisited

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Abstract The paper looks at the varying degree of incrementality in online sentence processing. A model that captures such differences by reference to the type of constituents involved is *Construal*. Construal assumes different mechanisms for the processing of complements (*primary relations*) and adjuncts (*non-primary relations*). According to *Construal*, adjuncts, in contrast to complements, are not immediately attached to the current phrase structure, but loosely associated with it, and are interpreted within the *current thematic processing domain*. We compare Construal to an alternative approach, the *Enlightened Incrementality Conjecture* (EIC) that explains the differing degree of incrementality in sentence processing by reference to domains of Logical Form, and evaluate these two accounts in the light of results from processing order variations with complements and adjuncts in German.

1 Processing Complements and Adjuncts

Several studies have shown that complements and adjuncts behave differently in online sentence comprehension and production (e.g., Clifton, Speer, & Abney 1991; Schütze & Gibson, 1999; Boland, 2005; Traxler, 2008). One early attempt, and still the most developed one, to capture these differences is *Construal* (Frazier & Clifton, 1996, 1997). Construal differentiates between primary and non-primary relations. Primary relations (roughly, subjects, predicates, and the complements of these and other primary phrases) are parsed immediately and highly incrementally into fully

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specified syntactic structures, according to the mechanisms and parsing principles assumed by the *Garden-Path Model* (Frazier, 1987), a serial two-stage syntax-first model.

In contrast, non-primary relations (phrases that cannot be taken, even temporarily, to instantiate a primary relation) are associated to the domain currently processed (i.e. the domain of the last theta assigner). Semantic and other nonstructural factors are used to fully specify the syntactic structures. The construal hypothesis is summarized in (1) (see Frazier & Clifton, 1996, pp. 41–42).

(1) a. *Construal Principle*

    i. Associate a phrase XP that cannot be analyzed as instantiating a primary relation into the current thematic processing domain.

    ii. Interpret XP within that domain using structural and non-structural (interpretive) principles.

  b. *Current thematic processing domain*

    The current thematic processing domain is the extended maximal projection of the last theta assigner.

Evidence for the assumed mechanisms in processing primary relations includes word order variations in German. Several studies using different offline and online measures have shown a robust syntactic preference for the subject-before-object order (whether this preference is purely syntactic in nature or (also) driven by thematic hierarchies is still a matter of debate, (see, e.g., Bornkessel, Schlesewsky, & Friederici, 2003a; Bornkessel-Schlesewsky & Schlesewsky, 2015)). This subject-before-object preference can be modulated, but not overridden, by several non-syntactic factors, e.g., plausibility (see, e.g., Friederici & Mecklinger, 1996), focus (see, e.g., Bader & Meng, 1999; Stolterfoht, 2005), verb type (see, e.g., Scheepers, Hemforth, & Konieczny, 2000), and context (see, e.g., Bornkessel, Schlesewsky, & Friederici, 2003b; Meng, Bader, & Bayer, 1999).

Evidence for the assumed mechanisms in processing non-primary relations comes, first and foremost, from secondary predication, adjunct attachment and extraction from adjuncts (see Frazier & Clifton, 1996, 1997). The results show that in many cases, there are no clear structural preferences, and if there are, it appears that non-structural information influences interpretation. That means that the processing of complements and adjuncts differs in the degree of incrementality of syntactic processing. Whereas complements are parsed highly incrementally into full-fledged syntactic structures, adjuncts are loosely associated to a specific domain and syntactic structure building might be delayed, using non-structural information in this process.

Another attempt to capture differences in incrementality is the *Enlightened Incrementality Conjecture* (EIC) proposed by Beck and Tiemann (to appear). EIC explains differences in the temporal dynamics of language comprehension by appealing to Logical Form (LF): Units in the same LF domain are composed incrementally (*immediate composition*), whereas the composition of units in different LF domains is delayed (*delayed composition*). Following von Stechow and Beck (2015), the relevant LF layers are DP, VP, AspP, TP (and CP). Examples of immediate vs. delayed composition are the processing of different types of temporal adverbials together

with the verb in German verb-second sentences (see Bott, 2010; Bott & Gattnar, 2015). Whereas a mismatch of a temporal adverbial like *morgen* ('tomorrow') that locates the described event in the future, and a past tense verb like *gewann* ('won') is detected immediately (Bott, 2010), the processing of an aspectual mismatch of a durational adverbial like *zwei Stunden lang* ('within two hours') and the same verb 'won' (describing a punctual event) is delayed (Bott & Gattnar, 2015). Beck and Tiemann explain this difference by differences in the associated LF structures. In the first case, the adverbial and the verb are both located within TP, whereas in the second, the two elements are scattered over several layers (TP, AspP and VP). Although EIC is a model of online semantic composition, it assumes a very tight syntax-semantics-mapping (see, e.g., Heim & Kratzer, 1998) and refers to phrase structural units for their processing predictions. Therefore, it seems appropriate to compare EIC to a model of syntactic processing like Construal.

Comparing the two processing approaches, it appears that they make different predictions for the processing of complements and adjuncts: Construal predicts that complements, which are immediately parsed into full-fledged syntactic structures, are parsed highly incrementally, whereas the syntactic (and semantic) processing of adjuncts, which are loosely associated to the thematic processing domain, might be delayed. In contrast, EIC does not draw the line at the type of syntactic constituent involved, but relates the degree of incrementality to the distribution of two elements within LF structure. In the following, we will look at these two accounts in the light of reading time studies that investigated order variations of (i) two adjuncts (sentence and frame adverbials), (ii) an adjunct and a (moved) complement (sentence adverbial and subject), and (iii) a (moved) adjunct and a complement (manner adverbial and direct object). Before that, we will introduce assumptions about adjunct positioning in German and present acceptability judgment data that largely confirm these assumptions with regard to hierarchical structure and interactions with non-structural factors like referentiality and definiteness. These data are the basis for predictions with regard to online processing. The reading time data presented in this paper show that neither processing account can capture the whole pattern of results.

2   Ordering Complements and Adjuncts

It has been argued that not only complements, but also adjuncts have base positions in the German sentence structure. Frey and Pittner (1998) and Frey (2003) classify adverbials on the basis of their lexical-semantic properties into several adverbial types (like 'temporal adverbial', 'manner adverbial', etc.), which they group in a further step into five different syntactic classes (sentence adjuncts, frame adjuncts, event-external adjuncts, event-internal adjuncts, and process-related adjuncts), each adverbial class having a different base position. To obtain evidence for the assumed base position of a certain class, the authors apply established argument base position tests to adjuncts (e.g., the position of wh-phrases interpreted as indefinites, complex prefields, focus projection data or the scopal behavior of quantified phrases).

In the following, we will look at the acceptability and processing of different types of order variations with adjuncts and complements in the light of the theoretical assumptions by Frey (2003, 2004), as well as of the two processing approaches Construal and EIC.

2.1   Sentence Adverbials and Frame Adverbials

Sentence adverbials like *leider* ('unfortunately')*, wahrscheinlich* ('probably'), *erfreulicherweise* ('fortunately'), etc. express a speaker's attitude towards the proposition. Frame adverbials, on the other hand, are usually local or temporal adverbials that set up a frame for the interpretation of the whole sentence. Frame-setting modifiers are not part of what is properly asserted, but restrict the speaker's claim (see, e.g., Maienborn, 2001). They restrict the proposition's validity to certain places or times (compare *in Deutschland* ('in Germany') in (2)).

(2)   *In Deutschland bin ich weltberühmt.*

in Germany   am I   world-famous

'In Germany, I am world-famous.'

(Harald Juhnke, radio interview 1998, quot. Maienborn, 2001, p. 227)

Thus, semantically both adverbial types apply to the proposition. For that reason, base position approaches assign both adverbials a base position above the verb and its participants, which we analyze as adjunction to TP. With regard to the question how these two types of adverbials are positioned in relation to each other, Frey (2003) assumes that the base position of a frame adverbial is below that of a sentence adverbial, since the position above the sentence adverbial is reserved for *aboutness topics* (i.e., the constituent that identifies the entity or set of entities under which the information expressed in the comment constituent should be stored in the common ground content; see Reinhart, 1981; Krifka, 2008). Frey (2004) claims that every element that is marked as an aboutness topic has to move into this position, and every element that appears in this position is marked as an aboutness topic. Elements cannot be base-generated in this position.

A precondition for aboutness topics is that they are referential (see e.g. Reinhart, 1981; Molnár, 1991; Lambrecht, 1994). Frey claims that referential frame adverbials are possible aboutness topics. A non-referential frame adverbial, in contrast, cannot used as an aboutness topic and therefore cannot appear above a sentence adverbial (compare *in keinem Land* in (3a)).

(3)a.   *Otto ist *in keinem Land/in Deutschland erstaunlicherweise sehr berühmt*.
           Otto is in no country/in Germany astonishingly very famous
     b.   *Otto ist erstaunlicherweise in keinem Land/in Deutschland sehr berühmt*.
           Otto is astonishingly in no country/in Germany very famous

‘Astonishingly, Otto is very famous in no country/in Germany.’

A non-referential element like the frame adverbial *in keinem Land* (‘in no country’) has to appear in its base position, which is below sentence adverbials, whereas a referential frame adverbial like *in Deutschland* (‘in Germany’) can move to the position above the sentence adverbial.

Störzer (2017) varied the order of sentence adverbials (SA) and frame adverbials (FA) in sentences like the examples in (4).

(4)   *Eva meint, dass …*

         Eva means that …

a.   *wahrscheinlich auf Mallorca alle Urlauber betrunken sind.*   SA-FA$_{ref}$

b.   *auf Mallorca wahrscheinlich alle Urlauber betrunken sind.*   FA$_{ref}$-SA

         $\{$probably / on Mallorca$\}$ all   tourists   drunk   are

c.   *wahrscheinlich auf jeder Insel alle Urlauber betrunken sind.*   SA-FA$_{non-ref}$

d.   *auf jeder Insel wahrscheinlich alle Urlauber betrunken sind.*   FA$_{non-ref}$-SA

         $\{$probably / on every island$\}$ all   tourists   drunk   are

         ‘Eva thinks that probably on Mallorca / on every island all vacationers are drunk.’

According to Frey, we should see a preference for the order SA-FA, since he postulates the base position of a frame adverbial below that of a sentence adverbial. But as we saw above, there is a non-syntactic factor which might play a role here, namely the referentiality of the frame adverbial. A referential FA (‘on Mallorca’) can serve as an aboutness topic and therefore can appear above a SA as in (3b). In contrast, a universally quantified phrase like *auf jeder Insel* (‘on every island’) is assumed to be non-referential and therefore cannot serve as an aboutness topic.

On the basis of Frey (2003, 2004), together with the data from previous studies investigating the processing of word order variation in German discussed in Sect. 1, we should see an overall preference for the linear order SA-FA, reflecting the base positions in the syntactic structure. Furthermore, an interaction between syntactic position and referentiality is predicted, since a non-referential quantified phrase is not allowed as an aboutness topic, whereas a referential definite phrase can be used as a topic and should be acceptable in the designated topic position above SA.

Acceptability data by Störzer (2017) revealed a main effect of position as well as an interaction of the two factors (see Fig. 1). Furthermore, a main effect of referentiality was found.

The data do not show the predicted base position effect. Instead, Störzer found a reverse main effect of position with higher ratings for the derived order FA-SA. Inspection of the descriptive data in Fig. 1 shows that this effect is driven by the
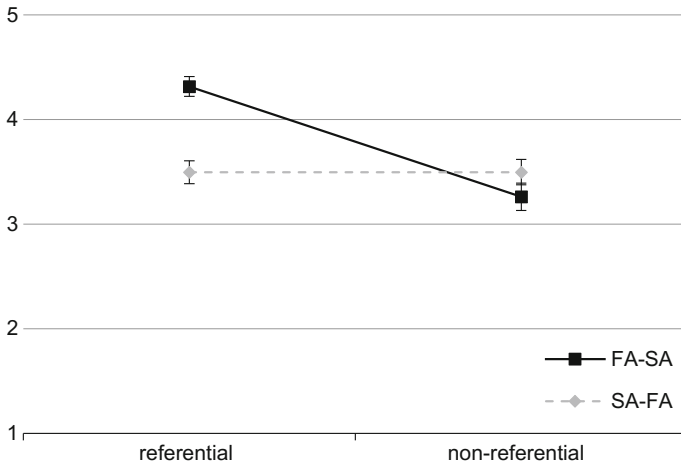
Fig. 1 Acceptability ratings on a Likert scale (5-1); *FA* frame adverbial, *SA* sentence adverbial (error bars indicate standard error)

exceptionally high ratings for FA-SA with referential FA. That means that a referential FA, containing a definite DP, is preferred in the position reserved for topics. The observed interaction confirms the prediction: the data reveal significantly higher ratings for the order SA-FA with non-referential FA and for the order FA-SA with referential FA. This pattern of results suggests that an element such as a referential FA preferentially moves to the designated topic position whereas a non-referential quantified phrase stays in its base position. Given the complexity of quantifiers (e.g., represented by an additional process of quantifier raising; see, e.g., Hackl, Koster-Hale, & Varvoutis, 2012) compared to definite DPs, the main effect of referentiality with lower ratings for sentences with quantified frame adverbials is not surprising.

As already discussed in Sect. 1, we can derive different predictions from Construal and EIC with regard to the incremental online processing of these order variations. Construal predicts no online effects in the region consisting of the two adjuncts, because both adverbials are only associated (and not finally attached) to the current thematic processing domain, the extended verbal projection. Note that in a head-final language like German, the relevant theta assigner, the verb, comes in after the critical region containing SA and FA. Both adverbials should be associated to TP. For this reason, EIC predicts immediate processing with online order effects. Since both adverbials are adjoined to TP, they belong to the same LF domain: Both adverbials modify the proposition. Given the assumptions by Frey (2003) and the rating data shown above, we should see an interaction of position and referentiality in the critical region hosting the two adverbials. Furthermore, we might also expect a base position effect in the online data, with shorter reading times for the base order SA-FA. According to Construal, we should not see these effects within the critical region, but later on, in the region of the theta assigner (the verb).
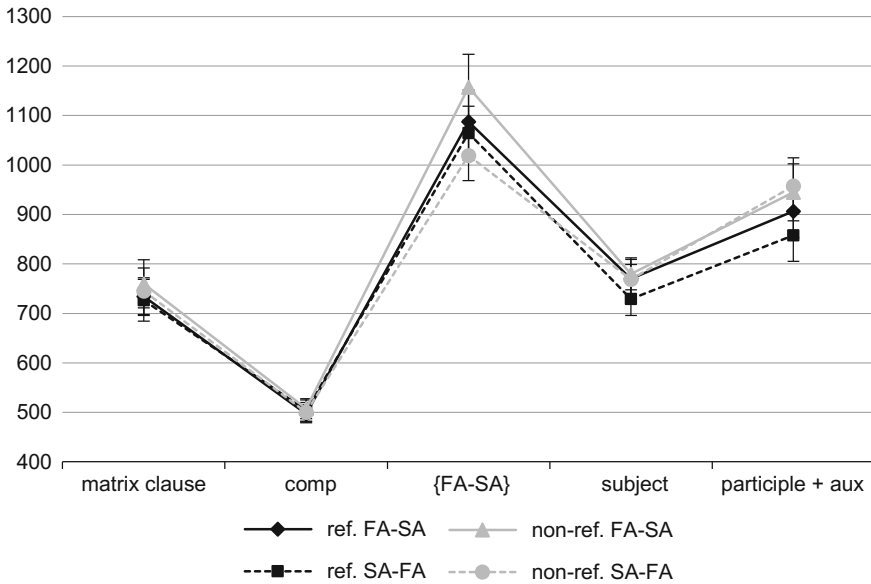
Fig. 2 Reading times in ms for Region 1–5; *FA* frame adverbial, *SA* sentence adverbial (error bars indicate standard error)

In a self-paced reading study, Störzer (2017) manipulated the position (SA-FA vs. FA-SA) and the referentiality (definite vs. quantified) of the frame adverbial (see examples in (4)). The sentences were segmented into five regions: the matrix clause (Region 1), complementizer (Region 2), sentence and frame adverbial (Region 3), subject (Region 4) and participle + auxiliary (Region 5). The results are presented in Fig. 2. In Region 1 and 2, which were identical for all four conditions, no significant effects were found. Region 3 revealed a significant main effect of position as well as a marginally significant interaction of the two factors position and referentiality. Single comparisons showed a significant difference for non-referential FA, with longer reading times for the order FA-SA, but no such difference for referential FA.

The following regions revealed a marginally significant spill-over effect of position (Region 4) and a significant effect of referentiality (Region 5), with longer reading times for sentences with quantified frame adverbials.

The pattern of results for Region 3 (and 4) reveals evidence for immediate processing and therefore confirms the predictions according to EIC, based on Frey's assumptions, and might be interpreted as evidence against Construal. Overall, we see shorter reading times for the assumed base order as well as a clear penalty for a non-referential phrase appearing in the topic position. In Region 5, Störzer found a delayed penalty for sentences with quantifiers, which was already seen in the rating data. This result can be explained by an additional process, namely quantifier raising (see, e.g., Hackl, Koster-Hale, & Varvoutis, 2012, for delays in quantifier processing).

The reading time data provide first evidence for the EIC. To find further evidence in favor of one of the two approaches, we will have a look at another type of word order variation.
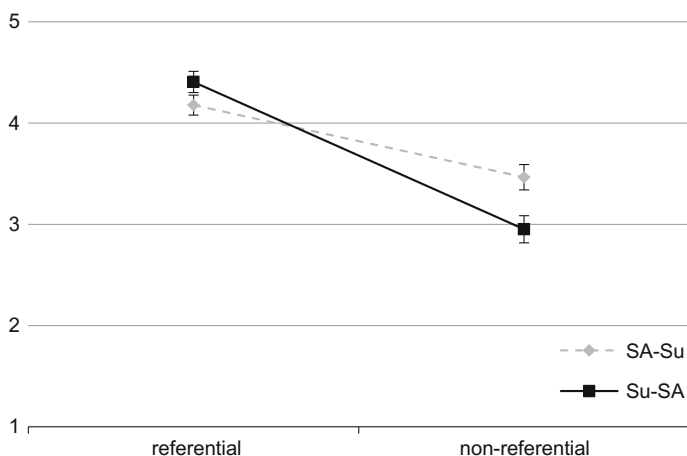
2.2   Sentence Adverbials and Subject

Störzer and Stolterfoht (2018) varied the order of sentence adverbials (SA) and the subject in sentences like those in (5).

(5)   *Der Nachbar erwähnte, dass …*

         The neighbor mentioned that …

a.   *wahrscheinlich der Junge den Wagen gewaschen hat.*   SA-subject$_{ref}$

b.   *der Junge wahrscheinlich den Wagen gewaschen hat.*   subject$_{ref}$-SA

        ⟨ probably / the boy ⟩   the car   washed   has

c.   *wahrscheinlich jeder Junge den Wagen gewaschen hat.*   SA-subject$_{non-ref}$

d.   **jeder Junge wahrscheinlich den Wagen gewaschen hat.*   subject$_{non-ref}$-SA

        ⟨ probably / every boy ⟩   the car   washed   has

        'The neighbor mentioned that probably the boy / every boy washed the car.'

According to Frey (2004), we should see a preference for the order SA-subject as in (5a, c), since he assumes that the base position of the sentence adverbial, which modifies the whole proposition, is above the subject, which is part of the event expressed by the VP.[1] Again the referentiality of the subject should play a role. A referential definite subject is a prototypical topic and is allowed to move across SA into the designated topic position as in (5b), whereas a non-referential subject cannot serve as an aboutness topic, as illustrated in (5d), and therefore has to stay in its base position below SA. Based on this assumption, we predicted a clear-cut syntactic preference for the order SA-subject only for non-referential quantified subjects, but not for referential ones, since a referential definite DP can move to the designated topic position and therefore appear above SA. Although we varied the order of a complement and an adjunct, note that the complement, the subject DP, is the moved element here. The SA stays in its base position for both orders. Given the results

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[1]For German, a widely accepted assumption with regard to phrase structure is a direct mapping of the thematic structure, encoded in the verb's lexical entry, onto the syntactic structure. The highest ranked argument, in our examples the subject, ends up in the highest position of the VP (see e.g., Haider, 1993).

Fig. 3 Acceptability ratings on a Likert scale (5-1); *SA* sentence adverbial, *Su* subject (error bars indicate standard error)

from the acceptability ratings by Störzer (2017), a main effect of referentiality with lower ratings for the more complex quantifier conditions is predicted.

The acceptability data by Störzer and Stolterfoht (2018) revealed a main effect of position and referentiality, as well as an interaction of the two factors (see Fig. 3), confirming the predictions formulated above. Single comparisons showed lower ratings for the order subject-SA for a quantified subject, and higher ratings for this order with a referential subject. The preference for a referential definite subject to appear in the topic position above SA is explained by the prototypicality of using a definite determiner phrase as an aboutness topic.

With regard to incremental online processing, the predictions that can be derived from Construal and the Garden-Path Model respectively, are not straightforward. It seems that there are two possible predictions, which are contradictory. With regard to the moved subject, a primary relation, the Garden-Path-Model might predict immediate processing with syntactic preference for the assumed syntactic base order SA-subject, and a penalty for the more complex derived order with a moved constituent. With regard to the adjunct involved, Construal might predict that SA is associated to the current thematic processing domain, namely the extended verbal projection, and no immediate processing in relation to the subject should take place. EIC also predicts no immediate processing, since the relevant units are located in different LF domains. The SA as a propositional adverbial is located in the highest LF domain, the CP, whereas the subject, which is part of the event, has to be interpreted within the VP. Therefore, delayed processing should be observed. Given the results discussed so far, we also expect to see an effect of referentiality, with longer reading times for sentences with a quantified subject.

In a self-paced reading study, Störzer and Stolterfoht (2018) manipulated the position (SA-Su vs. Su-SA) and the referentiality (definite vs. quantified) of the
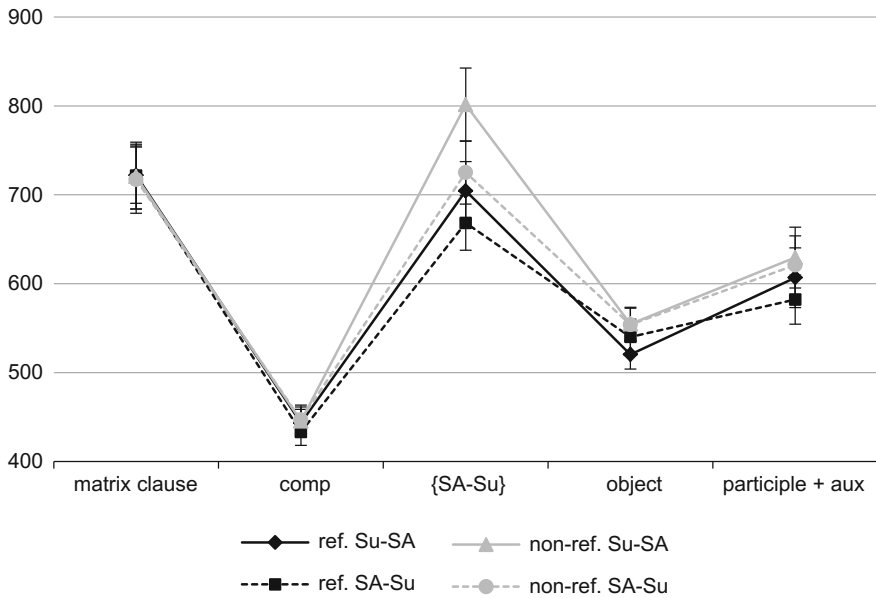
Fig. 4 Reading times in ms for the five regions; *SA* sentence adverbial, *Su* subject (error bars indicate standard error)

subject (see examples in (5)). The sentences were segmented into five regions: the matrix clause (Region 1), complementizer (Region 2), sentence adverbial + subject (Region 3), object (Region 4) and participle + auxiliary (Region 5). In Region 1 and 2, which were identical for all four conditions, no significant effects were found. Region 3 revealed a significant main effect of position, with shorter reading times for the assumed base order SA-subject, as well as a main effect of referentiality, with longer reading times for quantified subjects. For Region 4 and 5, a spill-over effect of referentiality was found (see Fig. 4).

The clear-cut syntactic preference supports the prediction derived from the Garden-Path Model. It seems that the subject complement is located in its base position in relation to SA immediately. The results are not predicted by the Construal principle with its assumption of loosely associating the adverbial to the extended verbal projection. Given that the Garden-Path Model and the Construal principle are part of one and the same model, the results can hardly be interpreted in favor of Construal.

The data are also evidence against the hypothesis derived from EIC, under which we expected delayed processing effects, and therefore no position effect in the critical region. But there might be an alternative explanation with reference to LF structure and a structural revision process. When the processor encounters the subject, the most plausible processing step is to place it in the specifier position of VP (or TP), its (surface) base position, which works fine with the order in which the subject follows SA.

When SA follows the subject, the processor has to revise the structure and move the subject in a position above the VP (or TP).

The interim conclusion is that order variations with (1) two adjuncts and (2) adjunct and complement both are processed immediately, which is not predicted by Construal, but might be explained by EIC. But there are open questions for future research with regard to the observed differences in processing these two types of order variations: Whereas for the processing of sentence and frame adverbials syntactic position and referentiality of the frame adverbial interact immediately, this type of interaction only appears in the offline data for sentence adverbials and the subject. Furthermore, increased reading times for quantified subjects appeared at the quantifier itself, whereas processing costs for quantified frame adverbials were delayed. It might be that the type of constituent (complement vs. adjunct) plays a role in these different temporal dynamics, but this has to be further tested.

All in all, the acceptability rating data confirm the assumptions concerning base positions in German sentence structure by Frey (2003, 2004). For both studies, we saw the predicted interaction of position and referentiality. Further research is necessary to explain the inconsistent data with regard to the preference for the assumed base order.

Finally, we will report a study on order variation with another type of complement-adjunct pair.

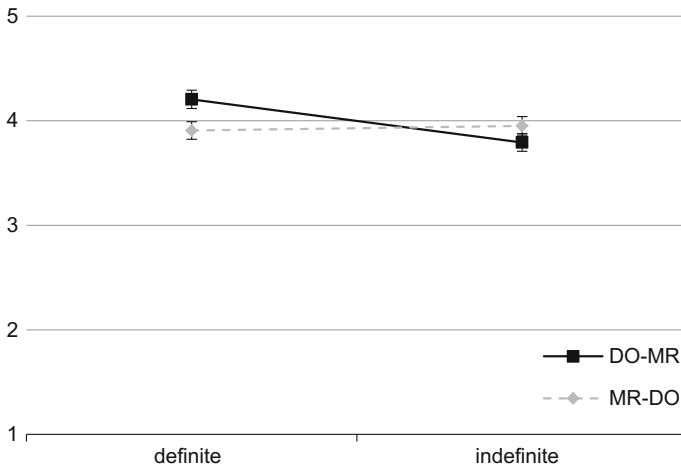## 2.3 Manner Adverbials and Direct Object

Gauza (2016) varied the order of manner adverbials (MR) and the direct object (DO) in sentences like the examples in (6).

(6)   *Elisabeth sagt, dass ...*

      Elisabeth says that …

a.   *Björn <u>das Gedicht</u> <u>laut</u> rezitiert.* DO_{def}-MR

b.   *Björn <u>laut</u> <u>das Gedicht</u> rezitiert.*   MR-DO_{def}

      Björn ⟨ the poem / loud ⟩ recites

c.   *Björn <u>ein Gedicht</u> <u>laut</u> rezitiert.* DO_{indef}-MR

d.   *Björn <u>laut</u> <u>ein Gedicht</u> rezitiert.*   MR-DO_{indef}

      Björn ⟨loud / a poem⟩ recites

   'Elisabeth says that Björn recites the poem loudly.'

Fig. 5 Acceptability ratings on a Likert scale (5-1); *MR* manner adverbial, *DO* direct object (error bars indicate standard error)

Based on intuitions with regard to scope ambiguities and the positioning of indefinite w-phrases, Frey (2003) concludes that the base position of process-related adverbials like MR is below the direct object. Therefore, we should see a preference for the order DO-MR as in (6a, c). The order MR-DO requires movement of the adverbial across the direct object, at least for sentences with definite DPs. For non-specific indefinite direct objects, it has been argued that they can be integrated or pseudo-incorporated into the predicate, and form a complex predicate together with the verb (Jacobs, 1993, 1999; Frey, 2001). The materials of the study allowed for a non-specific interpretation and therefore might be pseudo-incorporated. With the same experimental materials, Gauza (2016) showed that order preferences are modulated by the interpretation of the indefinite (specific vs. non-specific), which was determined by the preceding context.

If pseudo-incorporation takes place, MR is in its base position in both orders (6c, d), although it appears above the direct object in (6d). Therefore, we should see a preference for the linear order DO-MR, but only for definite DPs.

The acceptability ratings (see Fig. 5) confirm the preferences predicted on the basis of Frey (2003). We see a significant interaction of the two factors position and definiteness. Single comparison showed higher ratings for the base order DO-MR with a definite DO and higher ratings for the order MR-DO with indefinite DO, which was interpreted as a preference for the pseudo-incorporation of indefinites.

With regard to incremental online processing, Construal predicts no immediate processing in the region consisting of the adverbial and the object. For both orders, MR is associated to the current thematic processing domain, the verbal projection. Based on the assumptions by Frey and the rating data shown above, an interaction of the two factors position and definiteness (and a possible effect of the base order)
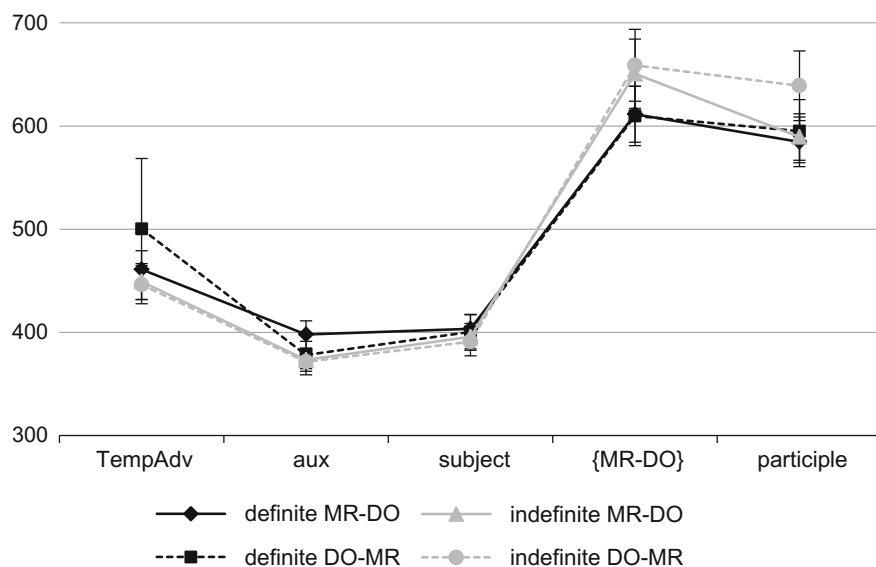
Fig. 6 Reading times in ms for Region 1–5; *MR* manner adverbial, *DO* direct object (error bars indicate standard error)

should be delayed. In contrast, EIC predicts online order effects and interaction with definiteness in the region hosting the adverbial and the object. Both units belong to the same LF domain, the event expressed by the VP.

In a self-paced reading study, Gauza (2016) manipulated the position (DO-MR vs. MR-DO) and the definiteness (definite vs. indefinite) of the direct object (see examples in (6)). For reasons of homogeneity of the whole experimental material set, another sentence structure was chosen (V2-sentences with a temporal adverbial in the position preceding the finite auxiliary). Furthermore, sentences were continued by adverbial clauses. The sentences were segmented into five regions: the temporal adverbial (Region 1), finite auxiliary (Region 2), subject (Region 3), manner adverbial + direct object (Region 4) and participle (Region 5).

The results are shown in Fig. 6. In Regions 1, 2 and 3, which were identical for all for conditions, no significant effects were found. Region 4 (MR + DO) revealed a significant main effect of definiteness with longer reading times for an indefinite DO. No significant effects were found in Region 5, or in the following adverbial clause.

Neither a main effect of position nor an interaction of the two factors in the critical region hosting the MR and DO and the following regions could be found.

The results are interpreted as evidence against EIC, which predicted immediate processing for units within the same LF domain, and might be interpreted as evidence in favor of delayed processing predicted by Construal. The interaction of position and definiteness only shows up offline. Nevertheless, we have to be cautious in

interpreting these results, since no delayed processing effects were found in the region of the theta assigner (Region 5) and the following adverbial clause.

The main effect of definiteness can be explained by the multiple interpretations of indefinites, which have at least three different readings in German (specific, non-specific and numeral). Since Gauza (2016) did not determine the reading of the indefinite, this ambiguity does not interact with position, and with the possibility of pseudo-incorporation, but, as already mentioned above, he was able to show this interaction in a follow-up study.

3   Summary and Discussion

Whereas the reported acceptability data confirm the assumptions derived from the literature on syntactic base positions of complements and adjuncts in German, the reading times show a quite heterogeneous pattern. The results from processing order variations of sentence and frame adverbials (Störzer, 2017) and sentence adverbials and subject (Störzer & Stolterfoht, 2018) both showed effects of immediate processing and were interpreted in favor of EIC. In contrast, results from processing order variations with manner adverbials and the direct object, for which EIC also predicted immediate effects, did not show any effect of order and interaction with the factor definiteness, which might be interpreted in favor of Construal. In sum, both accounts have difficulties in explaining the different behavior of order variations in online sentence processing. Therefore, the question arises whether there is an alternative explanation of the observed differences that can be tested in future research. If we look at sentence and frame adverbials, it appears that both are located within the same LF domain above the proposition (CP), but they are also both located outside the domain they modify, the proposition or TP. No specific element within this domain is required to analyze these two elements in relation to each other, and therefore, immediate processing can take place. In contrast to sentence and frame adverbials, a manner adverbial is located within the domain it modifies, the event expressed by the VP. Therefore, the complete event might be required to start the composition, which results in delayed processing. This idea fits well with results from processing aspectual mismatches in German that also showed delayed effects and for which it has been argued that the whole event has to be processed to start (aspectual) interpretation (see Bott & Gattnar, 2015). To further test this idea, we are planning a comparison of event-internal and event-external modifiers, for which we predict an online order preference for event-external modifiers as in the examples in (7a, b), but no such preference for event-internal ones as in (7c, d).

(7) *Elisabeth sagt, dass …*
     Elisabeth says that …

 a. *der Clown <u>während der Vorstellung</u> <u>in der Manege</u> ritt*.

 b. *der Clown <u>in der Manege</u> <u>während der Vorstellung</u> ritt*.

     the clown {in the arena/during the show} rode

     'Elisabeth says that the clown rode in the arena during the show.'

   c. *der Clown <u>auf dem Esel</u> <u>mit Geschick</u> ritt.*

   d. *der Clown <u>mit Geschick</u> <u>auf dem Esel</u> ritt.*

     the clown {on the donkey/with skill} rode

     'Elisabeth says that the clown rode on the donkey skillfully.'

To conclude, a model of sentence processing has to capture at least the following empirical facts: The observed similarities and differences in processing adjuncts and complements, the differences between the processing of different adjunct classes, as well as the temporal dynamics of complement and adjunct processing revealed by the discrepancies in online and offline data.

References

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

Beck, S., & Tiemann, S. (to appear). Towards a model of incremental composition. In Proceedings of Sinn und Bedeutung 21 (pre-print).

Boland, J. E. (2005). Visual arguments. *Cognition, 95,* 237–274.

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

Bornkessel, I., Schlesewsky, M., & Friederici, A. D. (2003b). Contextual information modulates initial processes of syntactic integration: The role of inter-versus intrasentential predictions. *Journal of Experimental Psychology. Learning, Memory, and Cognition, 29*(5), 871–882.

Bornkessel-Schlesewsky, I., & Schlesewsky, M. (2015). The argument dependency model. In G. Hickok & S. Small (Eds.), *Neurobiology of language* (pp. 357–369). Amsterdam: Academic Press.

Bott, O. (2010). *The processing of events*. Amsterdam: John Benjamins.

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

Clifton, C., Speer, S. R., & Abney, S. P. (1991). Parsing arguments: Phrase structure and argument structure as determinants of initial parsing decisions. *Journal of Memory and Language, 30,* 251–271.

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

Frazier, L., & Clifton, C., Jr. (1996). *Construal*. Cambridge: MIT Press.

Frazier, L., & Clifton, C., Jr. (1997). Construal. Overview, motivation, and some new evidence. *Journal of Psycholinguistic Research, 26*(3), 277–297.

Frey, W. (2001). About the whereabouts of indefinites. *Theoretical Linguistics, 27,* 137–161.

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.

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

Frey, W., & Pittner, K. (1998). Zur Positionierung der Adverbiale im deutschen Mittelfeld. *Linguistische Berichte, 176,* 489–534.

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

Gauza, H. (2016). *Position und Verarbeitung VP-interner Adjunkte*. Doctoral dissertation, University of Tübingen.

Hackl, M., Koster-Hale, J., & Varvoutis, J. (2012). Quantification and ACD: Evidence from real-time sentence processing. *Journal of Semantics, 29*(2), 145–206.

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

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

Jacobs, J. (1993). Integration. In M. Reis (Ed.), *Wortstellung und Informationsstruktur* (pp. 63–116). Tübingen: Niemeyer.

Jacobs, J. (1999). Informational autonomy. In P. Bosch & R. van der Sandt (Eds.), *Focus. Linguistic, cognitive and computational perspectives* (pp. 56–81). Cambridge: Cambridge University Press.

Krifka, M. (2008). Basic notions of information structure. *Acta Linguistica Hungarica, 55*(3), 243–276.

Lambrecht, K. (1994). *Information structure and sentence form: Topic, focus, and the mental representations of discourse referents*. Cambridge: Cambridge University Press.

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

Meng, M., Bader, M., & Bayer, J. (1999). Die Verarbeitung von Subjekt-Objekt Ambiguitäten im Kontext. In I. Wachsmuth & B. Jung (Eds.), *Proceedings der 4. Fachtagung der Gesellschaft für Kognitionswissenschaft* (pp. 244–249). St. Augustin: Infix.

Molnár, V. (1991). *Das TOPIK im Deutschen und Ungarischen*. Stockholm: Almqvist & Wiksell International.

Reinhart, T. (1981). Pragmatics and linguistics: An analysis of sentence topics. *Philosophica, 27*(1), 53–94.

Scheepers, C., Hemforth, B., & Konieczny, L. (2000). Linking syntactic functions with thematic roles: Psych-verbs and the resolution of subject-object ambiguity. In B. Hemforth & L. Konieczny (Eds.), *German sentence processing* (pp. 95–135). Dordrecht: Kluwer.

Schütze, C. T., & Gibson, E. (1999). Argumenthood and English prepositional phrase attachment. *Journal of Memory and Language, 32,* 96–114.

von Stechow, A., & Beck, S. (2015). Events, times, and worlds: An LF architecture. In C. Fortmann, W. Geuder, A. Lübbe, & I. Rapp (Eds.), *Situationsargumente im Nominalbereich* (pp. 13–46). Tübingen: Niemeyer.

Stolterfoht, B. (2005). *Processing word order variations and ellipses: The interplay of syntax and information structure during sentence comprehension*. (MPI Series in Human Cognitive and Brain Sciences 55). Leipzig: Max-Planck-Institut für Kognitions- und Neurowissenschaften.

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: TOBIAS-lib Publikationssystem.

Störzer, M., & Stolterfoht, B. (2018). Is German discourse-configurational? Experimental evidence for a topic position. *Glossa: A Journal of General Linguistics, 3*(1), 20, 1–24.

Traxler, M. (2008). Lexically independent priming in online sentence comprehension. *Psychonomic Bulletin & Review, 15*(1), 149–155.

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