

An Information Structural Account of German Integrated Verb Second Clauses^{*}

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Abstract. In this paper we present data of German integrated verb second clauses and verb final relative clauses that seem problematic for a compositional analysis. We show that although the compositional analysis of restrictive relative clauses in (Janssen, 1982) can be adapted, it cannot be sustained due to overgeneration and must be considered unintuitive in light of the paratactic syntactic analysis for the verb second clauses from Gärtner (2001). Hence we present a conceptually simpler analysis along the lines of (Endriss and Gärtner, 2005), which makes use of information structural properties of the involved clauses. We conclude with a brief discussion on the compositional status of such an approach.

Key words: verb-second, relative clauses, information structure

1. Introduction

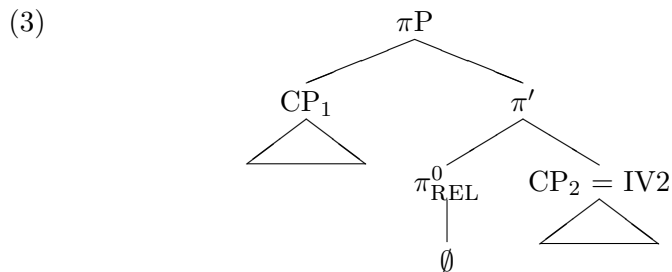
German provides for a special brand of verb second clauses, which can replace standard verb final relative clauses in certain contexts. This is illustrated in the following examples (1a) and (2a) from (Gärtner, 2001). Here (/) indicates a non-final marking of the boundary (e.g. a high boundary tone or continuation rise) and thus the second clause appears *integrated* into the first clause w.r.t. intonation. In (Gärtner, 2001), these instances are therefore referred to as *integrated verb second clauses* (IV2). The examples in (1b) and (2b) show corresponding versions where the second clause functions as a restrictive relative clause (RC in the following). In (1c) and (2c), IV2 are

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constrasted with independent V2 declarative sentences. Here both sentences constitute distinct intonational units, indicated by (\backslash), a final boundary marking (e.g. falling tone, drop, pause, etc.).

- (1) a. Das Blatt hat eine Seite, (/) die ist ganz schwarz.
The sheet has one side that is completely black.
- b. Das Blatt hat eine Seite, (/) die ganz schwarz ist.
The sheet has one side that completely black is.
'The sheet has one side that is completely black.'
- c. # Das Blatt hat eine Seite. (\backslash) Die ist ganz schwarz.
The sheet has one side. It is completely black.
'The sheet has one side. It is completely black.'
- (2) a. Apfeldorf hat viele Häuser, (/) die stehen leer.
Apfeldorf has many houses that stand empty.
- b. Apfeldorf hat viele Häuser, (/) die leer stehen.
Apfeldorf has many houses that empty stand.
'Apfeldorf has many houses that are vacant.'
- c. Apfeldorf hat viele Häuser. (\backslash) Die stehen leer.
Apfeldorf has many houses. They stand empty.
'Apfeldorf has many houses. They are vacant.'

Concerning the syntax, Gärtner (2001) argues that IV2 have to be treated paratactically as follows (where π stands for *paratactical*).



This is evidenced by, among other things, the fact that IV2 must occur extraposed, i.e. at the right edge of CP_1 . The following examples illustrate this, where an infelicitous CP_1 internal use of IV2 (4a) is contrasted with a standard verb last RC (4b) and an IV2 at the right edge of CP_1 (4c).

- (4) a. * Die Apfeldorfer haben viele Häuser, (/), die stehen
The Apfeldorfians have many houses that stand
heute leer, gebaut.
nowadays empty built.

- b. Die Apfeldorfer haben viele Häuser, (/), die heute
The Apfeldorfians have many houses that nowadays
leerstehen, gebaut.
empty stand built.
- c. Die Apfeldorfer haben viele Häuser gebaut, (/), die stehen
The Apfeldorfians have many houses built that stand
heute leer.
nowadays empty.
'The Apfeldorfians have built many houses that are vacant nowa-
days.'

Further support for a paratactic analysis comes from the fact that the pronoun is not a relative pronoun but a weak demonstrative. For instance, the weak demonstrative *da* (*there*) cannot head an RC (5a) but an IV2 (5b), whereas it is the other way round with the relative pronoun *wo* (*where*) (5c,d).

- (5) a. * Es gibt Länder, *da* das Bier ein Vermögen kostet.
There exist countries there the beer a fortune costs.
- b. Es gibt Länder, *da* kostet das Bier ein Vermögen.
There exist countries there costs the beer a fortune.
- c. Es gibt Länder, *wo* das Bier ein Vermögen kostet.
There exist countries where the beer a fortune costs.
- d. * Es gibt Länder, *wo* kostet das Bier ein Vermögen.
There exist countries where costs the beer a fortune.
'There are countries where beer costs a fortune.'

We will not go into any further detail about the syntactic analysis of IV2s, but refer the reader to (Gärtner, 2001) for an elaborate discussion.

Considering the semantic facts, the IV2 in (1a,2a) show a similar behaviour as the restrictive relative clause counterparts in (1b,2b) concerning interpretation. For instance, (1a) and (1b) both say that the sheet has one completely black page. This is in contrast with the sequence of V2 declarative clauses in (1c), where the pragmatically odd meaning is conveyed that the sheet has only one page and that this page is black. This effect is due to a Horn-scale implicature which arises after having processed the first sentence. The fact that this implicature does not arise in the case of (1a) provides another argument for the non-autonomy of IV2. Though syntactically (1a) and (1c) are both analysed as S-S constructions in the sense of (Janssen, 1982)(see below), in case of IV2 the initial sentence is not computed in isolation and no implicature is triggered. Likewise, (2a,b) state that there are many vacant houses in Apfeldorf. Again this is different from the (c) variant, which makes the statement that Apfeldorf overall has many houses. At first sight, from the semantic point of view, it seems that an analysis

of the IV2 phenomena should yield a restrictive interpretation of the clause w.r.t. to the DP it seems attached to. Such a relative clause analysis was proposed by Gärtner (2001) and Brandt (1990).

Let us in the following explore the possible readings of (2) in closer detail. According to Partee (1988), *many* is ambiguous between a proportional and a cardinal reading.

- (6) cardinal : $\text{many}_{\text{card}}(A)(B) \equiv |A \cap B| \geq n$
(n a contextual number)
- proportional : $\text{many}_{\text{prop}}(A)(B) \equiv \frac{|A \cap B|}{|A|} \geq k$
(k a contextual percentage)

In a proportional reading of (2a), an interpretation of the second clause as restrictive w.r.t. the noun *Häuser* would result in the statement that many vacant houses are such that they are in Apfeldorf*:

- (7) $\text{many}_{\text{prop}}[x, (\text{house}(x) \wedge \text{vacant}(x)), \text{have}(\text{apfeldorf}, x)]$

However, as a closer look reveals, this restrictive relative clause construal does not give the correct results. (7) is clearly not what (2a) and (2b) mean. They rather say that many of the houses in Apfeldorf are such that they are vacant. So the interpretation we are actually looking for is the following.

- (8) $\text{many}_{\text{prop}}[x, (\text{house}(x) \wedge \text{have}(\text{apfeldorf}, x)), \text{vacant}(x)]$

This seems to suggest the following generalization:

- (9) *many* incorporates the entire remaining matrix clause information into its restrictor, while the information of the second clause constitutes its nuclear scope.

So the restrictive relative clause analyses of Gärtner (2001) and Brandt (1990) seem to be on the wrong track (for the proportional reading).

Due to the ambiguity of *many*, one would also expect that there is a cardinal reading with IV2s. This prediction is confirmed by the following data, where *many* can be interpreted as cardinal:

- (10) Es gibt viele Häuser, (/) die stehen leer.
 It gives many houses that stand empty.

Sentence (10) in its preferred reading states that the number of empty houses is (surprisingly) high. It does not necessarily mean that among the

* In the remainder of this text, we use a more appropriate tripartite notation $\text{many}[x, A(x), B(x)]$ which makes the bound variable explicit and should be read as being equivalent to $\text{many}(A)(B)$

contextually relevant houses there are many empty ones. This shows that also with IV2, the cardinal reading is still available**. However, with the cardinal reading of *many* the generalization from above cannot be tested. This is due to the fact that the restrictor and nucleus cannot be told apart due to the symmetry of $\text{many}_{\text{card}}$.

For other quantifiers, the generalization in (9) is also easy to overlook, as the two different ways of determining the restrictor and nuclear scope yield equivalent interpretations. For instance, in the case of (1a) and (1b) the statement that there is a side of the sheet which is black is equivalent to the statement that there is a black side which the sheet has. Note that similar equivalences hold for all quantifiers D which are conservative and symmetric as the following holds (cf. Barwise and Cooper, 1981).

$$(11) \quad D(A \cap B, C) \equiv D(A \cap C, B)$$

Because of this fact, we conclude that it only *seems* that IV2 and verb final clauses are interpreted as restrictive relative clauses as Gärtner (2001) and Brandt (1990) claim. The actual analysis has to go along the lines of generalization (9) made above, which becomes clear when considering non-conservative/non-symmetric quantifiers.

Complicating the picture even further, the generalization does not seem to hold for all quantifiers. Consider the following variants of (2) containing *die meisten* (*most*) instead of *viele* (*many*).

- (12) a. * Apfeldorf hat die meisten Häuser, (/) die stehen leer.
 Apfeldorf has the most houses that stand empty.
 b. Apfeldorf hat die meisten Häuser, (/) die leer stehen.
 Apfeldorf has the most houses that empty stand.
 ‘Most houses that are vacant are in Apfeldorf.’

As (12a) illustrates, the IV2 construction is illicit with a DP headed by *die meisten*. In fact, only a proper subclass of indefinites licenses the use of IV2s as the following examples illustrate.

- (13) a. Ich kenne viele / drei Linguisten, (/) die haben rote Haare.
 I know many / three linguists that have red hair.
 b. * Ich kenne die meisten / wenige / keine / die Linguisten, (/)
 I know the most / few / no / the linguists
 die haben rote Haare.
 that have red hair.
 ‘I know ... linguists who are redheaded.’

With a verb final clause, (12b) actually has the restrictive RC interpretation that was unwarranted in the *viele* case. (12b) indeed states that Apfeldorf has the largest group of (contextually relevant) vacant houses.

** Thanks to Sigrid Beck and Manfred Krifka for calling our attention to this.

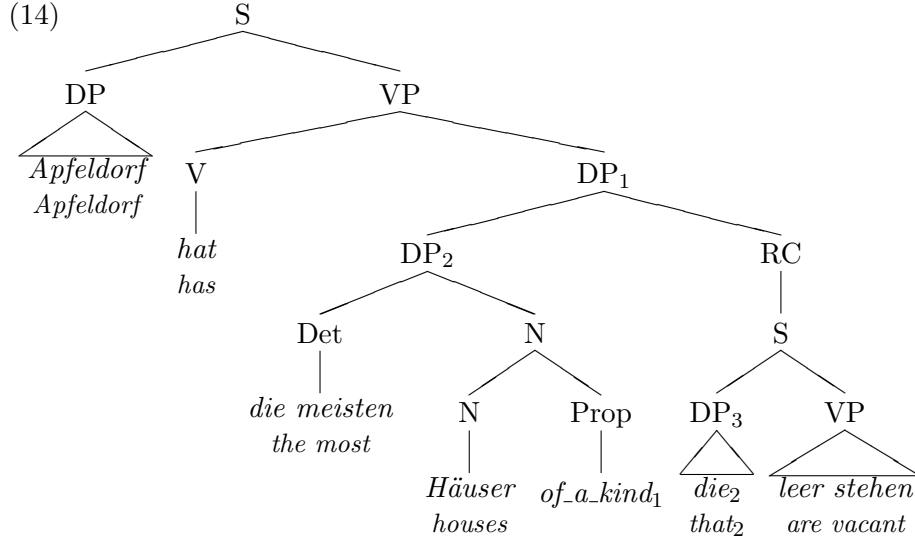
At first sight, the paratactic analysis in (3) on the one side and the desired interpretation on the other side constitute an obvious problem for a compositional analysis. If semantic composition solely followed syntactic structure, one would expect that the meaning of the CP_1 (and in particular the combination of the quantifier with its arguments) is fully computed at the point it combines with the meaning of the CP_2 . But then it would be unclear how the CP_2 could restrict the NP argument of that quantifier in the way it does, given that there is no evidence of a trace that could be used for a corresponding interpretation (e.g. for reconstruction). In the following section we will investigate to what extent the compositional treatment of relative clause constructions from (Janssen, 1982) can be adapted to yield the desired readings.

2. Relative Clauses and Compositionality

In (Janssen, 1982), Theo Janssen discusses the compositional interpretation of three options of RC attachment to its adjacent DP in English: attachment to the noun (the *CN-S analysis*), attachment to the DP (the *T-S analysis*, where ‘T’ stands for ‘term’, henceforth *DP-S analysis*), and attachment to the determiner (the *Det-S analysis*). Furthermore he investigates the more intricate case of RC constructions in Hittite from (Bach and Cooper, 1978), where the relative clause is a sentence that is adjoined left or right of the matrix sentence. With respect to the S-S attachment, Hittite resembles German IV2 sentences. Janssen proposes an *S-S analysis* of Hittite relative clauses that is based on his DP-S analysis of relative clauses for English. In the following we will illustrate the DP-S analysis of restrictive RCs and extend it to an S-S analysis that accounts for the German integrated non-restrictive IV2 cases*.

* The exposition here is simplified and differs slightly from the one in Janssen, e.g. with respect to category names and the treatment of the relative clause without the Montagovian ‘such that’ construct. Furthermore we gloss over the exact combinatorics of the verb with its arguments, e.g. by Quantifying-In or by raising them to an appropriate higher type in the spirit of Hendriks (1993).

Consider example (12b), where the second clause is a (standard) verb final relative clause that has to be interpreted restrictively, as we argued above. Janssen’s DP-S analysis proceeds along the following structure.



Janssen derives the restrictive interpretation of the second clause by introduction of a syntactic variable *of_a_kind*₁ (translated as a set type variable P_1), which combines with the noun *Häuser* to $\lambda x[\text{house}(x) \wedge P_1(x)]$. This serves as the restrictor of *most* which yields the DP interpretation

$$(15) \llbracket \text{DP}_2 \rrbracket = \lambda Q[\text{most}[x, (\text{house}(x) \wedge P_1(x)), Q(x)]]$$

The second clause is interpreted as the open proposition *vacant*(z_2) containing the free variable z_2 , that corresponds to the relative pronoun* *die*₂/*that*₂. At the RC node, an application of an indexed unary rule abstracts over this variable and transforms the open proposition into the property

$$(16) \llbracket \text{RC} \rrbracket = \lambda z_2 \text{vacant}(z_2)$$

By application of another indexed rule at the DP_1 node, the RC can eventually be ‘quantified in’ the resulting DP.

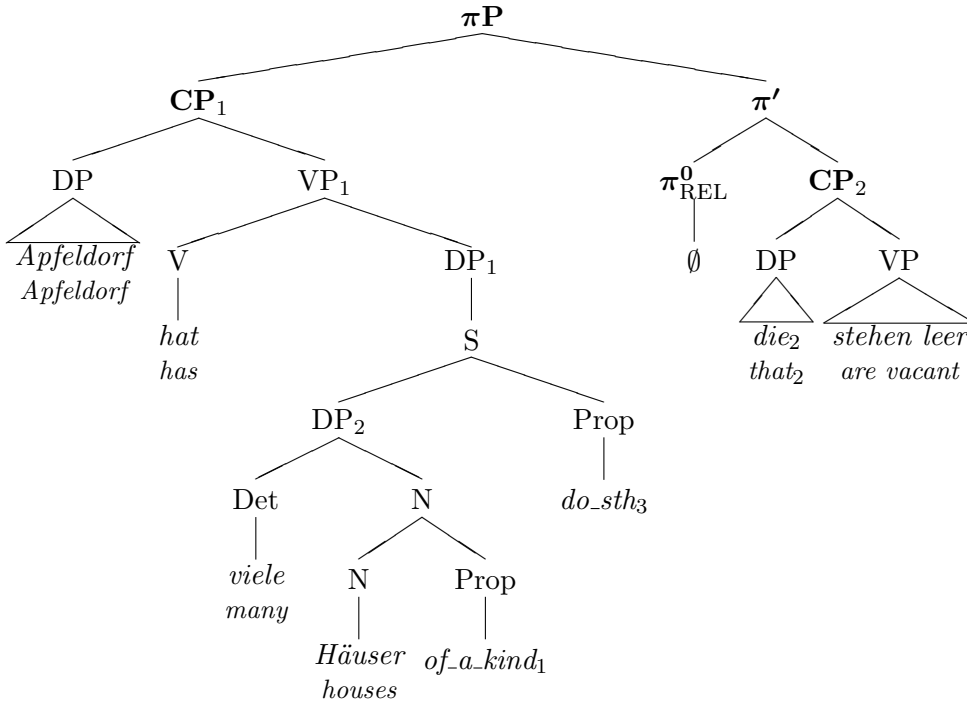
$$(17) \llbracket \text{DP}_1 \rrbracket = \lambda P_1 \llbracket \text{DP}_2 \rrbracket (\llbracket \text{RC} \rrbracket) = \lambda Q[\text{most}[x, (\text{houses}(x) \wedge \text{vacant}(x)), Q(x)]]$$

Completing the analysis of the sentence we get the correct restrictive interpretation

$$(18) \text{most}[x, (\text{house}(x) \wedge \text{vacant}(x)), \text{have}(\text{apfeldorf}, x)]$$

* As mentioned before, we simplify matters slightly compared to the original Montagovian treatment of RCs, which would derive *such that he*₂ *is vacant* at this point.

This DP-S analysis with its approach to ‘quantify in’ later information can be extended to IV2s and the paratactic analysis in (3) by deferring the ‘quantifying-in’ of the CP_2 information until the analysis of CP_1 is completed. Furthermore, in order to account for the integrated non-restrictive interpretation of (2a), we could propose an additional syntactic variable do_sth_n (translated as a property variable Q_n) for the nuclear scope of the quantifier in the DP. Then the remaining matrix clause information and the CP_2 information can ‘quantify in’ the restrictor variable (corresponding to $of_a_kind_m$) and the nuclear scope variable (do_sth_n), respectively.



According to this construal, DP_1 is interpreted as

$$(19) \llbracket DP_1 \rrbracket = \lambda P_1 \text{many}[x, (\text{house}(x) \wedge P_1(x)), Q_3(x)]$$

abstracting over the restrictor variable P_1 . Hence, the matrix verb *hat* (*has*) ends up in the restrictor of its object.

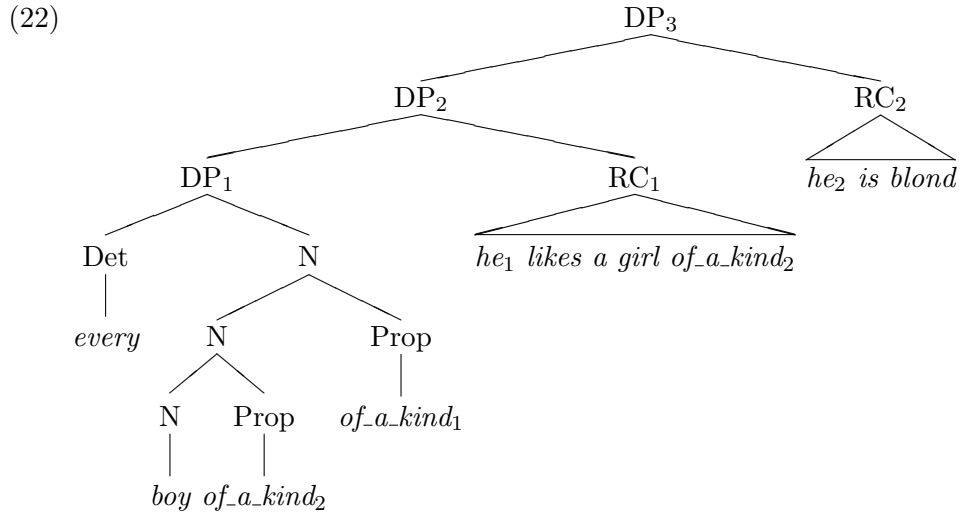
$$(20) \llbracket VP_1 \rrbracket = \lambda y \text{many}[x, (\text{house}(x) \wedge \text{have}(y, x)), Q_3(x)]$$

The VP finally combines with the subject to yield the interpretation of the first clause. Eventually, ‘quantifying in’ of the π' (which now plays the role of RC in (14)) results in

$$(21) \lambda Q_3 \llbracket CP_1 \rrbracket (\llbracket \pi' \rrbracket) = \text{many}[x, (\text{house}(x) \wedge \text{have}(\text{apfeldorf}, x)), \text{vacant}(x)]$$

which is the desired, integrated non-restrictive reading for (2a). Although this is the correct meaning, this analysis suffers from certain problems.

First, such a ‘quantifying in’ analysis overgenerates*. For instance, in an analysis of the DP *every boy who likes a girl who is blond* (with stacked relative clauses for *boy*), there is nothing that could prevent the same syntactic variable *of_a_kind₂* to occur twice: once in the ‘matrix’ DP *every boy* and once in the embedded DP *a girl* as follows.



‘Quantifying in’ the RC₁ interpretation into the DP₁ using *of_a_kind₁* results in

$$(23) \llbracket DP_2 \rrbracket = \lambda Q \forall y [(boy(y) \wedge P_2(y) \wedge \exists x [girl(x) \wedge P_2(x) \wedge like(y, x)]) \rightarrow Q(y)].$$

The final ‘quantifying in’ of the RC₂ results in

$$(24) \llbracket DP_3 \rrbracket = \lambda Q \forall y [(boy(y) \wedge blond(y) \wedge \exists x [girl(x) \wedge blond(x) \wedge like(y, x)]) \rightarrow Q(y)]$$

representing the unavailable interpretation *every blond boy who likes a blond girl*. The operation of ‘quantifying in’ the RC₂ simultaneously binds both variables P_2 and contributes its information to both the restrictor of the matrix and the embedded NP. This is unwarranted, of course. Janssen (1982) himself points to others problems of a DP-S analysis concerning scope relations with stacked relative clauses and concludes that only a CN-S analysis can account for these data. However, this option is not available here. The paratactic syntactic analysis of IV2 constructions and the desired interpretations make it necessary to adopt an S-S analysis that makes heavy use of ‘quantifying in’. Such an analysis runs into problems similar to the one in (22). For instance, a sentence such as

* Thanks to an anonymous ESSLLI reviewer for pointing this out to us.

- (25) Eine Norwegerin kennt eine Schwedin, (/) die ist blond.
 A Norwegian knows a Swede that is blond.

‘A Norwegian knows a Swede who is blond.’

receives an unavailable interpretation that can be paraphrased as *a blond Norwegian knows a blond Swede*, if both DPs share the same syntactic variable do_sth_i .

Second, nothing would prevent the ungrammatical cases with illicit DPs in (13b) to be derived in the same way as the grammatical ones in (13b) (cf. Gärtner, 2001, fn. 23). In order to rule out these derivations, one would need to impose a restriction requiring that only some quantifiers allow for the introduction of a syntactic variable do_sth_n (such as *viele (many)* or *drei (three)*), while others do not (such as *die meisten (most)*, *wenige (few)* or *keine (no)*). But there is nothing in this approach that could give an explanation for such a restriction, which would hence remain pure stipulation.

Maybe unsurprisingly, a compositional analysis is possible by unleashing the full power of the Montagovian framework. However, such an approach is prone to heavy overgeneration and it is hard to see, how an intuitively adequate compositional analysis along the syntactic structure alone could work for these examples. In the next section we propose an interpretation mechanism which is less dependent on syntactic structure but makes heavy use of *information structure* instead.

3. IV2 and Information Structure

In Section 1, we have already mentioned the fact that IV2 clauses do not build a fully separate intonational unit, but have to be integrated into the main clause. Matrix clause and IV2 then form one information structural unit together (cf. Brandt, 1990). This is also evidenced by the fact that focus-sensitive particles such as *sogar (even)* can find their associate within the IV2, which is not self-evident given the paratactic analysis (see Gärtner, 2001, p.110)*:

- (26) a. Ich kenne sogar Leute, (/) die lesen CHOMskys Bücher.
 I know even people that read Chomsky’s books.
 ‘I know people who even read Chomsky’s books.’
 b. Even Chomsky is an x such that I know people who read x’s books

Furthermore, IV2 constructions share certain characteristics with *presentational structures* (cf. Lambrecht, 1988), such as (27) from Lambrecht.

* Note that *sogar (even)* can associate with elements that are not syntactically c-commanded by it.

- (27) Once upon a time, there was an old cockroach who lived in a greasy paper bag.

In (27) the matrix clause introduces a new discourse referent (a *pre-topic* as Endriss and Gärtner (2005) call it), which simultaneously serves as an (*aboutness*) *topic* of the attached relative clause in the sense of (Reinhart, 1981). According to (Lambrecht, 1988, p. 322), presentational structures are ‘minimal processing units’, contrary to a sequence of isolated sentences.

The close connection of the two clauses can be realized in some variants of English by *presentational amalgams*, also called *contact clauses* (Lambrecht, 1988, p. 319).

- (28) There was a farmer had a dog.

As Lambrecht himself notes, these characteristics are similar in the case of IV2s. Here CP₁ sometimes carries little ‘informational content’, besides the introduction of a new pre-topic which is used as the topic in CP₂ for predication. Consider the following pair, for instance (see Endriss and Gärtner, 2005).

- (29) a. Im Sommer gab es plötzlich diesen Moment, (/) da
 In summer gave it suddenly that moment there
 stimmte einfach alles.
 fitted simply everything.
 ‘There was that moment in the summer where everything was perfect.’
 b. #Im Sommer gab es plötzlich diesen Moment (\).

The IV2 construction in (29a) is felicitous. Here CP₁ serves the purpose of introducing that moment in summer, of which CP₂ states that it was perfect. On the other hand, CP₁ as an isolated sentence sounds odd due to its little ‘informational content’ as such.

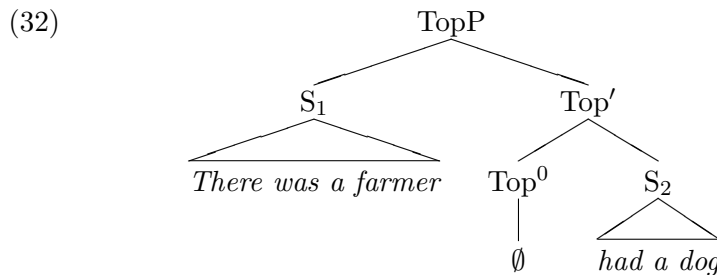
Yet another point in favour of the topical status of the CP₁ is the fact that (2a) (repeated below as (30b,31b)) is not good as an answer to a focus inducing question, as the following question-answer turn shows.

- (30) a. Was gibt es in Apfeldorf?
 ‘What is there in Apfeldorf?’
 b. # (Apfeldorf hat) viele Häuser, (/) die stehen leer.
 Apfeldorf has many houses that stand empty.
 ‘Apfeldorf has many houses that are vacant.’

The oddity arises as the (pre-)topic established in CP₁ and the IV2 clause cannot be focussed together. However, (2a) is particularly well suited as a reply to *Tell me something about (the houses in) Apfeldorf!*, which establishes the topical status of the CP₁.

- (31) a. Erzähl mal was über (die Häuser in) Apfeldorf!
 ‘Tell me something about (the houses in) Apfeldorf!’
 b. Apfeldorf hat viele Häuser, (/) die stehen leer.
 Apfeldorf has many houses that stand empty.
 ‘Apfeldorf has many houses that are vacant.’

All these findings let Endriss and Gärtner (2005) conclude that CP_1 and CP_2 are closely connected and form one information structural unit, in which CP_1 constitutes the topic and CP_2 the comment. This resembles the analysis of den Dikken (2005) of presentational amalgams of Lambrecht (1988), which is as follows.



Both den Dikken (2005) and Lambrecht (1988) directly apply their analyses of presentational sentences to IV2-constructions as well. However, Endriss and Gärtner (2005) note some issues that suggest that such a direct correspondence does not hold. For instance, whereas IV2 constructions are illicit with certain quantifiers (such as *few N* or *nothing*; cf. (13)), presentational amalgams seem to allow for them as the following examples from (den Dikken, 2005) and (Engdahl, 1997) suggest:

- (33) a. There are very few people would credit what I have done.
 b. There is nothing can be done about it.

4. An Information Structural Analysis

Given these findings, an analysis that makes heavy use of information structure seems to suggest itself. We propose such an analysis by combining two proposals, namely the information structure sensitivity of weak quantifiers put forward in (Herburger, 2000), and the treatment of topicality from (Ebert and Endriss, 2004). We cannot elaborate these proposals in full detail here, but give a short overview in the following, while referring the reader to the seminal sources for further elaboration.

4.1. BASIC INGREDIENTS

The first ingredient to our combined approach stems from the facts elaborated in (Herburger, 2000), that the semantic arguments of weak quantifiers (in the sense of Milsark (1977)) are determined by information structure. Focal material constitutes the nuclear scope and non-focal material the restrictor, independent of the syntactic structure.

- (34) a. Many Scandinavians [won the Nobel prize in LIterature]_F
 many[*x*, scandinavian(*x*), nobel_prize_winner(*x*)]
 b. Many [ScandiNAvians]_F won the Nobel prize in literature.
 many[*x*, nobel_prize_winner(*x*), scandinavian(*x*)]

As the interpretations for each of the above examples show, (34a) can only mean that many Scandinavians are such that they won the nobel prize, whereas (34b) states that many of the Nobel prize winners are Scandinavians. In this latter case, the focussed complement of *many* determines the nuclear scope and the VP the restrictor, although the syntactic structure dictates the exact opposite. However, as opposed to (Herburger, 2000) where the decisive information structural notion is *focus* we assume it to be *topic*. More precisely, we assume that topical material constitutes the *restrictor*, whereas non-topical/comment material constitutes the nucleus of an information structure sensitive quantifier. This is in line with e.g. Partee (1991) and Chierchia (1995), who also argue for such a correspondence in the context of adverbial quantification.

The second ingredient is our approach in (Ebert and Endriss, 2004), where we give a formal characterization of the concept of aboutness topicality, that simultaneously accounts for the wide scope behaviour of a certain class of indefinites. We can only sketch those parts, that are essential to the analysis here and refer the reader again to the seminal article for details.

In (Ebert and Endriss, 2004), we take the aboutness topic metaphor literally, that Reinhart (1981) has put forward. She suggests that if a constituent constitutes the aboutness topic of a sentence, it provides the address at which the information of the comment is stored. In this view, referential items such as proper names can function as aboutness topics quite naturally. For instance, a sentence such as

- (35) [Peter]_T ate bananas.

can be regarded as being about Peter, stating that he ate bananas. Following Reinhart's metaphor, the information of eating the bananas would then be stored under the storage address provided by the discourse referent established by the utterance of *Peter*. It is important to note that under this view of topicality also certain quantificational DPs can serve as aboutness topics if they can provide a suitable 'storage address'. For instance,

(36) [Three horses]_T ate bananas.

can be seen to be about a set of three horses in the same way as the preceding sentence could be regarded as being about Peter. In (Ebert and Endriss, 2004) we spell this out formally by looking for a suitable representative of the corresponding generalized quantifier that stands proxy for the entire quantifier and that is used as the argument in the predication of the information conveyed by the comment. We take one of the quantifier’s *minimal witness sets* (Barwise and Cooper, 1981) to be such a suitable representative. Minimal witness sets can, roughly speaking, be seen as those sets of a generalized quantifier which do contain only the ‘essential’ and no ‘disturbing’ elements. In the case of (36), a set of three horses would be such a minimal witness set of the generalized quantifier corresponding to *three horses*, which itself would comprise all sets containing at least three horses and other, possibly non-horse, elements. Spelled out formally, the following operator *MW* returns the set of all minimal witness sets when applied to a generalized quantifier.

(37) $MW := \lambda G \lambda P. P \in G \wedge \neg \exists Q [Q \in G \wedge Q \neq P \wedge Q \subseteq P]$

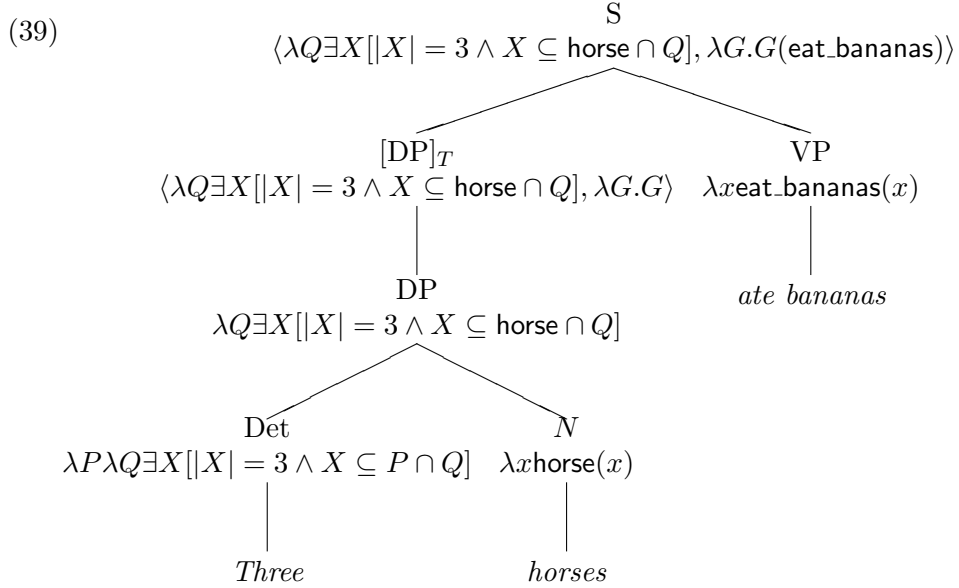
Considering the generalized quantifier semantics we follow (Kadmon, 1985). In this construal the generalized quantifier corresponding to the DP *three horses* comes out as

(38) $G_{\text{three_horses}} := \lambda Q \exists X [|X| = 3 \wedge X \subseteq \text{horse} \cap Q]$

The application of the minimal witness operator (37) to this generalized quantifier yields just the set of minimal witness sets of $G_{\text{three_horses}}$, i.e. all sets that contain exactly three horses and nothing else.

In order to keep track of the topical/comment material in the derivation of the meaning of a sentence, we employ *structured meanings* (Krifka, 1992) to compositionally build up structured representations, which are then subject to a process of topic interpretation. Those structured meanings are of the form $\langle T, C \rangle$ and consist of a topical component T and a comment component C , such that in each step of the derivation the application of the comment to the topic $C(T)$ yields the ‘standard’ semantics of the respective constituent. While the meaning composition of the comment proceeds in the standard way, topic marking of a constituent with meaning m introduces a topic-comment structure $\langle m, \lambda X.X \rangle$, where X is a variable of the same type as m . The following illustrates the derivation of the final structured meaning

representation for sentence (36), where the DP *three horses* is marked as aboutness topic of the sentence.



The first component of the resulting structure is the generalized quantifier corresponding to the aboutness topic *three horses*, and the second component corresponds to the commentary *ate bananas*. Here G is a variable that ranges over generalized quantifiers, i.e. it is of type $\langle \langle e, t \rangle, t \rangle$. As mentioned before, application of the comment to the topical component yields the ‘standard’ meaning of the sentence.

$$(40) \exists X [|X| = 3 \wedge X \subseteq \text{horse} \cap \text{eat_bananas}]$$

However, as pointed out above, we want to interpret the topical component along the lines of Reinhart’s aboutness topicality metaphor by making use of a suitable representative for that component. The idea is then to introduce a new discourse referent that refers to one such representative and use that discourse referent as the argument for the predication of the comment. The following schema illustrates the result of adopting this topic interpretation principle for the general case of an underlying topic-comment structure $\langle T, C \rangle$.

$$(41) \exists X [X \in MW(T) \wedge C(X)] \quad X \text{ a new discourse referent}$$

In the concrete case of the structured meaning representation (39) for (36), our topic interpretation principle yields the following result (where we abbreviate the generalized quantifier for perspicuity and assume an appropriate ‘distributional’ type shift from X to $\lambda Q.X \subseteq Q$ to resolve the type conflict arising in the comment component).

$$(42) \exists X [X \in MW(G_{\text{three_horses}}) \wedge X \subseteq \text{eat_bananas}] \quad X \text{ a new DR}$$

This represented meaning can be paraphrased as: there is a set of three horses, such that those horses ate bananas. Note that in this simple case this representation is equivalent to the ‘standard’ representation (40) that would arise if no topic marking was involved. This illustrates that topic marking in simple cases may actually have no truth conditional effect besides the establishment of a suitable discourse referent that the sentence is about.

One decisive feature of this analysis is, however, that a truth conditional effect arises in more complicated examples as the representation (43c) of (43a) illustrates.

- (43) a. If [three horses]_T eat bananas, I will be very surprised.
- b. $\langle G_{\text{three_horses}}, \lambda G.(G(\text{eat_bananas}) \rightarrow \text{surprised}(I)) \rangle$
- c. $\exists X[X \in MW(G_{\text{three_horses}}) \wedge (X \subseteq \text{eat_bananas} \rightarrow \text{surprised}(I))]$

Note that (c) shows what has been called the *exceptional wide scope reading* for *three horses* in (a), stating that there are three horses, such that I will be very surprised if those horses ate bananas. We can derive this reading as the generation of a suitable address/discourse referent (resulting in the existential closure of X) for the topic marked DPs basically happens in a separate step of topic interpretation* irrespective of any syntactic islands such as an *if*-clause. Hence the analysis put forward in (Ebert and Endriss, 2004) correlates aboutness topicality to exceptional wide scope readings. More precisely, we predict that a topic-marked quantifier always takes (possibly exceptional) wide scope.

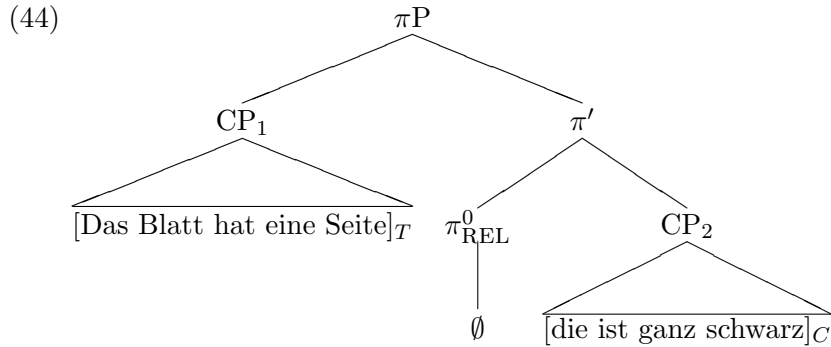
The second decisive feature of our approach in (Ebert and Endriss, 2004) is the definition of a criterion for the question, which quantificational DPs actually make good aboutness topics. We state a Topic Condition on the lexical semantics of generalized quantifiers that classifies a quantifier as ‘good aboutness topic’ if it provides suitable representatives that yield no truth-conditional effect and at most add to the anaphoric possibilities (by virtue of introducing a new discourse referent) for certain simple comments. As the outline of the analysis of (36) above shows, *three horses* is such a DP, which passes the Topic Condition. On the other hand, DPs corresponding to monotone decreasing quantifiers will fail the Topic Condition, as their unique minimal witness set is the empty set, which would yield a truth-conditional difference when used as a ‘storage address’. In addition to all monotone decreasing quantifiers, such as *few horses*, *less than three horses*, etc., other quantifiers that fail the Topic Condition are the non-monotonic ones, such as *exactly three horses*, and monotone upward quantifiers that allow for maximal reference anaphoric uses only (cf. Kadmon, 1985), such

* which can be reanalyzed as a separate speech act of topic establishment (see Endriss, submitted, for details)

as *at least three horses* and *most horses*. And indeed, those quantifiers have been observed to be unable to take exceptional wide scope and to be illicit in certain positions that can host topical constituents only (cf. Frey, 2004). Well suited in such positions are bare numerals and singleton indefinites, for instance, which are quantifiers that pass the Topic Condition. Hence our approach can account for the exceptional wide scope behaviour of certain quantificational DPs *and* simultaneously derive the correct class of DPs that can be topic-marked. Again, we cannot go into the details of the classification and refer the reader to the seminal paper.

4.2. ANALYSING IV2

The sensitivity to information structure (and the insensitivity to syntactic structure) is the key to accounting for IV2 constructions. As argued above, the CP_1 constitutes the topic, whereas the CP_2 contains comment information. Combining the observations from (Herburger, 2000) with the approach of Ebert and Endriss (2004), the derivation of the desired readings works straightforwardly. Let us look at (1a) again, repeated as (44) with the indication of the topic marking of the CP_1 material and the comment marking of the CP_2 .



Following our modified view of (Herburger, 2000), the weak quantifier introduced by the determiner *eine* (*a*) takes topical material in its restrictor and comment material in its nucleus. Hence, as the CP_1 containing the determiner is topical, its entire content is incorporated into the restrictor of that quantifier.

$$(45) \llbracket CP_1 \rrbracket = \lambda P[\exists x[\text{side}(x) \wedge \text{has}(\text{page}, x) \wedge P(x)]]$$

As this constitutes the topical part of the entire expression, we end up with the following structured meaning in our approach from (Ebert and Endriss, 2004).

$$(46) \langle \llbracket CP_1 \rrbracket, \lambda G.G(\text{black}) \rangle$$

Applying our topic interpretation principle to this structured meaning finally results in

$$(47) \exists X[X \in MW(\llbracket CP_1 \rrbracket) \wedge X \subseteq \text{black}]$$

stating that there is a (minimal witness set consisting of) a side the page has, and that this side is black. Note that this illustrates that for a symmetric quantifier such as *ein (a)* the restrictor cannot be told apart from the nuclear scope. It hence only *seems* that IV2 clauses are interpreted as standard restrictive relative clauses, i.e. in the restrictor. This difference comes out in the case of proportional *many* in the following analysis (48), where the IV2 clause information ends up in the nuclear scope and yields the desired interpretation.

- (48) a. [Apfeldorf hat viele Häuser]_{TOP}, (/) [die stehen leer]_C
 b. $\llbracket CP_1 \rrbracket = \lambda P[\text{many}[x, (\text{house}(x) \wedge \text{have}(\text{apfeldorf}, x)), P]]$
 c. $\langle \llbracket CP_1 \rrbracket, \lambda G.G(\text{vacant}) \rangle$
 d. $\exists X[X \in MW(\llbracket CP_1 \rrbracket) \wedge X \subseteq \text{vacant}]$

(48d) states that there is a minimal witness set of many houses in Apfeldorf and that those houses are vacant. Unfortunately, this natural language paraphrase is slightly misleading at this point. It is important to note that in the proportional reading of *many* (see (6)), the minimal witness set X is a minimal set such that the ratio *houses in Apfeldorf which are X/houses in Apfeldorf* is larger than some contextually determined percentage k . Hence this minimal witness set is in the same way contextually dependent on this percentage as the determination of the truth conditions for *many* in general. In particular, the contextually determined percentage k must be the ‘right’ percentage that compares houses in Apfeldorf to vacant houses in Apfeldorf in the same way as it must be the ‘right’ percentage comparing the ‘right’ things in all other uses of proportional *many*. Crucially, the reading in (d) is different from one that states that Apfeldorf (overall) has many houses and that all those houses are vacant, which would capture the truth conditions of two subsequent declarative clauses as in (2c). It is furthermore distinct from the reading represented by (7) where the IV2 would be analysed as being restrictive w.r.t. *houses*.

4.3. DISCUSSION

The straightforward combination of the proposals of (Herburger, 2000) and (Ebert and Endriss, 2004) allows for the correct derivation of the desired readings of IV2 constructions by recurrence to the information structural

facts we have argued for in the preceding section. In the following we briefly discuss further issues and predictions.

4.3.1. *Licit Quantifiers*

The first point that can be explained with this combined approach concerns the class of determiners that license IV2 constructions. As we have illustrated in (13), some determiners such as *most*, *few*, *no* are illicit in these cases. These restrictions again fall out of the combination of the two approaches mentioned above as follows.

First, recall that Herburger's (2000) observation excludes strong quantifiers such as *die meisten* (*most*) due to their insensitivity to information structure. These quantifiers take their arguments syntactically and hence will be 'saturated' by the material of the first clause alone. Therefore the IV2 clause cannot be integrated any more. A similar explanation holds for definites*.

Second, according to the topical status of the entire CP₁ clause, the involved quantifier must be of topical status also. As pointed out above, in (Ebert and Endriss, 2004) we give a characterization of quantifiers that can be topical by alluding to the ability of a quantifier to provide a suitable storage address/discourse referent. This Topic Condition rules out the remaining quantifiers in question such as *wenige* (*few*)**. Overall we predict to see neither strong quantifiers (such as *most*) nor non-topical quantifiers (such as *few*) in IV2 constructions, which seems to be borne out.

4.3.2. *Wide Scope*

As pointed out above, the mechanism of topic interpretation of (Ebert and Endriss, 2004) always derives a (possibly exceptional) wide scope reading for the topical DP. Hence we predict that the affected information structural quantifier in IV2 constructions also takes wide scope. This seems to be at odds with examples like the following from (Gärtner, 2001).

- (49) Jedes Haus hat ein Zimmer, (/) in dem ist es gemütlich.
 Every house has a room, in that is it cosy.

* A Russellian construal of definites is ruled out on the same grounds. An individual type construal leads also to a 'saturation' of the first clause already, without the possibility of further integration of more information. A different explanation is mentioned in (Gärtner, 2001) and elaborated in (Endriss and Gärtner, 2005), where it is argued that a definite containing a familiarity presupposition is incompatible with the proto-assertional character of IV2.

** Note that the topical status of *viele* (*many*) is not entirely clear. Reinhart (1997) regards *many* as a *wide scope indefinite*, i.e. an indefinite that can take scope out of syntactic islands. As we argue in (Ebert and Endriss, 2004), the class of wide scope quantifiers coincides with the class of topical quantifiers, although we do not discuss the topical status of *many* in particular.

Here it seems that *ein Zimmer (a room)* can indeed vary with the houses. However, as pointed out in (Gärtner, 2001, p. 131f) already, we are faced with an apparent narrow scope reading that is in fact an instance of a wide scope *functional* reading in this case. Those readings can be distinguished from genuine narrow scope readings by inspection of possible follow up contexts (cf. Groenendijk and Stokhof, 1984). While the former allow for pair-list continuations, the latter require the statement of a follow-up expression that can be interpreted as a functional expression. In the case at hand, we could for instance elaborate further by stating

- (50) Nämlich das Wohnzimmer.
 Namely the living room.

but not by

- (51) Haus Nr. 1 das Badezimmer, Haus Nr. 2 das Schlafzimmer, ...
 House No. 1 the bathroom, house no. 2 the bedroom, ...

Hence we assume the DP *ein Zimmer (a room)* in (49) to be a functional expression, i.e. to denote a function f from houses to cosy rooms, from the start. This function is then subject to the topic interpretation principle in the same way as non-functional DPs. The resulting representation would then represent a wide scope functional reading roughly as follows.

- (52) $\exists f[f \text{ is a function to cosy rooms} \wedge \forall x[\text{house}(x) \rightarrow \text{have}(x, f(x))]]$

Again, we cannot elaborate on this issue here but refer the reader to (Ebert and Endriss, to appear) and in particular to (Endriss, submitted), where the necessary distinction between genuine narrow and wide scope functional readings is discussed at length, the notion of *naturalness* of the involved functions is elaborated, and an extension of the approach in (Ebert and Endriss, 2004) is given.

4.3.3. *Relative Clauses*

Concerning verb final clauses, we noted in the preceding section that the interpretation for (2b) is the same as for the IV2 clause. However, this is only true for an ‘out-of-the-blue’ utterance with a certain information structure. Actually the interpretation of the relative clause should vary with the information structure if we assume the mechanism of Herburger (2000), contrary to IV2 constructions where the information structural properties are restricted as described above*. The following examples illustrate the possible variations in interpretation.

* Following earlier work by Wechsler (1991) and Reis (1997) (among others), GärtnerGärtner (2001,2002) assumes that V2-clauses possess (proto-)assertional force, which prevents them from being fully backgrounded or serving as purely topical information.

- (53) A: Kennst du viele Linguisten?
 ‘Do you know many linguists?’
 B: (Eigentlich nicht, aber) ich kenne viele Linguisten, die [über IV2 forschen.]_F
 ‘(Actually no, but) I know many linguists, who [work on IV2].’
 $\text{many}[x, (\text{linguist}(x) \wedge \text{know}(l, x)), \text{work_on_iv2}(x)]$
- (54) A: Was für Bekannte hast du denn so?
 ‘What kinds of friends do you have?’
 B: Ich kenne (beispielsweise) [viele Linguisten, die über IV2 forschen.]_F
 ‘I know [many linguists, who work on IV2], (for instance).’
 $\text{many}[x, \text{know}(l, x), (\text{linguist}(x) \wedge \text{work_on_iv2}(x))]$
- (55) A: Hast du schon mit vielen IV2-Forschern zusammengearbeitet?
 ‘Have you collaborated with many IV2 researchers?’
 B: (Zusammengearbeitet nicht, aber) ich [kenne]_F (zumindest) viele Linguisten, die über IV2 forschen.
 ‘(I haven’t collaborated with them, but at least) I [know] many linguists, who work on IV2.’
 $\text{many}[x, (\text{linguist}(x) \wedge \text{work_on_iv2}(x)), \text{know}(l, x)]$

Despite identical syntactic structure, the meanings of (53–55) differ and are fully determined by information structure, which is induced by the preceding questions.

In the preceding section we showed that a compositional analysis along the syntactic structure must be considered unintuitive and inadequate due to overgeneration. In this section it turned out that an information structural approach can much more naturally account for the data.

5. Conclusion

In this paper we have presented an analysis of German IV2 constructions on the basis of information structure, which can be extended to standard relative clauses. Such an analysis derives distinct readings of the three sentences in (53)–(55) despite their common syntactic structure. Whether this approach can be called compositional depends on the exact implementation of the meaning composition, on which we have not elaborated here in full detail. For instance, in Herburger’s analysis the determiner is *Q-raised* and then the information structural parts are mapped correspondingly by *focal mapping*. Therefore Herburger arrives at the following LF for (34b).

- (56) [[Many won the Nobel Prize in literature]][ScandiNAvians won the Nobel Prize in literature]]

Then, obviously, this restructured configuration can be interpreted compositionally. However, due to the necessary restructuring of the syntactic parts prior to interpretation, we would not want to call such an approach fully compositional. Our approach, as well as others such as (Krifka, 1992), uses structured meanings to more directly account for the contribution of information structure to semantics. However, the meaning composition still goes along the syntactic structure alone.

In fact, it has been observed that some informational structural issues seem to be independent of syntactic restrictions altogether. First, let us cite the observations of (Herburger, 2000) again, where the restrictor and the nucleus of a weak quantifier are determined by information structure and possibly counter to syntactic findings. Second, it is well known that association with focus is island-free, i.e. that a focus sensitive particle may associate with a focus embedded in a syntactic island. The following example is just one case in point, taken from (Krifka, 2006).

(57) John only introduced the man that [Jill]_F admires most to Sue.

This sentence has a reading that can be paraphrased as: The only person such that John introduced the man that this person admires most to Sue is Jill. Third, there are cases of non-constituent focus, where a focus phrase arguably does not coincide with a syntactic constituent, as the following example from (Krifka, 1992) illustrates.

(58) a. What happened to John?
b. [Sue kissed]_F him.

We would like to think of information structure as a separate level on a par with syntax in an extended definition of compositionality. For instance, the mapping of topic and focus into the restrictor/nuclear scope could be defined as a compositional operation, because the interpretation of the sentence is determined by the interpretations of its *information structural* parts. This is a rephrased version of the principle of compositionality which is usually assumed to talk about *syntactic* parts. Therefore meaning composition could go along syntactic structure as well as information structure. How exactly such a framework could be implemented is a difficult question which we did not touch here, but we hope that we could at least give some further evidence that such a line of research would be worth pursuing.

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