Linearizing Parentheticals in German: The Limitations of Phrase Structure

Jesse Tseng
Seminar für Sprachwissenschaft
Universität Tübingen

ESSLLI Workshop
"Linguistic Theory and Grammar Implementation"
August 17, 2000

In recent literature, several authors have proposed handling aspects of German syntax using linearization approaches, as opposed to traditional phrase structure (PS) analyses. In a PS grammar, constituent structure completely determines surface word order. PS expansion rules specify not only the categorial identity of the daughters in a local tree, but also their relative ordering. In a linearization grammar, this close link between constituent structure and linear word order is broken, and word order is handled by separate linearization rules that may or may not reflect the structural analysis. Such an approach offers clear advantages in the treatment of phenomena like discontinuous constituency and variable word order, which are obviously problematic for PS grammars.

The analysis of German sentence structure (i.e., the similarities and differences among V1, V2, and V-final clauses) has given rise to proposals including some form of linearization Kathol (1995), Uszkoreit (1987). Similarly, scrambling in the Mittelfeld (Reape, 1994) and verbal cluster formation (Bouma & van Noord, 1998; Kathol, 1996) have been targets for linearization analyses. For all of these phenomena, PS analyses are also available, using no separate linearization component (although other complications such as transformations and empty categories are required instead).

This paper presents some observations made while developing an HPSG-style grammar (without a linearization component) for a fragment of German. By taking advantage of the considerable expressive power of HPSG, it turns out that interesting and imaginative PS analyses can be found for quite a wide range of syntactic phenomena. In attempting to extend our fragment to include parentheticals, however, we hit against the limits of phrase structure. The placement of parentheticals in their host clauses cannot be satisfactorily accounted for with traditional PS rules. On the other hand, a linearization-based analysis appears promising.

1 Parenthetical Properties

1.1 Placement

A huge variety of grammatical elements can be grouped under the label "parenthetical," including items with widely divergent properties, in particular distributional properties. Generally speaking, every position is a potential host position for some parenthetical, but a given parenthetical may not necessarily exhibit a wide range of placement possibilities with respect to its host.

1.1.1 Meta-linguistic comments

The following examples from Pittner (1995) show parentheticals intervening between a determiner and and its N' and between a preposition and its NP complement:

(1) a. Sicherlich ist dieser—wenn man so will—offizielle Rückblick nur ein Teil dessen, was 1992 für jeden von uns bedeutete.
'To be sure, this—if you like—official view of the past was just part of what 1992 meant for all of us.'

b. Einer der Berater sucht ... Ökonomen mit—so der Text seiner Stellenanzeige—guten schriftlichen Ausdrucksformen, möglichst Publikationserfahrung.
'One of the advisers is looking for economists with—according to the text of his job announcement—good writing style, publication experience if possible.'

These parentheticals have a meta-linguistic effect with scope over the immediately following material. In example (1a), the parenthetical encourages the reader/listener to accept the use of the adjective *offizielle* as a characterization of *Rückblick*. In example (1b), the parenthetical indicates that the rest of the sentence is a quotation or close paraphrase of the job announcement text.

Similar examples can be found with such meta-linguistic parentheticals in practically any position. In every case, however, the placement of the parenthetical is fixed: it must appear immediately before the "commented" material, however much it may disrupt the constituent structure of the utterance.

Assuming that we want to deal with this phenomenon syntactically, a first approximation is to allow parenthetical elements to be left adjoined at any node. This accounts for the free placement, although it no doubt leads to overgeneration and structural ambiguity. Furthermore, in cases where the scope of the parenthetical "comment" is not a single constituent, this left adjunction analysis would not be able to provide a satisfactory representation.

With respect to linearization, these parentheticals do not pose a very interesting problem. Although any position can in principle host some parenthetical, if we look at a particular parenthetical with a particular scope, the placement possibilities are severely restricted.

1.1.2 Clausal parentheticals

In the rest of the discussion, I will turn instead to a class of parentheticals that on a case-by-case basis exhibit more interesting linearization properties. These are parentheticals hosted by, and having scope over, an entire clause. The following examples are taken from Reis (1995b):

(2) a. Wo wohnt sie, meinst du, seit der Trennung?
'Where has she been living, do you think, since the separation?'

b. Hans—so sagt Karl—hat Fritz getroffen.
'Hans—says Karl—met Fritz.'

c. Der Vorhangstoff ist, wie Peter findet, zu blau.
'The curtain fabric is, Peter finds, too blue.'

Within this class there is still significant variation; for example, there is a distinction between prosodically and interpretationally integrated parentheticals as in (2a) and non-integrated ones as in (2b). What they have in common is the ability to appear in a range of positions within the host clause. The preferred positions may vary for different subclasses of parentheticals, but broadly speaking a number of positions can be identified as niches for clausal parentheticals.

The simplified descriptive generalization offered by Reis (1995b) is that parentheticals must be peripheral to maximal projections. This condition correctly rules out clausal parentheticals intervening between Det and N′, for example, but it fails to block several other ungrammatical configurations:

(3) a. * Fragt er, [$_S$ wo wohnt sie seit der Trennung] ?
b. * Wo wohnt, fragt er, [$_{NP}$ sie] seit der Trennung?
c. * Wo wohnt sie seit, fragt er, [$_{NP}$ der Trennung] ?
d. ? Ob, fragt er, [$_{VP}$ Maria seit der Trennung in Berlin wohnt] ?

A more restrictive list of possible positions is given by Altmann (1981): parentheticals can appear before and after the finite verb, between constituents in the Mittelfeld, and in final position. This description still overgenerates in allowing parentheticals to intervene between the finite verb and Wackernagel pronouns, as in (3b). Furthermore, the following V1 and V-final examples are wrongly allowed, since the parenthetical element occurs before the finite verb:

(4) a. * Fragt er, wohnt sie seit der Trennung in Berlin?
b. * das Buch, das du ihm geschenkt, glaube ich, hast

In the following discussion, I assume that the following are allowable parenthetical positions:

(5) a. MF: between Mittelfeld items (complements and adjuncts)
b. VF: between the Vorfeld constituent and the V2 verb
c. POST-V: between the fronted (V1 or V2) verb and a non-pronominal Mittelfeld item
d. FINAL: clause final position

These possibilities are illustrated in the following examples:

(6) a. Maria (glaubt er) möchte (glaubt er) das Theorem (glaubt er) heute (glaubt er) beweisen (glaubt er).
'Maria, he believes, wants to prove the theorem today.'
b. obwohl Maria (glaubt er) das Theorem (glaubt er) heute (glaubt er) beweisen möchte (glaubt er)

All other positions are excluded. The following cases deserve particular emphasis:

(7) a. ¬INIT: clause initial position (possibly following a complementizer/conjunction)
b. ¬PPRO: directly preceding an unstressed Wackernagel pronoun
c. ¬VC: within the verbal cluster

Examples of ungrammatical parenthetical placement are given here:

(8) a. * Glaubt er, Maria möchte das Theorem beweisen.
b. * obwohl (glaubt er) Maria (glaubt er) es beweisen (glaubt er) möchte

There are no doubt exceptions and additions that one could make to the conditions in (5) and (7) to achieve greater descriptive accuracy. For example, there seems to be a tendency for parentheticals not to appear before the subject; this affects some cases of POST-V and may be more accurate than ¬INIT in the case of V-final CPs and relative clauses. I will stick with the seven conditions listed here, however, as a first approximation.

In Section 3 I present a number of accounts of parenthetical placement. Before that, though, it is necessary to introduce the core aspects of our PS grammar.

2 Sentence Structure

We have implemented a German grammar using HPSG representations, but with constituent structure and linear order determined by PS rules. In this section I introduce the rules needed to account for German sentence structure. Note that in the following discussion I will use familiar descriptive terms like "movement" and "extraction," but of course our analysis is in fact non-transformational.

2.1 Verb movement

We adopt a verb trace analysis to relate V-final and fronted-verb (V1 and V2) structures (cf. Kiss and Wesche (1991)). Roughly speaking, the finite verb has a base position at the end of every clause, where it determines complement selection and receives modifiers, but then in V1 and V2 structures the finite verb is moved to the left of the Mittelfeld. The main advantage of this analysis is that the structure of the Mittelfeld and of the rechte Satzklammer (verb cluster) remains the same whether the finite verb appears in front or at the end. This approach predicts correctly that in both cases we should see the the same sequence (or sequences) of elements in the Mittelfeld and verb cluster, and the same grammatical relations holding between them (government, quantifier/modifier scope, binding, and so on).

More formally, the position of the finite verb is determined by the value of the VFORM attribute: finite verbs in final position are marked [VFORM : *f-incomp*] while fronted verbs are [VFORM : *f-comp*]. Functionally incomplete verbs can become functionally complete via the following lexical rule:

(9)

$$\begin{bmatrix}\text{LOC } \boxed{1}\begin{bmatrix}\text{VFORM } \textit{f-incomp}\end{bmatrix}\end{bmatrix} \mapsto \begin{bmatrix} \text{VFORM } \textit{f-comp} \\ \text{COMPS } \left\langle \begin{bmatrix} \text{HEAD } \begin{bmatrix}\textit{v-trace}\\ \text{DSL } \boxed{1}\end{bmatrix} \\ \text{COMPS } \langle\,\rangle \\ \text{CONT } \boxed{2}\end{bmatrix}\right\rangle \\ \text{CONT } \boxed{2}\end{bmatrix}$$

The output of this rule is a functionally complete verb that subcategorizes for a saturated verbal complement headed by a verbal trace element. All of the relevant properties of the original input verb are copied into this complement's DSL ("double slash") value. This information is passed down via the Head Feature Principle to the verbal trace, which takes its valence and content specifications from its DSL value:

(10) Lexical entry for verbal trace

$$\begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{v-trace} & \\ \text{VFORM} & \textit{f-incomp} \\ \text{DSL} & \begin{bmatrix} \text{VALENCE} & \boxed{1} \\ \text{CONT} & \boxed{2} \end{bmatrix} \end{bmatrix} \\ \text{VALENCE} & \boxed{1} \\ \text{CONT} & \boxed{2} \end{bmatrix}$$

The verbal trace therefore turns out to be a "silent" version of the original V-final verb, with the same subcategorization frame and semantic content.

The output verb in (9) takes its CONTENT value from its complement. Given the DSL mechanism and the lexical entry in (10), this is more or less equivalent to directly inheriting the CONT value of the input verb. The difference is that the semantic contributions of adjuncts modifying the trace projection will also appear in the semantic representation of the whole clause. (See Figure 1 for an example: the finite verb *möchte* has $[\text{CONT} : \boxed{5}]$ rather than $[\text{CONT} : \boxed{3}]$.)

The difference between V1 and V2 clauses is accounted for by (traceless) extraction along the lines of Sag (1997). Any element of a verb's ARG-ST list can be instantiated as a *gap-synsem* rather than a *canonical-synsem*. In this case, the element is not mapped to the verb's COMPS list, meaning that it will not be realized in the Mittelfeld (or in the verbal cluster). Instead, it is stored in the SLASH set and carried up the tree until it is realized as a filler in the Vorfeld. Fronted-verb constructions with extraction therefore give rise to V2 structures; otherwise, the fronted verb surfaces in initial position.

The three clausal structures are compared below:

(11)	a.		(ob)	Maria das Theorem heute beweisen möchte.		(V-final)
	b.		Möchte	Maria das Theorem heute beweisen	*t* ?	(V1)
	c.	Maria$_i$	möchte	___$_i$ das Theorem heute beweisen	*t* .	(V2)

The different realizations evidently lead to interpretational differences, but I make no attempt to represent these effects formally.

2.2 PS rules

Our analysis includes a collection of binary PS rules, five of which are presented below. Unless explicitly stated otherwise, HEAD, CONT, and SLASH information is structure-shared between the mother and the head daughter, in accordance with standard HPSG principles. Example analyses for a V2 and a V-final clause are given in Figures 1 and 2.

(12) Verbal complex rule: A [+LEX] non-finite verbal complement appears to the left of the governing verbal head.

$$\begin{bmatrix} \textit{vc-phrase} & \\ \text{LEX} & \textit{bool} \\ \text{COMPS} & \boxed{2} \end{bmatrix}$$

$$\underset{\text{NONHD-DTR}}{\boxed{2}\begin{bmatrix} \text{VFORM} & \textit{non-finite} \\ \text{LEX} & + \end{bmatrix}} \qquad \underset{\text{HD-DTR}}{\begin{bmatrix} \textit{word} & \\ \text{VFORM} & \textit{non-fin} \vee \textit{f-incomp} \\ \text{COMPS} & \langle \boxed{1} \rangle \oplus \boxed{2} \end{bmatrix}}$$

(13) Complement-head rule: A verbal head combines with one complement to its left.

$$\begin{bmatrix} \textit{hc-phrase} & \\ \text{LEX} & - \\ \text{COMPS} & \boxed{2} \end{bmatrix}$$

$$\underset{\text{NONHD-DTR}}{\boxed{2}\begin{bmatrix} \text{LEX} & - \end{bmatrix}} \qquad \underset{\text{HD-DTR}}{\begin{bmatrix} \text{VFORM} & \textit{non-fin} \vee \textit{f-incomp} \\ \text{COMPS} & \langle \boxed{1} \rangle \oplus \boxed{2} \end{bmatrix}}$$

(14) Adjunct-head rule: A modifier adjoins to the left of a verbal head projection.

$$\begin{bmatrix} \textit{adj-hd-phrase} & \\ \text{LEX} & \boxed{1} \\ \text{CONT} & \boxed{2} \end{bmatrix}$$

$$\underset{\text{NONHD-DTR}}{\begin{bmatrix} \text{MOD} & \boxed{3} \\ \text{CONT} & \boxed{2} \end{bmatrix}} \qquad \underset{\text{HD-DTR}}{\boxed{3}\begin{bmatrix} \text{LEX} & \boxed{1} \\ \text{VFORM} & \textit{non-fin} \vee \textit{f-incomp} \end{bmatrix}}$$

(15) Head-complement rule: A functionally complete verb, or a complementizer,[1] preposition, or noun takes a rightward complement.

$$\begin{bmatrix} \textit{hc-phrase} & \\ \text{LEX} & - \\ \text{COMPS} & \boxed{2} \end{bmatrix}$$

$$\underset{\text{HD-DTR}}{\begin{bmatrix} \text{COMPS} & \langle \boxed{1} \rangle \oplus \boxed{2} \end{bmatrix}} \qquad \underset{\text{NONHD-DTR}}{\begin{bmatrix} \text{SYNSEM} & \boxed{1} \end{bmatrix}}$$

[1] Note that unlike in standard HPSG, we treat complementizers like *dass* and *ob* as heads, and not as markers. In our analysis the marker-head schema is eliminated.

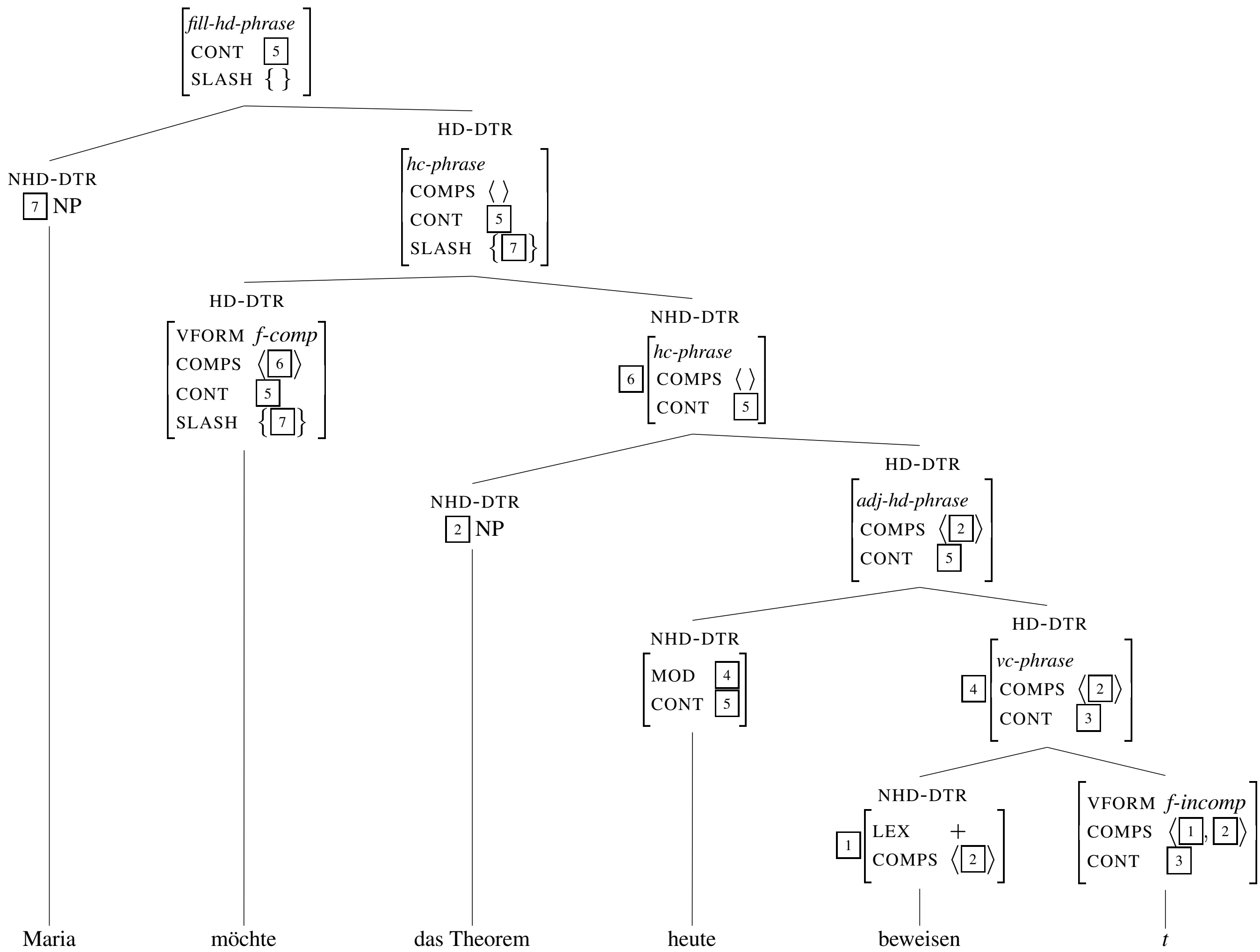
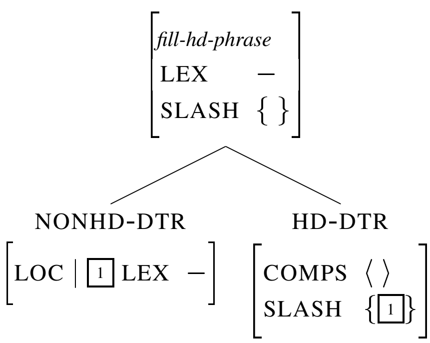


Figure 1: Analysis of a V2 clause

(16) Filler-head rule: The extracted element appears to the left of the gap-containing fronted verb projection.



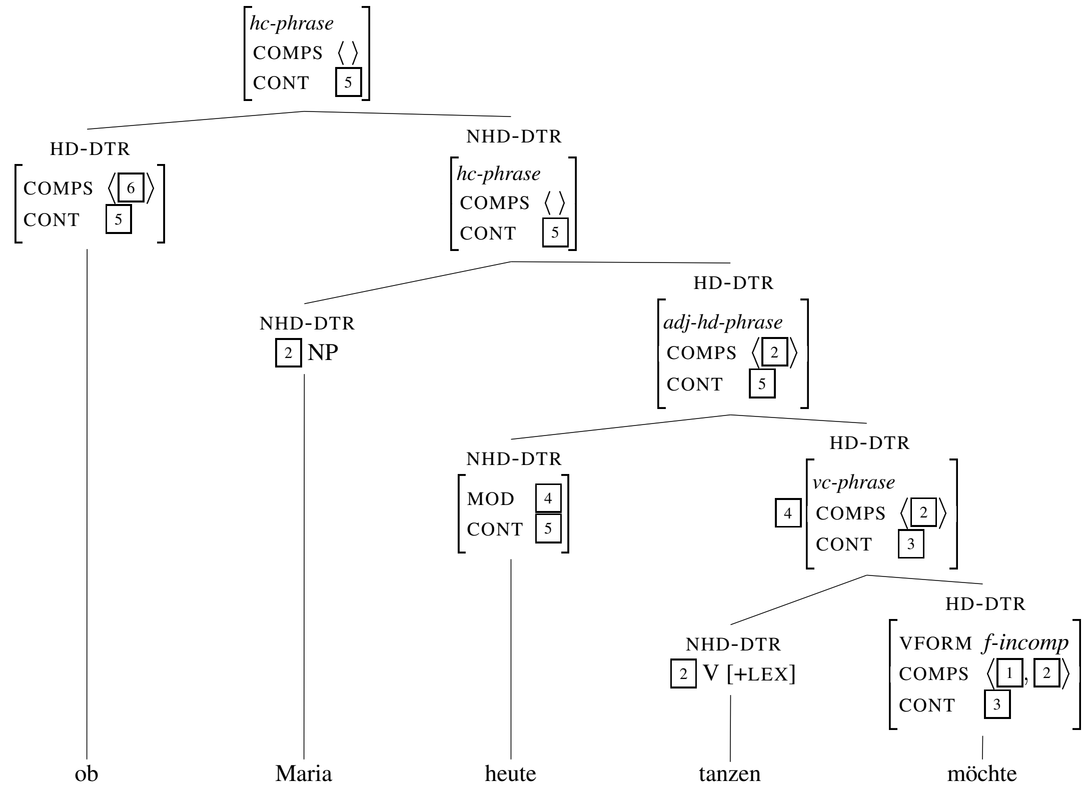


Figure 2: Analysis of a V-final clause

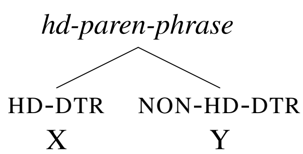
3 Incorporating Parentheticals

Given the basic clause structures above, we can now turn back to the question of incorporating parenthetical elements. There are several ways to accomplish this by adding one or more PS rules to the collection in (12–16). In this section I discuss three alternatives and evaluate how well they account for the conditions on parenthetical placement listed in above in (5) and (7).

3.1 Adjunction to the right

Given that clause-initial position for parentheticals is disallowed (¬INIT) but medial and final positions are possible, perhaps a process of right adjunction (RA) yields the right results.

(17) Head parenthetical rule



This rule has to include a (disjunctive) description for the head X that picks out all possible hosts—i.e., all constituents that can immediately precede a clausal parenthetical. The possible values for the host X include:

(18) a. all categories that can occur in the Mittelfeld: NP, AP, PP, AdvP[2]
b. all elements that can occur in the Vorfeld: this includes all of the above, plus all non-finite verb projections
c. finite verbs (not including traces)

These possible hosts are chosen specifically so the analysis satisfies conditions MF, VF, and POST-V. Note that condition FINAL is also satisfied because we have included all items that can occur at the end of a clause (ignoring verbal traces). This is without a doubt a "brute force" approach. We only need to add one rule, but it contains a lot of purely stipulated information. Moreover, the RA approach can do nothing about condition ¬PPRO, because rule (17) can only constrain what comes before the parenthetical, not what comes after it.

RA runs into problems of overgeneration, mostly because of the low attachment of the parenthetical. All of the categories identified in the rule are potential hosts, but not necessarily in all positions where they appear. For example, non-finite verbs must be able to host a parenthetical in the Vorfeld, but same verbs cannot be hosts in the verbal cluster (¬VC):

(19) a. [Beweisen glaubt er] möchte Maria das Theorem *t*.
b. * obwohl Maria das Theorem [beweisen glaubt er] möchte.

The representation of the verb *beweisen* by itself is exactly the same in both examples, and so there is no way to adjust the PS rule to allow it as a parenthetical host in one position and block it in another. Instead, in order to ensure condition ¬VC, we would have to modify the verbal complex rule in (12), for example by adding a feature [−PARENTHETICAL] to the non-head daughter (see below).

RA also leads to multiple analyses if one possible host is dominated by another host. For example, in sentence (20), the NP *das Theorem* is a possible host:

(20) Maria möchte [das Theorem glaubt er] beweisen.

Now consider what happens if this NP is contained within a PP, for example:

(21) Maria wird über das Theorem, glaubt er, reden.
'Maria will talk about the theorem, he believes.'

There are two ways to derive this word order, according to the rule in (17): one with the NP *das Theorem* as host, and one with the entire PP ¨uber das Theorem as host. In the first case, rule (17) is applied too early, before the entire Mittelfeld constituent (the PP) has been formed.

There is no way to block this spurious structural ambiguity just by adjusting the adjunction rule, because the rule cannot refer to anything higher in the tree. Instead, we could make the following changes to the grammar:

- add a (HEAD) feature [+PARENTHETICAL] to the mother in rule (17) indicating the presence of a parenthetical element
- ensure that prepositions always select [−PAREN] complements, by changing their lexical entries (or perhaps by modifying the head-complement rule in (15))

[2] I use XP as an abbreviation for a saturated projection of category X. For the sake of simplicity, I am ignoring the possibility of argument raising from NPs and APs (De Kuthy & Meurers, 1999), although this is taken into account in our implementation.

Similarly, we have to ensure that nouns take only [−PAREN] complements, and that nominal projections are only post-modified by [−PAREN] adjuncts. Non-finite verbs pose a particular problem, because they cannot take [+PAREN] adjuncts and complements when they are in the Vorfeld, but they can when they are in the Mittelfeld:

(22) a. * [Den Tango, sagt er, zu tanzen] lernt Maria.
b. Maria lernt [den Tango, sagt er, zu tanzen].
'Maria is learning to dance, he says, the tango.'

I will not pursue this issue any further. It is clear that the necessary adjustments would be totally ad hoc, and it is fair to say that right adjunction of parentheticals is simply not the right approach.

3.2 Adjunction to the left

The next PS analysis I consider is left adjunction (LA). In this case, instead of attaching the parentheticals to individual items in the Mittelfeld, Vorfeld, and so on, we adjoin them at various points along the main verbal projections.

(23) Parenthetical head rule

hd-paren-phrase

NON-HD-DTR HD-DTR
Y X

As with right-adjunction in (17), the LA PS rule must simply stipulate the inventory of possible hosts, although the disjunction is somewhat simpler in this case, including only verbal elements. In rule (23), the description of X should match the following:

(24) a. any verbal trace projection
b. any COMPS-unsaturated projection of a V-final verb or a non-finite verb
c. COMPS-saturated [VFORM : *f-comp*] verbs with an undischarged SLASH item (to account for VF)

The first two points account for MF and POST-V. Non-finite projections are included in (24b) to allow cases like example (22b). Parentheticals are correctly blocked inside the verbal cluster (¬VC) because the verbal complex rule in (12) requires the governing verb to be a *word*, not a *phrase*. If the LA rule applies first, then verbal cluster formation is impossible.

Condition ¬INIT is partially ensured by the SLASH requirement in (24c): a parenthetical can adjoin to the left of a V2 verb, but not a V1 verb. In the V-final case, ¬INIT is accounted for by the COMPS-unsaturated requirement in (24b). The idea is that at least one complement is yet to occur further to the left, ensuring that the parenthetical will not be clause-initial. This is not an altogether reliable solution, however, and it leads to both under- and overgeneration. Saturated V-final projections can host a parenthetical if they then go on to combine with an adjunct further to the left:

(25) das Theorem, das noch heute, glaubt er, bewiesen wird
'the theorem that will yet be proven, he believes, sometime today'

Such examples are incorrectly disallowed by rule (23).[3] On the other hand, in the non-finite case, the COMPS-unsaturated requirement leads to overgeneration in interaction with argument raising:

(26) a. Maria möchte das Theorem, glaubt er, beweisen *t*.
b. * Glaubt er, beweisen möchte Maria das Theorem.

In the current account, sentence (26a) can be analyzed in two ways, with the parenthetical adjoining either to the COMPS-unsaturated verb *beweisen* or to the trace projection [*beweisen t*].[4] We could rule out the first analysis by adding a [−LEX] specification to the mother in rule (23). Even with this adjustment, however, rule (23) still incorrectly allows the clause-initial parenthetical in (26b) (because fillers must be [−LEX]), as well as the Vorfeld-internal parenthetical in (22a).

Any LA approach will obviously run into problems accounting for clause final parentheticals—in particular, those that occur after a V-final verb:

(27) obwohl Maria heute krank ist, sagt er
'although Maria is sick today, he says'

There is nothing further to the right of *ist* in this example that can serve as a host for the parenthetical. Another class of problematic examples is illustrated by the following:

(28) Maria ist krank geworden, sagt er.
'Maria got sick, he says.'

Here the parenthetical[5] could adjoin to the left of the verbal trace, but subsequently the resulting phrase could not form a verbal cluster with *geworden*, as explained above.

One possible solution for these problematic cases is to assume that such parentheticals are moved into the Nachfeld via extraposition from some position in the Mittelfeld. This is a satisfactory solution as long as we care only about the correct word order (and as long as we actually have an analysis for extraposition). On a deeper lever, however, it is highly debatable whether clause final parentheticals as in (27) and (28) really have the properties of extraposed elements. The possibility of prosodic integration, for example, seems to argue against an extraposition analysis.

A simpler solution to the problem of clause-final parentheticals, is to assume a right-adjunction rule in addition to rule (23). This is what we have done in our implementation. Parenthetical elements can adjoin to the right of maximal (i.e., COMPS-saturated) [VFORM : *f-incomp*] projections.[6]

Like RA, the LA approach is unable to ensure condition ¬PPRO, the restriction against pre-Wackernagel insertion, because at the level of adjunction, the host VP does not indicate whether it has a pronoun at its left periphery or not. This information could be somehow encoded in the VP. For example, we could invent a feature [±PPRO] signalling the presence or absence of a left-peripheral pronominal element. This feature would require its own percolation mechanism; it could not be a HEAD feature, for example. It seems unsatisfactory, however, to propose such ad hoc modifications to the formal apparatus when ¬PPRO can be better understood as a constraint on word order, and not as a syntactic restriction.

[3]We can analyze *noch heute* as a modifier of the parenthetical itself to get the surface order right, but this is not the intended analysis.

[4]The same is not true for sentence (22b) because there is no argument raising in that case; the clause final trace combines with the entire COMPS-saturated VP *den Tango (sagt er) zu tanzen* and not with the verb *zu tanzen* alone.

[5]There is also an analysis where *sagt* is the main verb of the sentence, but this is not the analysis I am interested in.

[6]We also modify the LA rule (23) slightly. In particular, only phrasal trace projections are allowed as hosts, not all trace projections as stated in (24a). Otherwise we get multiple solutions for certain clause-final parentheticals.

3.3 Optional insertion

It is also possible to treat parentheticals as an optional third daughter in the relevant PS rules; I call this the insertion (INS) analysis. Specifically, we add a new set of triply-branching rules corresponding to the binary rules in (13–16), with a parenthetical element added as the middle daughter. There is no parenthetical version of the verbal complex rule in (12) because of restriction (¬VC). The complement-parenthetical-head and adjunct-parenthetical-head rules corresponding to (13) and (14) account for condition MF. The head-parenthetical-complement rule corresponding to (15) allows POST-V position; this rule must be restricted to apply only to verbal heads (no prepositions, nouns, or complementizers). Finally, the filler-parenthetical-rule corresponding to (16) accounts for condition VF.

As in the case of RA, the parentheticals in the INS analysis always have a sister to the left, so condition (¬INIT) is definitely satisfied. On the other hand, they always have a sister to the right, too, so condition FINAL is problematic. As in the LA analysis, a separate binary right-adjunction rule is still required to license clause-final parentheticals.[7] With respect to the pre-Wackernagel restriction ¬PPRO, the same remarks apply to INS as to LA in §3.2 above.

Obviously the proliferation of rules is a drawback of this approach. And further multiplication of the rules would be necessary to take iterated parentheticals into account:

(29) Das Problem, glaubt sie, meinen alle, ist gelöst.
 'The problem, she believes, everyone thinks, is solved.'

This example is given by Reis (1995a), who argues that it contains two separate parentheticals rather than a single complex one. Note that the adjunction analyses RA and LA discussed earlier are both iterable, although as they stand, they cannot account for the scope ambiguity in example (29).

4 Structural considerations

Up to now I have only been concerned with getting the linear order right, without giving any real thought to the tree structures that are built up along the way. In this section I discuss the adequacy of the three PS-approaches (RA, LA, INS) with respect to the structural representations they assign to parenthetical-host constructions.

4.1 Semantic combination

Thus far I have said nothing about the structure of V1 parentheticals, but now it becomes relevant. A partial description for *sagt er* is given here:

[7] Alternatively, there is the option of an extraposition analysis, as discussed in §3.2.

(30)

$$\begin{bmatrix} \text{HEAD} & \textit{f-comp} \\ \text{COMPS} & \langle\,\rangle \\ \text{CONT} & \begin{bmatrix} \textit{say} & \\ \text{SAYER} & \textit{ref} \\ \text{SAID} & \boxed{1}\,\textit{psoa} \end{bmatrix} \\ \text{SLASH} & \left\{ \begin{bmatrix} \text{CONT} & \boxed{1} \end{bmatrix} \right\} \end{bmatrix}$$

I analyze *sagt er* as a saturated projection of functionally complete (i.e., fronted) *sagt*. The sentential complement of *sagt* is not realized, however, because it has been extracted via SLASH and has not been discharged.[8] This unexpressed propositional argument is then identified with the content of the host clause. This provides the semantic link between the parenthetical and its host.

The existence of this link is confirmed by the fact that the possible combinations of parenthetical and host elements are subject to semantic restrictions. For example, parentheticals headed by the predicate *fragen* combine only with interrogative host clauses:

(31) a. * Hans, fragt Karl, hat Fritz getroffen.
b. —Wen, fragt Karl, hat Hans getroffen? —*Fritz.
'Who, asks Karl, did Hans meet?'

The two components interact to produce the overall interpretation of the combined structure. Parentheticals with *sagen*, in contrast to *fragen*, can be hosted by both declarative and interrogative clauses:

(32) a. Hans, sagt Karl, hat Fritz getroffen.
b. —Wen, sagt Karl, hat Hans getroffen? —Fritz.

The combination in (32a) gives rise to a declarative statement, while (32b) is a question. In these cases, the illocutionary type is the same as the host clause. In example (31b), on the other hand, the host clause is interrogative but the whole sentence is not a question, but a statement of reported speech (note the ungrammaticality of the "answer" in (31b) in constrast to (32b)) (Steinbach, 1999).

The significance of all of this with respect to the structural analysis is that the parenthetical must be incorporated structurally in such a way that it can interact appropriately with the semantics of its host clause. As a minimal requirement, the semantics of the host clause should be accessible to the parenthetical at the point of attachment. The (mostly) head-driven semantic percolation mechanism in HPSG facilitates the satisfaction of this requirement, because in many cases the semantics of the clause can be read from any projection of the head.

Let us now evaluate each of the proposed approaches with respect to these semantic considerations. It will be helpful to refer to the structure in Figure 1 as a concrete example. First, we look at the RA analysis. The adjunction rule in (17) can target the left daughter at every node of the tree in Figure 1. If the parenthetical happens to attach to the finite verb *möchte* or to the adverb *heute*, then it has access to the clausal semantics, represented by $\boxed{5}$. In all other cases, this information is inaccessible, and so in general it is impossible to account for the semantic interaction between parentheticals and their host clauses under the RA analysis.

[8] Note that this interacts badly with (24c) in the LA analysis. In general, since parentheticals are built up using the same structural rules (12–15) as normal clauses, we (wrongly) allow parentheticals as hosts for other parentheticals.

LA and INS both fare better in this regard, because the rule in (23) and the insertion rules described in §3.3 always refer to some verbal projection. Under LA, a parenthetical can adjoin to any of the right-hand side nodes in Figure 1, and most of these do carry the clausal content $\boxed{5}$. Lower in the tree, however, below the point where the adverb *heute* is attached, only the unmodified verbal content $\boxed{3}$ is visible, and in these cases the parenthetical does not have access to the complete semantic representation of its host clause.

Under INS, a parenthetical can be inserted at any of the nodes in the tree in Figure 1, except at the very bottom inside the verbal complex. Again, after the adverb, there is no problem, because the parenthetical can get hold of the clausal content from the head daughter. For the case where the parenthetical is inserted between the adjunct and the verbal cluster, we can simply specify (in the adjunct-parenthetical-head rule) that the parenthetical should look to the non-head daughter instead of the head daughter. Recall that in order to get clause final parentheticals under INS, we needed a separate right adjunction rule (which I did not formulate explicitly). As long as this rule targets a "high enough" projection (e.g., the *hc-phrase* headed by *möchte*) there will be no problems from a semantic viewpoint.

Semantic considerations therefore lead us to favor INS over LA (and to reject RA with even more certainty). It is apparent, however, that various stipulations are necessary for the INS analysis to work properly, and overall, it is a very inelegant approach. I will not go into further details about the semantic effects of parentheticals, but I conclude this section with the following suggestion: Since parentheticals have to combine semantically with an entire clause, the simplest and most direct solution would be for them somehow to combine with the entire clause syntactically. Given the surface word order facts, however, such an analysis cannot be accommodated under a PS rule approach.

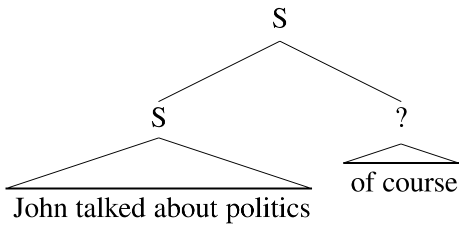
4.2 Syntactic Considerations

A more fundamental issue is whether there is any evidence that parentheticals are in fact syntactically incorporated into their host clauses. McCawley (1982) considers this question for English parentheticals, and concludes that all grammatical phenomena that are sensitive to the constituent structure of the host clause behave as if the parenthetical is not present. Although McCawley uses some tests that are inapplicable in German (e.g., V'-deletion), his general argument holds also for parentheticals in German. In other words, all of our efforts to insert parentheticals in just the right places in the tree just to get the word order right simply lead to unmotivated and misleading structural analyses.

McCawley argues instead in favor of an analysis where, at the level of constituent structure, parentheticals are adjoined to the entire clause, not to some sub-clausal constituent. He proposes the syntactic structure in (33b) for sentence (33a):

(33) a. John talked, of course, about politics.

b.



A so-called "order-changing" transformation applies to the tree in (33b) to insert the parenthetical between the verb and PP. According to McCawley, this transformation has no effect on constituent structure. At the syntactic level, the parenthetical-free VP *talked about politics* is still intact; it only appears to be discontinuous according to the surface word order.

McCawley's proposal is presented in terms of input trees and order-changing transformations, but fundamentally it is based on the same idea as linearization: dissociating syntactic constituency and surface word order. In the remainder of this paper I consider how we might deal with the German data using this alternative approach.

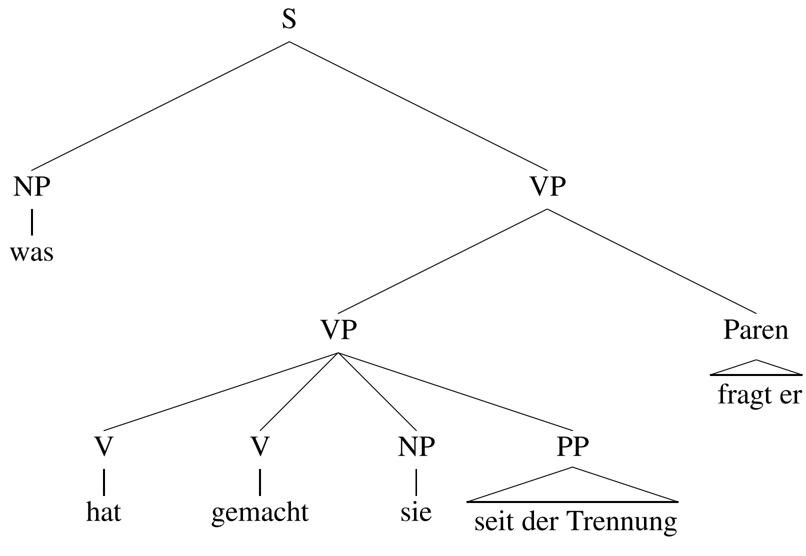
5 Linearization Constraints

In this final section I offer a sketch of a linearization-based approach to parentheticals that provides a simpler and more unified account than any of the PS alternatives considered above, and sidesteps the recurring problems encountered by those models.

First of all, introducing linearization constraints completely changes the approach to German sentence structure presented in Section 2. There is no longer a need for verb movement and verbal traces. In the most straightforward (and no doubt oversimplified) approach, a finite verb combines with all of its verbal cluster and Mittelfeld dependents at once, and is then linearized to appear in front (in a V1/V2 clause) or after them (in a V-final clause). Adjuncts could be added at the same time, in order to account for modifier scope and other interactions within the Mittelfeld (Kasper, 1994). Next, a parenthetical can adjoin to the VP, and finally, extraction and fronting of the Vorfeld element proceeds just as before.

As an example, this analysis could produce the following syntactic structure:

(34)



First of all, note that the semantic issues brought up in §4.1 are resolved here, because the parenthetical has access to its host clause's content. Following standard HPSG analyses, although the filler appears outside of the VP syntactically, its semantic contribution is still present in the VP. Also, syntactic processes can target the lower VP and ignore the parenthetical, even though the parenthetical may intervene in the surface string.

The problem now is to account for the word order corresponding to this syntactic structure. This is determined by various linearization constraints. Different linearization frameworks allow different kinds of constraints to be formulated. For example, the linear precedence rules in Pollard and Sag (1987) refer to sisters in a local tree and treat them as units for purposes of ordering. In other words, discontinous constituency is not allowed. The domain union mechanism of Reape (1994) is more powerful, in principle allowing the words in a construction to appear in any sequence, completely independent of the constituent structure.

Below, in descriptive terms, I list the constraints determining the word order for (34). I assume that ordering constraints operate on local trees, and sisters can have interleaved elements as long as no constraints are violated.

(35) a. The finite verbal head is the first element in the VP if it is [VFORM : *f-comp*], and the last element if it is [VFORM : *f-incomp*].
b. Unstressed Wackernagel pronouns occur in a cluster (i.e., an obligatorily continous string) at the beginning of the VP, together with the. *f-comp* verb, if any.[9]
c. Non-finite [+LEX] verbal complements go at end of the VP, forming a cluster with the *f-incomp* verb, if any.
d. NPs and PPs are obligatorily continuous.
e. In a filler-head structure, the filler precedes the head.

These constraints are obviously oversimplified, ignoring many interesting word order phenomena such as extraposition and Oberfeldumstellung. But this model is enough to illustrate how parentheticals fit into the picture.

Given the restrictions in (35), there are only two possible orderings for the elements of the lower VP in (34). The square brackets below indicate indivisible word sequences, not (necessarily) syntactic consitutents.

(36) a. [hat sie] [seit der Trennung] gemacht
b. sie [seit der Trennung] [gemacht hat]

The order in (36a) is appropriate for a V2 wh-question, while the one in (36b) is appropriate for an embedded V-final question. In principle, the parenthetical *fragt er* can combine with either, but the semantic effect of this parenthetical on its host clause (see the discussion of example (31b)) makes it difficult to find a suitable context in the V-final case:

(37) * Ich wollte nur wissen, was sie, fragt er, seit der Trennung gemacht hat.

I will therefore focus on the ordering with the fronted verb in (36a). Since there are no additional linearization restrictions on the placement of the parenthetical, it can appear before, after, or between the items in (36a). The wh-word *was*, finally, appears at the beginning of the sentence. The following grammatical surface word orders are licensed:

(38) was (fragt er) hat sie (fragt er) seit der Trennung (fragt er) gemacht (fragt er)

All other possibilities are correctly excluded.

This analysis is preliminary; it is unlikely that we will be able to formalize the constraints described in (35) in exactly those terms in our implementation. What is striking, however, is how easily parentheticals can be incorporated into such a grammar. Once the constraints are in place for ordering the "core" elements of the clause, parentheticals can be added in almost effortlesly, without any stipulative lists

[9] I ignore the following complication: a nominative NP (i.e., the subject) can appear in front of, or perhaps as the first element of, the "Wackernagel cluster" (Reinhard, 2000).

of possible points for adjunction or insertion. It is clear that the linearization approach is more elegant and linguistically satisfying than any of the phrase structure approaches presented earlier.

Naturally the move to a linearization-based analysis increases the power of the grammar, and from a computational perspective it requires a significantly different, and inevitably more complex parsing strategy. In the case of parentheticals, however, the advantages gained by abandoning traditional phrase structure in favor of linearization provide strong justification.

References

Altmann, H. (1981). *Formen der "Herausstellung" im Deutschen: Linksversetzung, Rechtsversetzung, Freies Thema und verwandte Konstruktionen.* Tübingen: Niemeyer.

Bouma, G., & van Noord, G. (1998). Word order constraints on verb clusters in German and Dutch. In E. Hinrichs, T. Nakazawa, & A. Kathol (Eds.), *Complex predicates in nonderivational syntax* (pp. 43–72). New York: Academic Press.

De Kuthy, K., & Meurers, W. D. (1999). On partial constituent fronting in German. In V. Kordoni (Ed.), *Tübingen studies in Head-Driven Phrase Structure Grammar* (pp. 22–73). Tübingen: Universität Tübingen.

Kasper, R. (1994). Adjuncts in the Mittelfeld. In J. Nerbonne, K. Netter, & C. Pollard (Eds.), *German in Head-Driven Phrase Structure Grammar* (pp. 39–69). Stanford, CA: CSLI Publications.

Kathol, A. (1995). *Linearization-based German syntax.* Unpublished doctoral dissertation, Ohio State University.

Kathol, A. (1996). Order variability in German and Dutch verb clusters. In W. Daelemans, G. Durieux, & S. Gillis (Eds.), *CLIN VI: Papers from the sixth CLIN meeting.* Antwerp.

Kiss, T., & Wesche, B. (1991). Verb order and head movement. In O. Herzog & C.-R. Rollinger (Eds.), *Text understanding in LILOG* (pp. 216–240). Berlin: Springer.

McCawley, J. D. (1982). Parentheticals and discontinuous constituent structure. *Linguistic Inquiry*, *13*, 91–106.

Nerbonne, J., Netter, K., & Pollard, C. (Eds.). (1994). *German in Head-Driven Phrase Structure Grammar.* Stanford, CA: CSLI Publications.

Pittner, K. (1995). Zur Syntax von Parenthesen. *Linguistische Berichte*, *156*, 85–108.

Pollard, C., & Sag, I. A. (1987). *Information-based syntax and semantics, Volume 1: Fundamentals.* Stanford, CA: CSLI Publications.

Reape, M. (1994). Domain union and word order variation in German. In J. Nerbonne, K. Netter, & C. Pollard (Eds.), *German in Head-Driven Phrase Structure Grammar* (pp. 151–197). Stanford, CA: CSLI Publications.

Reinhard, L. (2000). *Pronominale Wortstellung im Mittelfeld.* Unpublished master's thesis, Universität Tübingen.

Reis, M. (1995a). Extractions from verb-second clauses in German. In U. Lutz & J. Pafel (Eds.), *On extraction and extraposition in German* (pp. 45–88). Amsterdam: John Benjamins.

Reis, M. (1995b). *Wer glaubst du hat recht?* On so-called extractions from verb-second clauses and verb-first parenthetical constructions in German. *Sprache und Pragmatik Arbeitsberichte*, *36*, 27–83.

Sag, I. A. (1997). English relative clause constructions. *Journal of Linguistics*, *33*, 431–484.

Steinbach, M. (1999). *Notes on parenthetical constructions* (Tech. Rep. No. 144). Sonderforschungsbereich 340, Universität Tübingen.

Uszkoreit, H. (1987). *Word order and constituent structure in German.* Stanford, CA: CSLI Publications.