Arbeitspapiere des SFB 340
Bericht Nr. 132, September 1999

GERMAN WH-INTERROGATIVES IN HPSG

ANKE FELDHAUS

Contents

This article is the revised version of a talk presented at the 4th HPSG Conference 1997, at Cornell University, Ithaca, NY. Research for this paper was supported by a DFG grant to Marga Reis, SFB 340, University of Tübingen. I am grateful for valuable comments on earlier versions of this work. I would particularly like to thank Franz D'Avis, Tibor Kiss, Ulrich Lutz, Detmar Meurers, Marga Reis, Manfred Sailer and Petra Schulz as well as the audience of the conference.

ISSN 0947-6954/99

1. Introduction

Interrogative clauses represent a class of sentences whose syntactic structure and semantic interpretation pose a challenge to any theory of the grammar of German. So far, however, has been conducted no detailed analysis of German *wh*-questions within the HPSG framework apart from Kathol's linearization based approach cast in the framework of construction grammar (Kathol 1995). Since Kathol's analysis encounters empirical and conceptual problems, the principal goal of this article is to develop an alternative treatment of syntactic and semantic properties of German *wh*-interrogatives using standard HPSG theory (Pollard and Sag 1994). The gist of the proposed analysis is an Interrogative-Head Schema, which is inspired by Reis's (Reis 1998) argumentation for derivational sentence moods. On the one hand, this schema corresponds to an abstract syntactic sentence type *wh-interrogative* that is independently justified. On the other hand, the schema can be easily enriched by semantic information, thereby accounting for the fact that structural aspects contribute to the meaning of an interrogative clause in the same manner as individual elements such as *wh*-phrases do.

The article is organized as follows:

Firstly, the essential properties of German *wh*-interrogatives are described, setting forth the range of data that the novel analysis is intended to account for. In particular, it will be empirically proven that pied piping is not only syntactically but also semantically restricted.

Secondly, a critical evaluation of Kathol's general approach to German clause types will be made. Apart from conceptual drawbacks, his analysis of *wh*-constructions is flawed with respect to the left periphery of *wh*-clauses and generates spurious ambiguities in one particular case of *wh*-clause embedding as I will demonstrate.

Thirdly, a specific Immediate Dominance Schema for sentential *wh*-constructions will be introduced which can be used for matrix as well as embedded clauses. This Schema is inspired by Reis's concept of a syntactic interrogative sentence type that is related to detectable formal properties and can be compositionally interpreted. While the feature SENTENCE TYPE and a corresponding sort *sentence type* are invoked for the representation of abstract syntactic sentence types, categorial information concerning individual elements that are related to certain sentence types is stored by a *head*-feature called FORM and passed up within a structure by the *Head Feature Principle* (Pollard and Sag 1994). In addition, the so-called *Form Amalgamation Constraint* is introduced, that lexically threads categorial information within a complex structure.

Finally, the pied piping phenomenon will be thoroughly examined. It is argued that the FORM information can be used to describe (complex) *wh*-phrases as a result of which the traditional QUE feature becomes superfluous. Since all constraints proposed so far for handling pied piping do not take semantic information into account, they are condemned either to undergenerate or to overgenerate as will be shown. This drawback is avoided in the current approach by incorporating semantic restrictions into the proposed *Form Amalgamation Constraint.*

2. The Empirical Scope of the Analysis

German is recognised as a so-called verb second (V2) language with overt syntactic *wh*-movement. Concerning *wh*-interrogative clauses, linguists agree upon the following facts, which any syntactic analysis of German *wh*-interrogatives has to account for:

1. Every *wh*-interrogative clause contains an interrogative *wh*-phrase and is marked by exactly one interrogative *wh*-phrase in clause initial position.
2. In multiple *wh*-interrogatives, every interrogative *wh*-phrase *in situ* is licensed by a clause initial interrogative *wh*-phrase.[1]
3. Verbs can be subcategorized for a clausal interrogative *wh*-complement, but neither infinitival interrogative *wh*-complements nor interrogative *wh*-complements with the finite verb occurring in second position are allowed.
4. An interrogative *wh*-word can be embedded in a bigger constituent which then is turned into an interrogative *wh*-phrase that occurs clause initially. This is known as the pied piping effect.

[1]Note that an interrogative *wh*-phrase *in situ* in an embedded clause might be licensed by the clause initial interrogative *wh*-phrase of the matrix clause.

In this section, the German data that confirm the above statements are discussed.

2.1. **Initial Position.** It is well-known that every *wh*-interrogative clause must contain an interrogative *wh*-phrase that scope marks the entire interrogative clause, cf. (Reis 1991).[2] This means that in *wh*-interrogative clauses exactly one interrogative *wh*-phrase occurs in clause initial position[3] as the data in (1) to (3) show. This initial *wh*-phrase is syntactically realized to the left of a fronted finite verb in the case of matrix clauses (=1).[4]

(1) a. *Wer liest denn das Buch?*
who reads then the book
'Who is reading the book, then?'

b. **Das Buch liest denn wer?*
the book reads then who

c. *[*Wer wann*] *liest denn das Buch?*
who when reads then the book

As for embedded *wh*-interrogative clauses (=2), the initial position is not as easily identifiable in Standard German. But evidence for an obligatory clause initial *wh*-phrase comes particularly from South German dialect areas where a *wh*-phrase and a complementizer occur together at the syntactic surface (cf. Bayer 1984). As (3) illustrates, in these dialects it is not allowed that more than one *wh*-phrase occurs to the left of the complementizer.

[2]The scope is identified here with the proposition within which the *wh*-phrase is interpreted.

[3]The notion of 'clause initial position' is well-established in Germanic linguistics, cf., among others, (Reis 1985).

[4]The modal particle '*denn*' ('*then*') is an indicator of interrogativity because it occurs in interrogative clauses only. Sentences like (i) are not in the scope of the paper because their status as standard interrogatives is highly questionable. Contrary to standard *wh*-interrogatives, they are confined to very special contexts and they do not allow the particle '*denn*'. Moreover, the *wh*-phrase must not be expanded by elements such as '*zum Teufel*' ('*the devil/hell*') and has to be stressed as already (Reis 1985) has observed. For quite similar reasons, echo questions are not discussed in this paper.

(i) Napoleon starb wo? 'Napoleon died where?'

(2) Max fragt sich, ...
'Max wonders, ...'
a. ..., *wer das Buch liest.*
who the book reads
'..., who is reading the book.'

b. ..., **dass das Buch wer liest.*
that the book who reads

c. ..., *[*wer wann*] das Buch liest.*
who when the book reads

(3) Max fragt sich, ...
'Max wonders, ...'
a. ..., *wer dass das Buch liest.*
who that the book reads
'..., who is reading the book.'

b. ..., *[*wer wann*] *dass das Buch liest.*
who when that the book reads

Thus, the grammar has to detect interrogative *wh*-phrases and has to provide a mechanism that forces one and only one interrogative *wh*-phrase[5] to be realized clause initially. In the approach presented here, this is ensured by the Interrogative-Head Schema in interaction with the well-known SLASH mechanism and the specifications of the features SENTENCE-TYPE and FORM, as will be discussed in section 3.2.

2.2. ***Wh*-Phrases in situ.** In multiple *wh*-questions, all interrogative *wh*-phrases stay *in situ* except one that must be fronted, as can be seen in (4).[6]

(4) a. *Wann liest Max welches Buch?*
when reads Max which book

[5]Sentences like (i) do not disprove this statement because '*welche Dichterin welcher Nationalität*' ('*which poet of which nationality*') has to be analyzed as a single complex *wh*-phrase containing two simple(r) *wh*-phrases.

(i) Welche Dichterin welcher Nationalität wurde geehrt? 'Which poet of which nationality was awarded?'

[6]See also footnote 5.

'When is Max reading which book?'

b. **Max liest wann welches Buch?*
Max reads when which book

The clause initial interrogative *wh*-phrase licenses the remaining interrogative *wh*-phrases *in situ*. For this reason, it is necessary to recognize *wh*-phrases *in situ* and to check whether they are licensed appropriately. If not, the sentence has to be ruled out by the grammar. For this purpose, a *Form Amalgamation Constraint* will be proposed that controls the percolation of the *wh*-property.

2.3. **Specific Properties of Embedded *Wh*-Interrogatives.** Clearly, embedded *wh*-interrogatives with a fronted verb in second position are ungrammatical in German, as is shown in (5).[7]

(5) **Maria fragt sich, wo geht die Sonne auf.*
Maria wonders where rises the sun VPRT
'Maria wants to know where the sun rises.'

(5) cannot be explained simply by the assumption that in German the verb comes last in subordinate clauses because the corresponding declarative sentences are perfect as (6) illustrates.

(6) *Maria weiss, die Sonne geht im Osten auf.*
Maria knows the sun rises in the east VPRT
'Maria knows that the sun rises in the east.'

Furthermore, contrary to English, nonfinite *wh*-interrogatives in German cannot be embedded.

(7) **Maria weiss, was zu tun.*
Maria knows what to do
'Maria knows what to do.'

At first glance, it seems to be a trivial fact that embedded *wh*-interrogatives do not turn the matrix clause they are subordinated to into a *wh*-sentence.[8] But in theories, like Kathol's account of *wh*-interrogatives, where the *wh*-property is always inherited from the leftmost object within

[7] VPRT abbreviates verbal particle.
[8] See (Trissler and Lutz 1992) for a concise discussion of these issues.

a verbal interrogative phrase, an explicit constraint is needed to prevent sentences like (8) from being marked as interrogative.

(8) *Welches Buch Maria liest, weiss Max.*
which book Maria reads knows Max
'Max knows which book Maria is reading.'

2.4. **Pied Piping.** In *wh*-interrogative clauses, the minimal interrogative *wh*-phrase cannot be fronted by itself, instead a complex phrase containing an interrogative *wh*-phrase occurs clause initially. This phenomenon is known as pied piping. In (9a) a preposition is pied piped and in (9b) a *wh*-possessive pied pipes the whole nominal phrase.

(9) Maria fragt sich, ...
'Maria wonders, ...'
a. *...,* [*an wen*] *Max einen Brief geschrieben hat.*
to whom Max a letter written has
' ..., to whom Max has written a letter.'

b. *...,* [*wessen Brief*] *verloren gegangen ist.*
whose letter lost gotten is
' ..., whose letter has gotten lost.'

Apart from these standard cases of pied piping, more complex pied piping cases like (10) were observed by (Rapp 1992) and (Trissler and Lutz 1997).

(10) *...,* [*ein wie grosses Haus*] *Max erbte.*
a how big house Max inherited
' ..., how big a house Max has inherited.'

One could suggest that elements that belong to the class of determiners are generally pied piped. However, such a view is refuted by the data in (11).

(11) *...,* [**das wie grosse Haus*] *Max erbte.*
the how big house Max inherited

Similarly, quantifiers like '*jeder*' ('*every*') and '*kein*' ('*no*') oppose pied piping as (12) exemplifies.

(12) a. ..., [*jedes wie grosse Haus] Max erbte.
every how big house Max inherited

b. ..., [*kein wie grosses Haus] Max erbte.
no how big house Max inherited

Until now, the latter examples of complex pied piping have been disregarded in the HPSG literature. As is argued in section 4.2, these facts can be explained by taking semantic information into consideration. Presupposing a DP analysis[9], the constrasts can be attributed to the (in)definiteness of the functional head D^0. This observation is supported by grammatical examples like (13), where the plural is involved, and by ungrammatical examples like (14) characterized by a non-*wh* possessive phrase within the fronted *wh*-constituent.

(13) ..., [*wie grosse Häuser*] *Max erbte.*
how big houses Max inherited
' ..., how big houses Max has inherited.'

(14) a. ..., [*sein wie grosses Haus] Max erbte.
his how big house Max inherited

b. ..., [*Peters wie grosses Haus] Max erbte.
Peters how big house Max inherited

Also, data like (15) (cited by (Rapp 1992)) have not been considered in HPSG so far.[10] Although regionally bounded, they prove that in principal indefiniteness licenses complex nominal *wh*-phrases containing an interrogative *wh*-word which is not placed to the left of the noun.

(15) a. ..., [*einen Aufsatz von welchem Linguisten*] *ihr*
an article of which linguist you
diskutiert.
discuss
'..., an article of which linguist are you discussing.'

[9]It is beyond the scope of the current paper to portray the argumentation pro and contra different possible structural analyses of nominal phrases. Even so, it is fairly safe to presume a DP analysis at least for German noun phrases. Although several authors have argued for a distinction between determiner headed phrases and quantifier headed phrases, this proposal is disregarded here because nothing hinges on it.

[10]Although the data are not completely clear-cut and vary regionally, a significant number of speakers accept them without any reservation.

b. ..., [*Hoffnungen auf was*] *du dir noch machst.*
hopes on what you you still make
'..., hopes on what you still have.'

The data in (16) seem to contradict the idea that (in)definiteness constrains pied piping. Yet, these examples do not present a severe problem for this asumption because (Rapp 1992) has already proven that *wievielt*-phrases pattern with echo phrases in several aspects. Thus, it is not surprising that pied piping is less restricted in those cases.

(16) a. ..., [*Luthers wievielten Geburtstag*] *die Stadt feiert.*
Luthers how many birthday the city celebrates
'..., which birthday of Luther the city celebrates.'

b. ..., [*das wievielte Mal*] *Max dieses Buch liest.*
the how many time Max this book reads
'..., how many times Max has read this book.'

By restricting the percolation of the *wh*-information within a nominal phrase with respect to the (in)definiteness of the head of the phrase, the insight that indefiniteness plays a role in the formation of complex interrogative *wh*-phrases is integrated in the analysis outlined in the current article. This is implemented particularly by the *Form Amalgamation Constraint* as defined in section 4.2.

3. Accounting for Clausal *Wh*-Interrogatives

Accounting for all the data presented in section 2 in an adequate way basically means addressing the two following analytic issues:

1. How can all *wh*-phrases, including the more complex ones, be detected?
2. How can exactly one of these *wh*-phrases be forced to occur clause initially?

The first issue concerns both the description of simple *wh*-phrases as interrogative *wh*-phrases (thereby cancelling out all non-*wh*-phrases) and the description of pied piping phrases and (complex) interrogative *wh-in-situ* phrases. If the latter occur in a sentence, they have to be licensed by an initial interrogative *wh*-phrase. Further, we need to know not only whether a complex phrase contains a *wh*-word at all, but also whether all conditions for building such a complex interrogative *wh*-phrase are met.

The second issue focusses on the major characteristics of clausal *wh*-interrogatives which is the obligatory *wh*-phrase at the left edge of an interrogative sentence.

Before presenting the novel analysis pursued here, the account of German *wh*-interrogatives developed in (Kathol 1995) shall be evaluated, revealing the empirical and conceptual problems of a constructionist approach.

3.1. **Kathol's (1995) Approach.** Kathol's analysis is couched within the framework of construction grammar and it makes use of enlarged linearization domains organized according to so-called topological fields.

3.1.1. *Constructions in HPSG.* In a constructionist perspective, formal syntactic properties of larger syntactic properties are directly associated with constraints on meaning. Regarding the relationship between syntactic structure and sentence mood, Kathol takes such a 'complex sign' view.[11] Generalizations about constructions are treated in terms of cross-classifying sort hierarchies, the heart of which is the (partial) hierarchy of a sort *clause*. This sort is meant to organize different clausal constructions with respect to the dimensions 'internal syntax' and 'sentence mood'. As Kathol states it, he distinguishes three basic sentence moods, interrogative, declarative, and imperative. Interrogatives are further subdivided into polar and *wh*-interrogatives.

In Kathol's approach, the subsorts grouped under the partition called 'internal syntax', which bifurcates clauses in terms of their subordinate and root status based on the internal syntactic properties of clauses like the location of the finite verb, are cross-classified with the 'sentence mood' partition. As will be shown in the following, this way of strictly separating clausal objects of sort *root* and clausal objects of sort *subordinate* leads to empirically unjustified results.

Kathol claims that root clauses are instances of independent utterances expressed by the feature PHON, which is appropriate for the sort *root* but not for the sort *subordinate*, comprising subordinated clauses. Since *v2*

[11](Reis 1998) pervasively discusses the conceptual problems which approaches that arbitrarily associate various form types with a functional meaning give raise to. For reasons of space, her argumentation cannot be discussed here and the reader has to be referred to her original work.

is only a subsort of *root*, Kathol has to stipulate that root clauses can be embedded under certain circumstances in order to handle verb second declarative sentences like (17).

(17)	*Maria*	*weiss,*	*die*	*Sonne*	*geht*	*im*	*Osten*	*auf.*
	Maria	knows	the	sun	rises	in the	east	VPRT

'Maria knows that the sun rises in the east.'

As Kathol noticed himself, the assumption that clauses of sort *root* count as independent signs has to be questioned because of examples like (17), which Kathol has to catogorize as *root* clauses although they are syntactically dependent.

That it is generally inadequate to have phonological (in)dependency and the syntactic occurrence of the finite verb (clause initial versus clause final) always glued together, as Kathol has by the definition of the sorts *root* and *subordinate*, is also justified by another kind of clauses, the so-called independent verb final sentences, illustrated in (18).

(18)	*Ob*	*Maria*	*morgen*	*kommt?*
	whether	Maria	tomorrow	comes

'Does Maria come tomorrow?'

This class of sentence neither corresponds to Kathol's *root* clause sort nor to his *subordinate* clause sort firstly because sentences like (18) are independent utterances; and also because they are introduced by a complementizer and the finite verb shows up in clause final position.

Also, unintegrated sentences, shown in (19), hold problems for Kathol's approach.

(19) a.	*Max*	*las*	*jedes*	*Buch,*	*was*	*mich*	*überraschte.*
	Max	read	every	book	what	me	surprised

'Max was reading every book what surprised me'

b.	*Max*	*traf*	*einen*	*Bauern,*	*den*	*er*	*nach*	*dem*	*Weg*
	Max	met	a	farmer	who	he	for	the	way
	fragte.								
	asked								

'Max met a farmer who he asked the way.'

As (Reis 1997) has convincingly argued, unintegrated sentences like the ones in (19) are far less dependent (if they are dependent at all) on a possible matrix clause than embedded V2-sentences, cf. (17). Nevertheless, Kathol has to assign them the sort *subordinate* because of the finite verb's clause final position and the initial relative marker.[12] Hence, contrary to evidence, the analysis suggests that the unintegrated sentences in (19) are even more dependent than the V2-sentences in (17).

Apart from these problems Kathol's own constructionist approach raises general issues concerning the theory of constructions which are in need of discussion. So, the ontological status of constructions is still quite unclear. Also, it has not yet been stated how the indefinite set of potential constructions is limited. In other words, proliferation of construction types is not excluded as long as it is not stated how fine-grained the encoding of a construction is supposed to be.

Since the theory of constructions has not yet been shown to be superior to the standard HPSG phrase structural account, a phrase structural analysis of German *wh*-interrogatives is still a desideratum in HPSG.

3.1.2. *Topological Fields in HPSG.* The implementation of a variant of the traditional theory of topological fields (cf. Höhle 1986) into HPSG is another characterizing feature of Kathol's analysis. He formulates constraints for dividing the elements into certain equivalence classes that represent linearly ordered topological fields. Accordingly, the left peripherical elements of German sentences are treated in terms of an assignment of specific topological fields (notably *vf* indicating the so-called *vorfeld* and *cf* naming the complementizer field). It is assumed that *wh*-phrases and complementizers within verb final interrogative clauses behave similarly. Technically, both compete for the *cf*-class, which is allowed to contain only one element of a clause's linearization domain, and both belong to the class of so-called marking-triggers, which introduce obligatorily verb final subordinate clauses. As for matrix clauses, the *wh*-phrase is assigned to the *vf*-equivalence class and the fronted finite verb bears the *cf*-specification.

This approach is debatable for several reasons:

First, (Richter and Sailer 1998) present empirical arguments against splitting up the left periphery into two independent topological fields. Citing

[12] There is another reason why these sentences cannot be analyzed as *root* clauses in Kathol's approach. Clauses of sort *root* are specified as [MOD:*none*], which means that they are not allowed to modify other syntactic constituents.

(Höhle 1997), they discuss data of Modern Dutch and Modern German dialects demonstrating that the kind of constituent occupying the *Vorfeld* determines the fronted verbs' morphology in the case of verb initial clauses with a second person singular subject. As Richter and Sailer point out, such a morphological variation presents a problem for Kathol's idea of independent topological fields because fronted finite verbs do not have access to the constituent realized to their left at the word level.

Second, Kathol's way of treating alike *wh*-phrases and complementizers in subordinate clauses is not uncontroversial: *Wh*-phrases and complementizers clearly differ in their syntactic behavior and their semantic contribution. Complementizers are best analyzed as functional elements selecting a verbal projection (cf. for instance (Kiss 1995) for such a view) or as clausal markers, whereas standard *wh*-phrases are undoubtably substantive elements, functioning grammatically as complements and modifiers, while occurring freely within a clause. Semantically, complementizers introduce, at most, a sentence mood operator, if anything at all to the semantic interpretation of a sentence. *Wh*-phrases, however, do have their own meaning, regardless of whether they are best interpreted as quantifiers or restricted variables.

Third, if it ultimately turns out that complementizers and fronted verbs really do build a natural class (cf. Höhle 1997), *wh*-phrases certainly should not belong to this class. Since a *wh*-phrase is fronted with a finite verb in verb second but not in verb final clauses, *wh*-phrases only partly pattern with the other class members.

Fourth, evidence against Kathol's 'equivalence' assumption comes particularly from Southern German dialect areas where the *wh*-phrase and the complementizer even occur together at the syntactic surface (cf. Bayer 1984)

(20) *Peter will wissen, wer dass kommt.*
Peter wonders who that comes
'Peter wonders who comes.'

To account for these facts, Kathol stipulates an otherwise unmotivated parametric variation in assigning topological sorts to *wh*-phrases in embedded clauses: In Southern dialects, the *wh*-phrase bears a *vf* specification if and only if a complementizer is overtly realized. Since embedded *wh*-clauses without an overt complementizer are also grammatical in these dialects, such a solution encounters the problem that it has to be assumed that in Southern dialects *wh*-phrases of embedded clauses sometimes pattern with complementizers and sometimes not.[13]

Fifth, defending his analysis, Kathol argues that the so-called verum focus[14] necessitates a parallel analysis of *wh*-phrases and complementizers because verum focus is always realized on the element assigned to the *cf* topological field. But this argument is incomprehensible to me. First, in the case of pied piping only the *wh*-word is stressed not the whole phrase in the *cf* topological field. Second, as long as we do not know how to account for verum focus at all and whether verum focus is assigned segmentally or not[15], nothing should be derived from verum focus data.

Sixth and last, Kathol's claim that *wh*-phrases do not bear the same syntagmatic relations to the rest of the clause in root and embedded environment results in undesirable spurious ambiguities in the case of embedded sentences only consisting of a *wh*-phrase and a finite verb, shown in (21).

(21) *Peter weiss, wer kommt.*
Peter knows who comes
'Peter knows who comes.'

(21) can perfectly be embedded by a matrix verb like '*wissen*' ('*to know*') which is subcategorized for both clauses of sort *root* and clauses of sort *subordinate*. Hence, two structural analyses are possible which do not differ interpretationally. In the root case[16], the *wh*-phrase is assigned the sort *vf* and the finite verb the sort *cf*. In the subordinate case, the *wh*-phrase is assigned the sort *cf* and the finite verb the sort *vc* indicating the sort of the clause final verbal complex.

For these reasons, it is doubtful whether *wh*-phrases and complementizers belong to the same natural class as Kathol's analysis suggests. It seems to

[13]Kathol also wrongly predicts that the stress pattern that is available only with root clauses' *wh*-phrases and that he uses to prove that *wh*-phrases of root clauses and *wh*-phrases in subordinate clauses are distinct in their topological sort should be observable in Southern dialects if the complementizer is overt and the *vf*-sort is assigned to the *wh*-phrase but not otherwise.

[14]The concept 'verum focus' is used to describe the effect that results of emphasizing a predicate 'true'. See (Höhle 1992) for further explination.

[15]Cf. (Höhle 1992) for a concise overview of the theoretical problems.

[16]Aditionally, such an analysis wrongly predicts embedded V2 *wh*-interrogatives, cf. section 2.3

be more plausible to generally distinguish *wh*-phrases from complementizers and to deal with *wh*-phrases in a uniform way instead of separating the class of *wh*-phrases in 'root clause *wh*-phrases' and 'subordinate clause *wh*-phrases'.

To sum up, neither Kathol's construction based approach to German clause types, including the *wh*-interrogative clause type, nor his analysis of *wh*-phrases is sufficient. Therefore, a novel analysis cast within the standard HPSG setup as given by (Pollard and Sag 1994) shall be developed in the following section. It is shown how the aforementioned problems can be avoided by a uniform analysis for matrix and subordinate *wh*-interrogatives.

3.2. **A Novel Analysis.** The analysis provided in this section treats verb second and verb final *wh*-interrogative clauses in a parallel way and distinguishes clearly between interrogative *wh*-elements and complementizers. The central idea of the analysis is that there exists a syntactic *wh*-interrogative sentence type from which specific structural and interpretational properties are derived.

The postulation of syntactic sentence types with certain formal properties for German clauses is not new and has been substantiated by several authors, cf. (BRRZ 1992), (Reis 1991). In standard HPSG, this idea can be realized in terms of a (finite) set of Immediate Dominance Schemata (ID-Schemata, henceforth) that are defined as conceivable abstract sentence types in combination with a sort *sentence-type* that comprises three basic sentence types and two subtypes and a sort *form* that reflects the categorial properties of individual elements that are constrained to the respective sentence types.[17]

In the remaining sections, I will define formally the fundamental means of such a derivational approach. Although I confine my attention to *wh*-interrogatives, I believe that the general approach extends to other sentence types.

3.2.1. *Representing Sentence Types.* The sentence type information is properly represented by a sort *sentence-type*. As depicted in (22), this sort is partitioned by three subsorts, *declar(ative)*, *interrog(ative)*, and

[17]It may ultimately prove to be necessary to assume more subsorts or maybe none. This is an empirical issue that goes beyond the scope of this paper. But as long as we derive the properties of certain sentence types compositionally from the properties of single (perhaps abstract) elements the grammar can easily be extended.

imper(ative). As for the sort *interrogative*, it is further partitioned by *pol(ar)-interrog(ative)* and *wh-interrog(ative)* thereby accounting for the different grammatical properties of yes-no questions and constituent questions. For instance, not all predicates that select interrogative complements embed both *wh-interrogative* and *ob-interrogative* clauses. Moreover, it is still a matter of discussion whether the meaning of polar interrogatives is related to the meaning of *wh*-interrogatives and how.[18]

(22)
- *s-type*
  - *declar*
  - *interrog*
    - *wh-interrog*
    - *pol-interrog*
  - *imper*

Since the ID-Schemata are meant to express different sentence types, they need to be enriched by specific sentence type information which makes them distinct. The sentence type information is accessible by the *head*-feature S(ENTENCE)-TYPE, which is introduced into the grammar. The value of S-TYPE is of sort *s-type*. If the S-TYPE is defined as a *head*-feature, the *Head Feature Principle* (Pollard and Sag 1994) controls its percolation in the verbal projection.

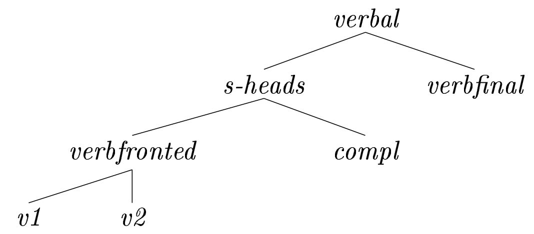
Clausal Heads. Complementizers are analyzed as functional categories which head the sentential projection.[19] Given this analysis for complementizers, heads of sentences are confined to a class consisting of finite verbs that are fronted and complementizers that select verbal projections containing a final finite verb. This result perfectly fits to the observation that complementizers and fronted finite verbs belong to the same natural class as has been discussed in the previous section. The idea which suggests itself is to enrich the sort hierarchy in such a way that this natural class is represented. Therefore, the common sort *verb* is replaced by the sort *verbal*, which subsumes the sort *verbfinal*, modelling final finite verbs, and the sort *s(entential)-heads*, depicting the natural class consisting of complementizers and fronted verbs, illustrated in (23).[20] It is exactly this class the S-TYPE feature is appropriate for. Hence, S-TYPE is defined on complementizers as well as fronted verbs.

[18]It might turn out empirically that both sorts should be conflated. I have to leave open this issue here.

[19]Evidence for this treatment of German complementizers even in HPSG is given by (Kiss 1995).

[20]A comparable but in detail different idea is outlined in (Richter and Sailer 1998).

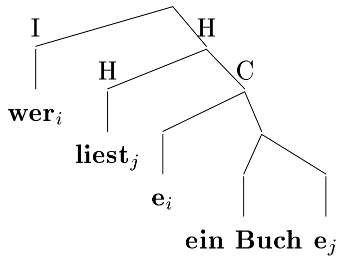
(23)



One could ask why S-TYPE has not been defined by objects of sort *category*. This has not been done in order to avoid the implausible result that every object bears an S-TYPE-feature mostly containing information that would be irrelevant for the interpretation of the sentence.

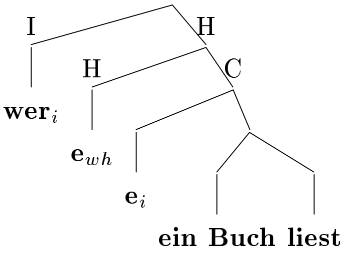
Sentence Structure of Wh-Interrogatives. According to the claim that every German clause is headed by an element of sort *s-head* and by taking the evidence for a uniform analysis for all *wh*-phrases despite their occurrence in verb second or verb final *wh*-interrogative clauses into account, a phonologically empty complementizer is predicted that heads verb final *wh*-interrogative clauses. Without such a complementizer, the generalization would be lost that fronted verbs and complementizers belong to a natural class the elements of which head German clauses. Of course, in verb second interrogative clauses the role of such an empty element is taken by the fronted verb. (24) and (25) illustrate sentence structures proposed for verb second and verb final *wh*-interrogative clauses. The element e_{wh} in (25) indicates the phonologically empty *wh*-complementizer.[21]

(24)



[21]The details of fronting a *wh*-phrase will be explained in section 3.2.4.

(25)



Crucially, contrary to similar assumptions made within the Principle and Parameters framework, the postulated empty complementizer only occurs in verb final *wh*-interrogative clauses not in verb second ones.[22] Since the empty complementizer belongs to the same natural class as other complementizers and fronted verbs, it bears an S-TYPE-feature, too. Its specification is the defining property of this empty complementizer. It is instantiated by the *wh-interrogative*, therefore prohibiting, that the empty complementizer heads any clause but *wh*-interrogatives.

Although the structural relation between fronted and final finite verbs would need further explication, I do not explore alternative approaches to the German sentence structure here because nothing important in our analysis of *wh*-interrogatives hinges on it. The presented analysis for *wh*-interrogatives can easily be adjusted to several analyses of German clause structure as long as they are compatible with the following two minimal assumptions. First, a fronted finite verb selects a verbal projection containing a phonologically empty verbal trace that shares important structural information with that verb. Second, complementizers select a verbal projection containing an overt finite verb in final clause position.

Selectional Properties of Verbs. The sentence type information together with sentential head information can be used to characterize the verbs' selectional properties. It is well-known, that predicates differ both with respect to the selected sentence type and to the selected sentence's verb position.

In our terms, verbs like '*fragen*' ('*to ask*') that only embed interrogatives select complements of sentence type *interrogative* headed by a complementizer. So, the final position of the finite verb of the embedded *wh*-interrogative falls out:

---

[22](BRRZ 1992) have already argued empirically for an asymmetric structure for verb second versus verb final *wh*-interrogative clauses even though their analysis is cast in a different framework.

(26)
$$\begin{bmatrix} \textit{word} \\ \textsc{phon} < \textit{fragen} \quad \text{`}\textit{to} \quad \textit{ask}' > \\ \textsc{ss}|\ldots|\textsc{sc} < \ldots, \begin{bmatrix} \textit{synsem} \\ \ldots|\textsc{hd} \begin{bmatrix} \textit{compl} \\ \textsc{s-type}\ \textit{interrogative} \end{bmatrix} \end{bmatrix}, \ldots > \end{bmatrix}$$

As discussed before, a verb like '*wissen*' ('*to know*') allows in principle verb second and verb final complements headed by a fronted verb or a complementizer, resp. But, as shown in section 2.3, verb second *wh*-interrogatives are ungrammatical. To account for this, all we need to state is that '*wissen*' ('*to know*') comes with the following subcategorization frame:

(27)
$$\begin{bmatrix} \textit{word} \\ \textsc{phon} < \textit{wissen} \quad \text{`}\textit{to} \quad \textit{know}' > \\ \textsc{ss}|\ldots|\textsc{sc} < \ldots, \begin{bmatrix} \textit{synsem} \\ \ldots|\textsc{hd} \begin{bmatrix} \textit{compl} \\ \textsc{s-type}\ \textit{interrogative} \end{bmatrix} \end{bmatrix} \\ \qquad\qquad \vee \begin{bmatrix} \textit{synsem} \\ \ldots|\textsc{hd} \begin{bmatrix} \textit{s-heads} \\ \textsc{s-type}\ \textit{declarative} \end{bmatrix} \end{bmatrix}, \ldots > \end{bmatrix}$$

As noted earlier, Kathol's analysis generates spurious ambiguities in this case. Our analysis does not encounter such problems.

3.2.2. *Representing Categorial Information.* It is fairly obvious that an abstract sentence type is correlated with a particular morpho-syntactic realization. Therefore, structural information, such as the first position of the finite verb in the case of imperatives[23], and categorial information, such as the obligatory occurrence of an interrogative *wh*-phrase or a specific complementizer, should be derivable from an abstract sentence type.[24] Partly, this kind of information is already accessible by the *head*-sort of a sentence, which indicates the sentential head from which the position of the finite verb can be derived. But in order to represent categorial information a second *head*-feature is needed called FORM, whose value is of sort *form*.[25]

---

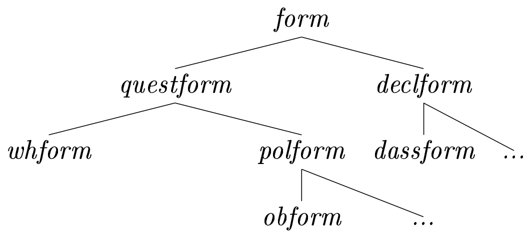
[23]I refer here to standard imperatives which indeed do not topicalize any phrase to the left of the fronted finite verb. But note that there are some cases of imperatives in German which allow a fronted XP. Since in the present paper nothing important hinges on this observation, it is not necessary to go more deeply into this issue.

[24]It is not clear whether specific phonological information should be derived from particular sentence types.

[25]It is intended that this feature brings to mind other well-known *head*-features like PFORM and VFORM.

As shown in (28), *form* is partitioned with respect to categorial information that lexical elements contribute to the description and this restricts them to specific sentence types such as interrogative *wh*-phrases to *wh*-interrogatives.[26]

(28)



As illustrated in (28), *form* is partitioned by two sorts *quest(ion)form* and *decl(arative)form*. *Questform* subsumes interrogative *wh*-elements (=sort *whform*) as well as yes-no question elements (=sort *pol(ar)form*), at least comprising the complementizer *ob* ('*whether*').[27]

Since (Gallmann 1997) and (Trissler 1998) have independently presented persuasive evidence showing that interrogative, indefinite and echo *wh*-phrases[28] behave syntactically differently and, thus, should be separated, it is assumed here that the *wh*-lexemes that are contained in pure indefinite and echo *wh*-phrases phrases are not specified as *whform*.[29]

Clearly, all *wh*-interrogatives can be singled out by a FORM-specification *whform*, which makes the traditional HPSGian *nonlocal*-feature QUE, and

[26]The dots in the hierarchy are meant as placeholders for other potential complementizers of the particular sort.

[27]It may prove to be plausible that there is something like an empty interrogative element restricted to matrix polar questions.

[28]See (Reis 1992) for a different approach. She states that no echo *wh*-phrases exist but only echo *wh*-lexemes.

[29]It cannot be investigated here whether those lexemes remain underspecified with respect to their FORM value or whether their FORM value is specified in the lexicon. Supposing (Reis 1992) approach to echo *wh*-lexemes, the former solution might be more feasible in view of data like (i) which show that echo *wh*-elements can occur within complex interrogative *wh*-phrases. The latter solution would require a constraint that prevents the percolation of the FORM value out of the echo *wh*-lexeme.

(i) Welchen Artikel von WEM hat Peter gelesen? 'Which article of WHOM has Peter read?'

However, following (Gallmann 1997) and (Trissler 1998), who assume that syntactic echo *wh*-phrases exist, it might be more plausible to assign a specific FORM value to the echo *wh*-lexemes and to constrain its percolation within a nominal phrase. This cannot be clarified here.

its complex percolation via the inherited-to-bind mechanism, superfluous. Of course, it has to be proven in detail that all functions of the former QUE-feature can be accounted for in a more intriguing way by a FORM-specification *whform*. So, it has to be shown, that the inherited-to-bind mechanism for passing up QUE can be replaced by a more sophisticated FORM percolation principle and, then, that pied piping is still analyzed properly.

Before addressing this issue, we need to look at some lexical entries that exemplify the FORM-specifications of particular categories.

Lexical FORM-*Specifications.* As is to be expected, the FORM value of *wh*-words is instantiated by *whform*. This is illustrated by the partial lexical entry in (29a). As said before, only interrogative *wh*-elements bear a FORM-specification *whform* in the lexicon.

As will be seen in a moment, the lexical FORM-specification of non-*wh*-elements is crucial to the percolation of the *wh*-property in verbal phrases. Therefore, the FORM-values of these elements are briefly described. Complementizers like *dass* '*that*' and *ob* '*whether*' are confined to declarative and polar interrogative clauses, respectively. This can be expressed by the appropriate FORM-specifications *dassform* and *obform* in the lexicon, as can be seen in (29b) and (29c), resp. Particularly important is the fact that the traditionally substantive categories, namely nouns, verbs, adjectives and prepositions, remain underspecified in the lexicon with respect to their FORM feature, as is illustrated in (29d) to (29f).

(29) • Specified FORM-values

a. $$\left[\begin{array}{ll} \multicolumn{2}{l}{\textit{word}} \\ \text{PHON} & <\textit{wer} \quad \textit{`who'}> \\ \text{SS}|\ldots|\text{HEAD} & \left[\begin{array}{l} \textit{pronoun} \\ \text{FORM}\ \textit{whform} \end{array}\right] \end{array}\right]$$

b. $$\left[\begin{array}{ll} \multicolumn{2}{l}{\textit{word}} \\ \text{PHON} & <\textit{dass} \quad \textit{`that'}> \\ \text{SYNSEM}|\ldots|\text{HEAD} & \left[\begin{array}{l} \textit{compl} \\ \text{FORM}\ \textit{dassform} \end{array}\right] \end{array}\right]$$

c. $$\left[\begin{array}{ll} \multicolumn{2}{l}{\textit{word}} \\ \text{PHON} & <\textit{ob} \quad \textit{`whether'}> \\ \text{SYNSEM}|\ldots|\text{HEAD} & \left[\begin{array}{l} \textit{compl} \\ \text{FORM}\ \textit{obform} \end{array}\right] \end{array}\right]$$

• Underspecified FORM-values

d. $$\left[\begin{array}{ll} \multicolumn{2}{l}{\textit{word}} \\ \text{PHON} & <\textit{lesen} \quad \textit{`to read'}> \\ \text{SYNSEM}|\ldots|\text{HEAD} & \left[\begin{array}{l} \textit{verb} \\ \text{FORM}\ \textit{form} \end{array}\right] \end{array}\right]$$

e. $\begin{bmatrix} \textit{word} & \\ \text{PHON} & <\ \textit{buch}\quad \text{`}\textit{book}\text{'}\ > \\ \text{SYNSEM}|\ldots|\text{HEAD} & \begin{bmatrix} \textit{noun} \\ \text{FORM}\ \textit{form} \end{bmatrix} \end{bmatrix}$

f. $\begin{bmatrix} \textit{word} & \\ \text{PHON} & <\ \textit{neu}\quad \text{`}\textit{new}\text{'}\ > \\ \text{SYNSEM}|\ldots|\text{HEAD} & \begin{bmatrix} \textit{adjective} \\ \text{FORM}\ \textit{form} \end{bmatrix} \end{bmatrix}$

The Percolation of the FORM*-Property in a Phrase.* The FORM-specification of an object has to be passed up within a phrase in order to be accessible for corresponding sentence type schemata. Since FORM is a *head*-feature, its percolation along the head line via the *Head Feature Principle* (Pollard and Sag 1994) is guaranteed without further assumptions. However, the inheritance of the FORM-value out of complements and adjuncts still must be made possible. For this purpose, the amalgamation idea of (Pollard and Yoo 1997) and (Ginzburg and Sag 1998) is adopted in the present analysis. This lexical threading mechanism is based on the assumption that a head takes over a feature specification from those words it selects or it is modified by.

The so-called *Form Amalgamation Constraint* defined in (30) exploits this idea:

(30) FORM AMALGAMATION CONSTRAINT (FAC)
The FORM-value of a lexical head is identified with the FORM-values of its non-sentential complements, modifiers and specifiers[30].

By FAC, a head gets access to the FORM-values of all the elements it selects or it is modified/specified by, but only if the concerned object is not *sentential*.[31] Such a restriction is necessary in order to prevent

[30]Whether inheritance out of specifiers has really to be allowed depends on the treatment of possessives and prenominal genitives. It is debatable whether they are best analyzed as specifiers or as heads of a DP. The amalgamation constraint that is proposed in the current section can be adjusted to either structural approach. Therefore, I do not consider it necessary to go into this issue here.

[31]Unfortunately, it is not completely clear how *sentential* has to be defined formally within HPSG. A proposal of (Netter 1994), which is inspired by the idea of the complete functional complex (cf. Chomsky 1986), might be useful according to which maximal phrasal projections are defined as fully saturated and functionally complete. Functional completeness is taken to be a property, which can either be introduced through a functional category such as complementizers or can be directly associated with a lexical category, e.g., an initial verb. It may turn out that in our terms *sentential* is a property of elements of sort *s-head*.

matrix phrases from being marked as interrogative, if they embed a *wh*-interrogative clause.[32] [33]

It is important to point out that verbal interrogative *wh*-phrases are treated as complex interrogative *wh*-phrases. As will be seen in section 4.2, verbal interrogative *wh*-phrases do not differ from nominal interrogative *wh*-phrases regarding the percolation of the *wh*-property.

Again, the independently motivated HFP ensures the inheritance of the *wh*-property from head to head. The FAC combined with the HFP replaces the complex inheritance-to-bind mechanism defined for the percolation of the *nonlocal*-feature QUE. Moreover, contrary to Ginzburg and Sag's approach, there is no extra *wh*-inheritance principle needed because FORM has been defined as a *head*-feature.

To sum up, the FORM-specification *whform* clearly distinguishes interrogative *wh*-phrases from other kinds of *wh*-phrases. By FAC, every interrogative *wh*-phrase *in situ* marks a verbal phrase similarly as *whform*. Addressing the first issue stated at the very beginning of this section, interrogative *wh*-phrases including those *in situ* are detected easily.

3.2.3. *Linking Categorial Information to Sentence Types.* By imposing the requirement in (31) to (33), the grammar ensures that every sentence type is linked to appropriate FORM-specifications and relates to legitimate structural properties such as the finite verb's position.

(31) states that a clause of sentence type *wh-interrogative* is correlated to categorial properties of [FORM:*whform*]. In other words, the sentence must contain an interrogative *wh*-phrase because this is the only possible element that introduces the FORM specification *whform* lexically.

(31) $$\begin{bmatrix} \textit{head} \\ \text{S-TYPE } \textit{wh-interrogative} \end{bmatrix} \longrightarrow \begin{bmatrix} \textit{head} \\ \text{FORM } \textit{whform} \end{bmatrix}$$

Similarly, a polar interrogative clause must not contain an interrogative *wh*-phrase because of (32). Otherwise, a sort mismatch between the sentence specification *polform*, which is obligatory for polar interrogative clauses, and the *wh*-phrase's specification *whform* would arise.

[32] Note that Kathol has to exclude this possibility also explicite. He defines an extra constraint for finite domain objects.

[33] It falls out from this analysis that sentence mood is clause bounded.

(32) $$\begin{bmatrix} \textit{head} \\ \text{S-TYPE } \textit{pol-interrogative} \end{bmatrix} \longrightarrow \begin{bmatrix} \textit{head} \\ \text{FORM } \textit{polform} \end{bmatrix}$$

For the sake of completeness, the properties that are implied by a declarative and an imperative sentence type, resp. are illustrated in (33). The respective feature specifications for FORM prevent interrogative *wh*-phrases from occurring in clauses of these sentence types, whereas indefinite *wh*-phrases and echo *wh*-phrases are perfect in those sentences.

(33) a. $$\begin{bmatrix} \textit{head} \\ \text{S-TYPE } \textit{declarative} \end{bmatrix} \longrightarrow \begin{bmatrix} \textit{head} \\ \text{FORM} \neg\ \textit{whform} \end{bmatrix}$$

b. $$\begin{bmatrix} \textit{head} \\ \text{S-TYPE } \textit{imperative} \end{bmatrix} \longrightarrow \begin{bmatrix} \textit{head} \\ \text{FORM} \neg\ \textit{whform} \end{bmatrix}$$

Now, we have all means at hand to define properly the Interrogative-Head Schema (I-H Schema) that acounts for the peculiar structural properties of *wh*-interrogative clauses.

3.2.4. *The Interrogative-Head Schema.* The I-H-Schema in (34) represents the abstract *wh*-interrogative sentence type and characterizes *wh*-interrogative clauses structurally.

(34) The I-H Schema licenses phrases that satisfy the following description:

$$\begin{bmatrix} \textit{phrase} & \\ \text{SS} & \begin{bmatrix} \textit{synsem} & \\ \text{LOC} \mid \text{CAT} \mid \text{HD} \mid \text{S-TYPE } \textit{wh-interrog} & \\ \text{NLOC} & \begin{bmatrix} \textit{nonlocal} & \\ \text{INH} \mid \text{SL} & \{\} \vee \left\{ \begin{bmatrix} \textit{local} \\ \text{CAT} \mid \text{HD} \mid \text{FORM } \neg\ \textit{whform} \end{bmatrix} \right\} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

$$\begin{array}{cc} \text{I} & \text{H} \\ \begin{bmatrix} \textit{sign} & \\ \text{SS} \mid \text{LOC } \boxed{1} & \begin{bmatrix} \textit{local} & \\ \text{CAT} \mid \text{HD} & \begin{bmatrix} \textit{head} & \\ \text{VFORM} & \neg\textit{finite} \\ \text{FORM} & \textit{whform} \end{bmatrix} \end{bmatrix} \end{bmatrix} & \begin{bmatrix} \textit{phrase} & \\ \text{SS} & \begin{bmatrix} \textit{synsem} & \\ \text{LOC} \mid \text{CONT } \textit{interrog-op} & \\ \text{NLOC} & \begin{bmatrix} \textit{nonlocal} & \\ \text{INH} \mid \text{SL} & \left\{ \boxed{1}, \ldots \right\} \\ \text{T-BD} \mid \text{SL} & \left\{ \boxed{1} \right\} \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{array}$$

The schema licenses a *wh*-phrase in initial position. In particular, the LP-Statement in (35) guarantees that the phonology of the *wh*-daughter precedes the phonology of the remainder of the sentence.

(35) I $\prec$ H

The inherited SLASH value of the head daughter which represents the obligatory *wh*-phrase in initial position is bound off by this schema. The SLASH-value of the mother ensures that the schema is applied not more than once per clause. Hence, it is not possible to front more than one interrogative *wh*-phrase.

The S-TYPE-specification of the mother automatically guarantees that the I-H Schema in (34) is distinguishable from other (declarative or imperative) sentence type schemata.[34] Since the FORM-value of the head daughter is fixed to *whform* by (31) together with the HFP and since the constraints (32) and (33) hold, the I-H Schema is not applicable to polar interrogatives, declaratives or imperatives.

The restriction that every *wh*-phrase *in situ* has to be licensed by one in initial position comes from the interaction of (34) and the definition of the sort *form*. In the case of verb second *wh*-interrogatives, the interrogative *wh*-phrase *in situ* forces the verbal projection headed by a fronted finite verb to bear a FORM-value specified as *whform* and, thus, only the I-H Schema applies. If there is no initial interrogative *wh*-phrase realized, the FORM-specification of the SLASH-value of the head daughter, which would correspond to a realized interrogative daughter, is not satisfied. Since there is no other schema (and therefore no other sentence type) that could match, the grammar rules out such sentences.

Similarly, in clauses with a final finite verb, an interrogative *wh*-phrase *in situ* without a licencing initial interrogative *wh*-phrase is impossible. As previously stated, every *verbfinal* clause is headed by a complementizer, which is either overtly realized (polar or declarative complementizers) or is empty as the *wh*-interrogative complementizer. In the former case, the FORM-specification of the respective complementizer and the one of the verbal phrase are incompatible because the verbal phrase bears the FORM-value *whform* coming from the *wh*-phrase in situ.[35] In the latter case, the verbal projection is necessarily indicated as *whform* by the empty

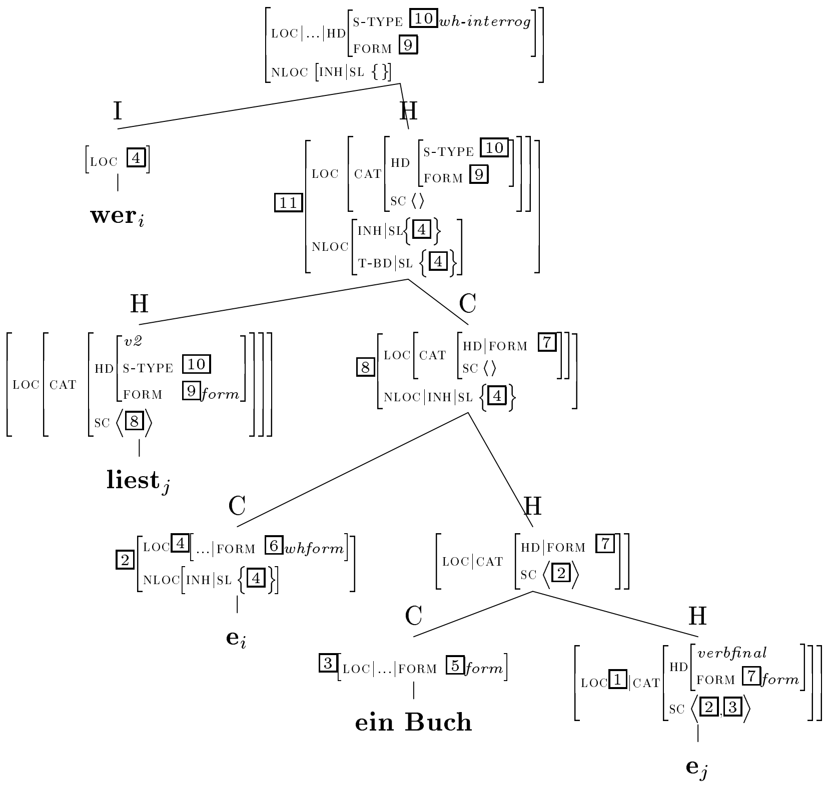
[34]See (Kiss 1995) for a similar view. He claims that in German the Filler-Head Schema is only used for topicalization in declarative sentences.

[35]Furthermore, the co-occurrence of an initial interrogative *wh*-phrase and the complementizer '*dass*' ('*that*') in certain German dialects can be explained by stipulating

complementizer and the same reasoning as above for verb second *wh*-interrogative clauses applies.

An Example. With example (36), let us now illustrate how the I-H Schema interacts with both the FORM-specification and the S-TYPE-specification.

(36) Wer liest ein Buch?
'Who is reading a book?'



$\wedge$ $\boxed{5} = \boxed{7}$ by FAC
$\wedge$ $\boxed{6} = \boxed{7}$ by FAC
$\wedge$ $\boxed{9} = \boxed{7}$ by FAC

that the empty *wh*-interrogative complementizer can be phonologically realized as '*dass*' in certain dialects. This assumption suits the observation that interrogative *wh*-phrases co-occur only with particular complementizers.

In (36), the verb *lesen* ('*read*') is subcategorized for two nominal complements, realized by *wer* ('*who*') (=$\boxed{2}$) and *ein Buch* ('*a book*') (=$\boxed{3}$). Since *wer* is fronted, a trace (=e_i) which shares the *local*-information (=$\boxed{4}$) with its binder *wer* satisfies the selectional requirements of the finite verb. Whereas the DP *ein Buch* as well as the fronted verb and its trace e_j are underspecified with respect to their FORM-value, the interrogative pronoun *wer* carries the FORM-specification *whform* from the lexicon (=$\boxed{6}$).

The FAC causes the identification of the verb's FORM-value (=$\boxed{7}$) with the FORM-values of its complements (=$\boxed{5}$,$\boxed{6}$). This identification leads to a specification *whform* at the VP, which is passed up via the HFP and which finally triggers the application of the I-H Schema. Hence, *wer* is licensed in first position by the I-H Schema.

By defining the I-H-Schema and by its interaction with FORM-information, the second issue stated at the very beginning of this section, which concerns the occurrence of exactly one initial *wh*-phrase, is adequately accounted for.

The merits of the proposed analysis are obvious. By applying the presented I-H Schema, the formation of verb second and verb final *wh*-interrogative clauses becomes a uniform syntactic process. Contrary to Kathol's approach, interrogative *wh*-phrases behave similarly in verb second and in verb final clauses. The apparent difference between these two kinds of clauses, namely the position of the finite verb, is not attributed to the initial overt interrogative *wh*-phrase but to a covert *wh*-interrogative complementizer. By this assumption, the problems discussed in section 3.1 vanish. Also, this account does not encounter the problems traced back to hard-wiring a split between root and subordinate clauses into the grammar.

Moreover, there is another nice implication of the proposed I-H Schema. This syntactic basis allows the compositional construction of the semantics of *wh*-questions because a semantic interrogative operator can be introduced by the CONTENT-value of the schema's head daughter. Assuming that *wh*-questions are interpreted as the set of all possible propositional answers, the interrogative operator contributes the appropriate abstractor.[36] For reasons of space, this idea cannot be explicated. For a detailed discussion of the semantic analysis see (Egg and Feldhaus 1997) and (Egg 1998).

[36]For the motivation of such an analysis cf. for instance v. Stechow (1993).

4. Pied Piping

4.1. **Previous Approaches.** Until now, only standard pied piping data have been regarded in HPSG. Abstracting away from details, all approaches to pied piping, e.g. (Kathol 1995), (Pollard and Yoo 1997) and (Ginzburg and Sag 1998), are based on the claim that *wh*-information is stored by a QUE-feature which is not defined on the sort *nonlocal* anymore. Therefore, QUE is excluded from the *Nonlocal Feature Principle* (cf. Pollard and Sag 1994). The necessity to formulate specific QUE-percolation constraints follows from this. Two strategies regarding such *wh*-constraints have been pursued. First, the QUE-value is in principle inherited from each daughter unless specific restrictions prohibit such an unrestricted inheritance. This strategy is basically taken by (Kathol 1995) and (Pollard and Yoo 1997). Second, the QUE-percolation is divided into an amalgamation of QUE out of arguments and a feature passing along the head line via a QUE-Constraint, see (Ginzburg and Sag 1998).

The latter strategy is adopted here, which means that an amalgamation constraint will be defined in the current section. This constraint restricts amalgamation, contrary to the one proposed by (Ginzburg and Sag 1998), with respect to certain syntacto-semantic properties of the involved elements. The data given in section 2.4 prove that an unrestricted amalgamation leads to overgeneration (Cf. cases like (11), here repeated as (37)).

(37)	...,	[**das/*jedes*	*wie*	*grosse*	*Haus*]	*Max*	*erbte.*
		the/every	how	big	house	Max	inherited

Why do we not just apply Kathol's pied piping strategy? For the following reasons: Kathol's WH-Constraint is defined for verbal phrases only. His twofold constraint builds on a constituent's domain structure and states that the QUE-property of a sign is projected from its initial domain object as long as this object is not specified as *finite*. If it is, nothing gets projected. Since Kathol restricts the QUE-percolation to the leftmost domain elements, he prevents inheritance from any noninitial *in situ* element. Although Kathol does not work out the details of the QUE percolation within nominal, adjectival/adverbial and prepositional phrases, he gives an informal clue to his intentions in (Kathol 1995, p.171, fn.15). Excluding prepositional phrases because they allow inheritance not (necessarily) from the leftmost element, but directly from its complement, Kathol argues for additional constraints which control the inheritance of QUE in nonverbal phrases similarly to that in verbal phrases. Assuming a leftness condition for *wh*-elements on domain lists of nonverbal phrases, (37) would be correctly ruled out, but at the expense of grammatical examples like (38) which would be ruled out at the same time.

(38) ..., [*ein wie grosses Haus*] *Max erbte.*
a how big house Max inherited
' ..., how big a house Max has inherited.'

Another undesirable consequence of his proposal would be that data like (15), repeated here as (39), would be analyzed as ungrammatical.[37]

(39) a. ..., [*einen Aufsatz von welchem Linguisten*] *ihr*
an article of which linguist you
diskutiert.
discuss
'..., an article of which linguist are you discussing.'

b. ..., [*Hoffnungen auf was*] *du dir noch machst.*
hopes on what you you still make
'..., hopes on what you still have.'

In certain nominal phrases, leftness of a *wh*-word does not necessarily constrain the percolation of the *wh*-property, as the data in (39) suggest.

Despite these insufficiencies, it is important to emphasize that Kathol's approach assimilates finite clauses in their QUE-status to that of pied piped *wh*-expressions in general. This view already has been advocated by (Trissler and Lutz 1997) and is also adopted here, as has been mentioned in section 3.2, and will be further worked out in the following section by extending the FAC defined in section 3.2.

4.2. **A Novel Pied Piping Approach.** As previously stated, the approach pursued here is inspired by the amalgamation mechanism of (Ginzburg and Sag 1998) and exploits the FORM feature. The FAC as formulated in section 3.2 already ensures that a head amalgamates the *wh*-property out of any complement, modifier and/or specifier.[38] The FORM-value is passed up in accordance with the HFP. However, as the pied piping data

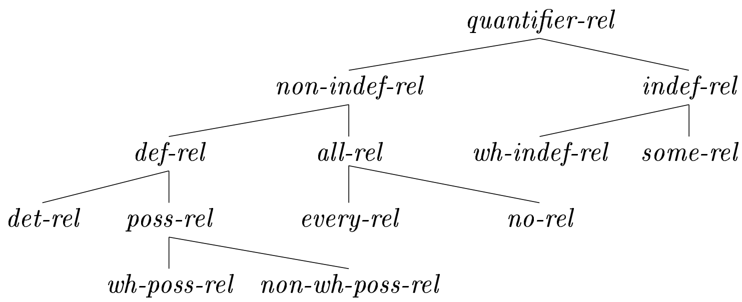
[37]This is different to English: (i) *I wonder John's book about whom you read.
[38]See footnote 30.

discussed above prove, unrestricted amalgamation overgenerates. The amalgamation has to be restricted within nominal phrases. But, instead of stressing the leftness of a *wh*-word, semantic information, precisely the (in)definiteness of the head of the respective nominal phrase is taken into account.

In order to express semantic restrictions, I adopt the framework of Minimal Recursion Semantics (MRS) as formulated by (Copestake et al. 1995). Due to the format of the paper I will address the semantic aspects only in passing.[39] MRS is a computable meta-language whose semantic representations are flat lists of metalanguage constants. The constants of the metalanguage are called 'relations' (*rels*) and are interpreted as sorts in a sorted feature structure formalism. If MRS is taken as a representation of semantics in HPSG, the CONTENT value will be restricted to objects of sort *mrs*. One of the appropriate features of structures of sort *mrs* is LISZT which comprises a list of so-called *relation*-objects whose features depend on their sort; those features, however, are irrelevant for our purposes.

In accordance with (Pollard and Sag 1994), determiners also represent a relation which is indicated by a *rel*-sort. Suppose determiners are treated as indefinite quantifiers. The partial sort hierarchy in (40) illustrates a possible organisation of elements of sort *quantifier-rel*. Note that *wh*-words introduce a quantifier.[40] Furthermore, *wh*-elements split up into *wh*-possessives like '*wessen*' ('*whose*'), that behave like definite determiners, similarly to other possessives, and *wh*-indefinites like '*welch-*' ('*which*'), '*was*' ('*what*') and so on.

(40)



[39]The reader is refered to the original work of Copestake et al.

[40]The assumption that *wh*-words introduce an indefinite quantifier has found proponents and opponents. In spite of everything, it is still plausible to analyze *wh*-words as indefinite quantifiers. This issue cannot be discussed here.

Before revising FAC, it is important to point out that the value of LISZT for a phrase P is the result of appending the values of LISZT in each of P's daughters'.

Now, we have all the technical means to formulate the final version of the *Form Amalgamation Constraint* that forces lexical threading:

(41) FORM AMALGAMATION CONSTRAINT (FAC) (final version)
The FORM-value of a lexical head *must* be identified with the FORM-values of its non-sentential complements, modifiers and specifiers.

As argued before in detail, the FAC needs further restriction to cover the pied piping data. For this purpose, a Blocking Condition is introduced causing the FAC not to be satisfied in certain cases.

(42) BLOCKING CONDITION
FORM-Amalgamation is blocked by incompatible semantic relations.[41]

The Blocking Condition addresses complex nominal pied piping. In particular, cases like (43) are ruled out by suppressing the percolation of the *wh*-property, which contradicts the FAC.

(43) a. **das/ *Peters/*ihr/ *jedes wie grosse(s) Haus*
the/ Peter's/her/ every how big house

b. **wessen wie grosses Haus*
whose how big house

By and large, incompatible semantic relations are relations between objects that differ in (in)definiteness. Using MRS, Incompatibility is stated more precisely in (44):

(44) SEMANTIC INCOMPATIBILITY
A nominal head's LISZT-value that is a subsort of *non-indefinite-rel* is incompatible with a complement's LISZT-value that contains a *relation*-object which is a subsort of *wh-indefinite-rel*.

[41] The term 'relation' is meant in the sense of MRS, cf. (Copestake et al. 1995).

Taking the sort hierarchy (40) and Semantic Incompatibility into account and assuming that a *wh*-degree-word like '*wie*' ('*how*') is described semantically by a relation *wh-degree-rel* that is a subtype of *wh-indefinite-rel*, the FAC correctly rules out examples like (43a). Given a DP[42] analysis according to which nominal phrases are headed by a D^0 element, the definite determiner '*das*' ('*the*') introduces a sort *definite-rel* to its LISZT-value, which is incompatible with the *wh-indefinite-rel* of its complement. Therefore, it cannot be amalgamated because of the Blocking Condition. With FAC, the structure is ungrammatical.

If possessives are analyzed as heads, then the same argumentation applies here as for (43). If possessives (and prenominal genitives) are analyzed as specifiers of an empty determiner[43], then, as a first stage, it is assumed that the possessive specifier and the empty head share their semantic properties which means that the empty determiner is marked as definite. Everything else is similar to other definite determiners. Since *wh-poss-rel* is the semantic relation defined for the possessive *wh*-word '*wessen*' ('*whose*'), it is correctly predicted that examples like (43b) are ungrammatical.

As for grammatical examples like (38), the indefinite determiner '*ein*' ('*a*'), which heads the phrase, introduces a sort *indefinite-rel* to its LISZT-value which is compatible with the *wh-indefinite-rel* of its complement. Thus, the structure satisfies the FAC.

To conclude: Applying the FAC ensures that all interrogative *wh*-phrases are recognizable and that complex interrogative *wh*-phrases are admitted only if built correctly, whereas incorrectly built complex interrogative *wh*-phrases are ruled out as desired. The proposed sort *form* and the corresponding feature FORM combined with FAC satisfy the first issue stated at the very beginning of this section.

5. Summary

In this article, a rather straightforward analysis of German *wh*-interrogatives was presented within the standard HPSG framework. This article has proposed an abstract sentence type *wh*-interrogative from which

[42] Cf. (Netter 1994) and (Winhart 1997) for such an analysis and see the remarks in footnote 30).

[43] Cf. (Abb 1994) for such a proposal.

the main structural properties of German *wh*-interrogatives can be derived. The sentence type *wh*-interrogative has been represented by an Interrogative-Head Schema, which accounts for verb second and verb final *wh*-interrogative clauses uniformly. While distinguishing complementizers and *wh*-phrases syntactically, all interrogative *wh*-phrases are treated in a uniform way, independently of their occurrence in verb second or verb final clauses.

Wh-interrogatives are interpreted compositionally. Apart from *wh*-phrases that contribute a quantifier to the meaning, the Interrogative-Head Schema provides structurally an interrogative operator that a semantics for *wh*-question can be linked to.

By proposing the *Form Amalgamation Constraint*, semantic information has been made accessible to the percolation of the *wh*-property within a phrase, thereby accounting for the pied piping data.

References

Abb, Bernd. 1994. Die Generierung deutscher Nominalstrukturen. Arbeitspapiere zur Sprachproduktion No. 5. Univ. Hamburg.

Bayer, Joseph. 1984. COMP in Bavarian Syntax. *The Linguistic Review* 3:209–274.

Brandt, Margareta, Marga Reis, Inger Rosengren, and Ilse Zimmermann. 1992. Satztyp, Satzmodus und Illokution. In Inger Rosengren, ed., *Satz und Illokution*. Tübingen.

Chomsky, Noam. 1986. *Knowledge of Language: Its Nature, Origin and Use*. New York.

Copestake, Ann, Daniel Flickinger, Robert Malouf, Susanne Riehemann, and Ivan Sag. 1995. Translation Using Minimal Recursion Semantics. In *Proceedings of the 6th Intern. Conference on Theoretical and Methodological Issues in MT*. Leuven.

Egg, Markus. 1998. Wh-questions in underspecified Minimal Recursion Semantics. To appear in *Journal of Semantics*. 15:37–82.

Egg, Markus, and Anke Feldhaus. 1997. Syntax and Semantics of Complex and Ambiguous *wh*-Questions. In *Proceedings of the 2nd Intern. Workshop on Computational Semantics*. Tilburg.

Gallmann, Peter. 1997. Zu Morphosyntax und Lexik der w-Wörter. Arbeitspapiere des SFB 340 No. 107. Univ. Tübingen.

Ginzburg, Jonathan, and Ivan Sag. 1998. English Interrogative Constructions. Unpubl. ms., Stanford University.

Höhle, Tilman. 1986. Der Begriff 'Mittelfeld', Anmerkungen über die Theorie der topologischen Felder. In Walter Weiss, Herbert Ernst Wiegand, and Marga Reis, eds.,*Kontroversen, alte und neue. Akten des VII. Internationalen Germanistenkongresses Göttingen.* Bd.3. Tübingen.

Höhle, Tilman. 1992. Über Verum-Fokus im Deutschen. In Joachim Jacobs, ed., *Informationsstruktur und Grammatik.* Opladen.

Höhle, Tilman. 1997. Vorangestellte Verben und Komplementierer sind eine natürliche Klasse. In Franz-Josef d'Avis, and Ulrich Lutz, eds., *Zur Satzstruktur im Deutschen.* Arbeitspapiere des SFB 340 No. 90. Univ. Tübingen.

Kathol, Andreas. 1995. *Linearization-Based German Syntax.* Doctoral dissertation, OSU.

Kiss, Tibor. 1995. *Merkmale und Repräsentationen.* Westdeutscher Verlag Opladen.

Netter, Klaus. 1994. Toward a Theory of Functional Heads: German Nominal Phrases. In John Nerbonne, Klaus Netter, and Carl Pollard, eds., *German in HPSG.* CSLI Publications.

Pollard, Carl, and Ivan Sag. 1994. *Head-driven Phrase Structure Grammar.* CSLI Publications and University of Chicago.

Pollard, Carl, and Eun Jung Hong Yoo. 1997. Amount Quantifier Phrases, Wh-in-situ, and Quantification. Unpubl. ms., OSU. (To appear in *Journal of Linguistics*).

Rapp, Irene. 1992. Die w-Wörter wie, wieviel-, wievielt- im Rahmen einer Degree-Phrasen Analyse. In Marga Reis et al., eds., *W-Phrasen, W-Merkmale, Skopusberechnung* . Arbeitspapiere des SFB 340 No. 7. Univ. Tübingen.

Richter, Frank, and Manfred Sailer. 1998. Complementizers and Finite Verbs in German Sentence Structure. Paper presented at the ESSLLI98-Workshop 'Current Topics in Constraint-based formal Theories of Germanic Syntax'. Univ. Saarbrücken

Reis, Marga. 1985. Satzeinleitende Strukturen im Deutschen. Über COMP, Haupt- und Nebensätze, w-Bewegung und die Doppelkopfanalyse. In Werner Abraham, ed., *Erklärende Syntax des Deutschen.* Tübingen.

Reis, Marga. 1991. Was konstituiert w-Interrogativsätze? Gegen Paschs Überlegungen zur Syntax und Semantik interrogativer w-Konstruktionen. *Deutsche Sprache* 19:213–262.

Reis, Marga. 1992. Zur Grammatik und Pragmatik von Echo-w-Fragen. In Inger Rosengren, ed., *Satz und Illokution*.Bd.1. Tübingen.

Reis, Marga. 1997. Zum syntaktischen Status unselbständiger Verbzweit-Sätze. In Christa Dürscheid, Karl Ramers, and Monika Schwarz, eds., *Syntax im Fokus. Festschrift für Heinz Vater*. Tübingen.

Reis, Marga. 1998. On Sentence Types in German. An Enquiry into the Interface of Grammar and Pragmatics. In Irmengard Rauch, ed., Proceedings of the Germanic Round Table at Berkeley, April 1998.

Stechow, Arnim v. 1993. Die Aufgaben der Syntax. In Joachim Jacobs, Arnim v. Stechow, and Wolfgang Sternefeld, eds., *Handbuch der Syntax.* Berlin.

Trissler, Susanne. 1998. Syntaktische w-Phrasen im Deutschen. Unpubl. ms., Univ. Tübingen.

Trissler, Susanne, and Ulrich Lutz. 1992. Einige Überlegungen zu syntaktischen +w-Mermalen, Interrogativsätzen und w-Phrasen im Deutschen. In Marga Reis et al., eds., *W-Phrasen, W-Merkmale, Skopusberechnung* . Arbeitspapiere des SFB 340 No. 7. Univ. Tübingen.

Trissler, Susanne, and Ulrich Lutz. 1997. On some Cases of Complex Pied Piping in German. Talk given at the *International Conference on Pied Pieping*, Univ. Jena.

Winhart, Heike. 1997. Die Nominalphrase in einem HPSG-Fragment des Deutschen. In Erhard Hinrichs, Detmar Meurers, Frank Richter, Manfred Sailer, and Heike Winhart, eds., *Ein HPSG-Fragment des Deutschen.* Arbeitspapiere des SFB 340 No. 95. Univ. Tübingen.

Anke Feldhaus

Sonderforschungsbereich 340, Projekt A3
Seminar für Sprachwissenschaft
Kleine Wilhelmstr. 113
72074 Tübingen
Germany

E-mail address: `feldhaus@sfs.nphil.uni-tuebingen.de`
Hompage: `http://www.sfs.nphil.uni-tuebingen.de/~feldhaus/`