An HPSG analysis of non-integrated *wh*-relative clauses in German

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Abstract

In this article, the so-called *wh*-relative clause construction is investigated. The German *wh*-relative clauses are syntactically relevant as they show both, root clause and subordinate clause properties. They matter semantically because they are introduced by a *wh*-anaphor that has to be resolved by an appropriate abstract entity of the matrix clause. Additionally, the *wh*-relative clause construction is discourse-functionally peculiar since it evokes coherence. Besides these interesting empirical characteristics, *wh*-relatives raise important theoretical questions. It is argued that the standard HPSG theory has to be extended to account for non-restrictive relative clauses in general, and to cope with the particular properties of the *wh*-relative construction.

1 Introduction

This paper discusses a certain class of German relative clauses. They are called '*wh*-relatives' since this class can easily be detected by an overt left-peripheral *wh*-relative expression. A typical example of this class is given in (1):

(1) Anna hat die Schachpartie gewonnen, was Peter ärgerte.
Anna has the game of chess won which Peter annoyed
'Anna won the game of chess, which annoyed Peter.'

The investigation of the *wh*-relatives is worthwhile for two reasons:

Firstly, although the *wh*-relatives are mentioned in almost every grammar book of German, to date their grammatical properties have not been studied comprehensively, the only exception being Brandt (1990). Brandt focusses on the pragmatic aspects of the *wh*-relative construction and therefore does not provide a formalized syntactic and semantic analysis of *wh*-relatives.

Secondly, the existence of the *wh*-relative construction makes it necessary to extend the HPSG theory as given by Pollard und Sag (1994).

The paper is organized as follows:

In the first part, the *wh*-relatives will be described empirically. By characterizing their syntactic behaviour, it is investigated how *wh*-relatives are linked to the complex sentence structure. Then, the semantic and discourse-functional properties of the *wh*-relative construction will be examined.

In the second part, the *wh*-relatives are interpreted within the HPSG framework. An analysis will be developed that allows both, to cope with non-restrictive relative clauses in general, and to give an adequate formalization of the *wh*-relative construction.

2 Empirical facts

The point of departure is the hypothesis stated in (2):

(2) A *wh*-relative is a relative clause with the following properties:

a. A *wh*-relative is a non-restrictive clause introduced by an anaphoric *wh*-expression.

b. Syntactically, it is dependent on a matrix clause without being embedded into it.

c. Semantically, it is related to various kinds of abstract entities.

d. Pragmatically, the *wh*-relative construction establishes a symmetric discourse relation.

In the following, this hypothesis will be tested.

2.1 Syntactic properties

2.1.1 Left periphery

One can easily recognize a *wh*-relative by its left periphery. Three kinds of expressions which may act as a complement or an adjunct of the relative clause's predicate can be observed on the left of a *wh*-relative:

(i) The underspecified pronoun *was* (‘*which*’) as illustrated in (3) occurs at the left of a *wh*-relative. *Was* represents either a verbal phrase or a nominal phrase. In the latter case *was* is not specified with respect to person, number and gender, but depending on the selection properties of the respective predicate it is case marked as nominative or accusative.

(3) a. Max kann Orgel spielen, was$_{VP}$ Anna auch kann.
Max can organ play which Anna too can
‘Max can play the organ, which Anna can, too.’

b. Max spielt Orgel, was$_{NP[NOM]}$ gut klingt.
Max plays organ which good sounds
‘Max is playing the organ, which sounds good.’

c. Max spielt Orgel, was$_{NP[ACC]}$ Anna überrascht.
Max plays organ which Anna surprises
‘Max is playing the organ, which surprises Anna.’

(ii) *wh*-Adverbs such as *weswegen* (‘*why*’) and *wofür* (‘*for which*’) as illustrated in (4) can introduce a *wh*-relative. These adverbs preserve their modal, temporal or causal meaning if they occur in a *wh*-relative.

(4) a. Otto hat sich sein Bein gebrochen, weswegen er jetzt im
Otto has REFL *his leg broken that's why he now in*
Krankenhaus ist.
hospital is
‘Otto broke his leg, and that's why he is in hospital now.’

b. Otto schenkt Emma Schokolade, wofür sie ihm dankt.
Otto gives Emma chocolate for which she him thanks
'Otto gives Emma chocolate for which she thanks him.'

(iii) Complex expressions including a *wh*-element and an abstract noun can be found at the left of a *wh*-relative as exemplified in (5). In this case, the meaning of the abstract noun has to be compatible with the meaning of the matrix clause's predicate.

(5) Max bat Maria, einen Brief einzuwerfen, welcher Bitte sie nachkam.
Max asked Maria a letter to mail which request she granted
'Max asked Maria to mail a letter, and she granted this request.'

Note that the *wh*-expressions presented here are all anaphoric since their meaning depends on a preceding item. I will come back to this issue in section 2.2.

2.1.2 Variants of the *wh*-relative construction

Depending on the syntactic status of the *wh*-expression three *wh*-relative construction variants can be distinguished, which are dubbed variant A, variant B and variant C.

In the construction variants A and B, the left-peripheral *wh*-expression is selected by the relative clause's predicate. In the construction variant C, the *wh*-expression modifies the respective predicate.

The variants A and B differ in the particular selection properties of the predicate of the *wh*-relative clause. The sentence given in (1) repeated here as (6) is an example for the construction variant A.

(6) Anna hat die Schachpartie gewonnen, was Peter ärgerte.
Anna has the game of chess won which Peter annoyed
'Anna won the game of chess, which annoyed Peter.'

Predicates that occur in a *wh*-relative of this variant are subcategorized for a finite sentential or an infinitival complement of the '2. Status' (Bech, 1957) that can alternatively be realized as a nominal or prepositional phrase. For this reason a verb like *sich weigern* ('*to refuse to do something*') cannot occur in a *wh*-relative as can be seen in (7). Although *sich weigern* allows an infinitival complement (cf. (7b)), it cannot take a nominal complement (cf. (7c)).

(7) a. * Peter soll seinen Freund verraten, was er sich weigerte.
Peter was to his friend betray which he REFL *refused*
'Peter was to betray his friend, but he refused it.'

b. Peter weigerte sich, seinen Freund zu verraten.
Peter refused REFL *his friend to betray*
'Peter refused to betray his friend.'

c. * Peter weigerte sich den Verrat seines Freundes.
Peter refused REFL *the betrayal his friend*

Examples for the construction variant B are given in (8). This construction variant is similar to the so-called VP-ellipses as *was* (*'which'*) realizes a VP complement. The class of verbs occurring in these constructions is restricted to auxiliary verbs such as *haben* (*'to have'*), *sein* (*'to be'*) and *werden ('will'*) and to auxiliary modal verbs in root interpretation. Hence, example (9) containing an epistemic modal is ungrammatical.

(8) a. In München hat es geschneit, was es in Stuttgart auch hat.
In Munich has EXPL *snowed which* EXPL *in Stuttgart as well has*
'It snowed in Munich and in Stuttgart as well.'

b. Otto muss nach Frankreich fahren, was Max jetzt auch soll.
Otto must to France go which Max now too should
'Otto must go to France, which Max should do now, too.'

(9) * Peter muss krank gewesen sein, was Otto auch muss.
Peter must sick been has which Otto too must.

As mentioned before, construction variant C covers all clauses introduced by a *wh*-phrase modifying the *wh*-relative's predicate. This is exemplified in (10):

(10) Otto ist krank, weshalb er zu Hause bleiben muss.
Otto is sick that's why he at home stay must
'Otto is sick, and that's why he has to stay at home.'

Looking at the examples given so far, it is obvious that *wh*-relatives can be considered relative clauses. First, they are attached to a preceding clause. Second, they are introduced by a relative constituent that is grammatically dependent on the predicate of the *wh*-relative and that is linked to an entity of the matrix clause. The next question to be discussed is whether *wh*-relatives are in fact non-restrictive clauses.

2.1.3 Root clause properties

The strongest evidence for the claim that *wh*-relatives belong to the class of non-restrictive clauses comes from the observation that they behave like typical root clauses. This is shown by the following phenomena symptomatic of root clauses.

As indicated by (11), a *wh*-relative clause can easily be transformed into a main clause.

(11) Anna hat die Schachpartie gewonnen. Das ärgerte Peter.
Anna won the game of chess. This annoyed Peter.

Also, epistemic expressions, performative indicators, modal particles, etc. can be found in *wh*-relatives, cf. (12a) to (12c).

(12) a. Anna hat die Schachpartie gewonnen, was Peter sicher ärgerte.
Anna has the game of chess won which Peter certainly annoyed
'Anna won the game of chess, which must have annoyed Peter.'

b. Die Firma handelt mit Waffen, weshalb ich hiermit
the company deals with weapons that's why I hereby
kündige.
hand in my notice
'The company deals with weapons, and that's why I hereby hand in my notice.'

c. Max hat den Preis bekommen, was wohl jeden überraschte.
Max has the prize won which well everyone surprised
'Max won the prize, which was probably surprising for everyone.'

Furthermore, it is impossible to form a Yes/No-question integrating the whole *wh*-relative construction. This is indicated by (13).

(13) * Hat Anna die Schachpartie gewonnen, was Peter ärgerte?
has Anna the game of chess won which Peter annoyed

Last, the root clause character of *wh*-relatives is confirmed by examples like (14). A quantifier occuring in the matrix clause cannot bind a variable within the *wh*-relative:

(14) a. * Niemand$_i$ gewann das Schachspiel, was ihn$_i$ maßlos ärgerte.
nobody$_i$ won the game of chess which him$_i$ extremely annoyed

b. * Jeder$_i$ hat sich das Bein gebrochen, weswegen er$_i$ jetzt im
everyone$_i$ has REFL *the leg broken that's why he$_i$ now in*
Krankenhaus ist.
hospital is

2.1.4 Independent focus domain

The observation that a *wh*-relative establishes an independent focus domain within the *wh*-relative construction provides additional evidence for the non-restrictiveness of a *wh*-relative clause.

The standard test for focus assumes that the focus structure of a given declarative utterance can be identified by reconstructing a question that would license the utterance as a coherent answer. The focus corresponds to the interrogative constituent in that question. Based on these test conditions, (15) suggests that the focus does not project out of the *wh*-relative since (15a) is not a coherent answer to the question '*What happened?*'.[1]

[1] In the example, focus is marked by a syntactic focus feature that projects from the pitch-accented focus exponent written in capital letters.

(15) *Was ist passiert?*

a. # [Anna gewann die Schachpartie, was Peter von seiner
Anna won the game of chess which Peter from his
SCHWEster erwartet hat.]$_F$
sister expected has
'Anna won the game of chess, which Peter expected from his sister.'

The independent focus domain of a *wh*-relative is also supported by (16), which demonstrates that the focus sensitive particle *nur* (*'only'*) occuring in the matrix clause does not scope over the *wh*-relative:

(16) ? Anna gewann nur die Schachpartie, was Peter von seiner Schwester
Anna won only the game of chess which Peter from his sister
erwartet hat.
expected has
'Anna only won the game of chess, which Peter expected from his sister.'

2.1.5 Assertion versus presupposition

A third argument for the non-restrictiveness of *wh*-relative clauses is provided by data like (17), which show that a *wh*-relative is asserted and not presupposed.

(17) Peter bedauerte, dass er die GRÜNEN gewählt hatte, was seine Frau
Peter regretted that he the Green Party elected had which his wife
wiederum gut verstand.
in turn well understood
'Peter regretted to have elected the Green Party, which his wife well understood'

Against the background of the presented evidence, it is convincing that *wh*-relatives are non-restrictive clauses. Consequently, the left-peripheral *wh*-expression has to be interpreted anaphorically.

In the next section it will be investigated how *wh*-relatives are related to their matrix clause.

2.1.6 Complex sentence structure

In the literature, one often finds the statement that a *wh*-relative is sentence-related. Based on the assumption that the matrix clause of the *wh*-relative construction can be transformed into a component part of the relative clause[2], it is claimed that a *wh*-relative and its matrix clause establish an inverse dependency relation. Assuming this inverse relationship, the *wh*-expression is taken as a place holder or a variable representing the whole matrix clause, cf. Helbig (1980) and Steube (1991).

Contrary to this assumption, Brandt (1990) argued that examples like (18) show that *wh*-relatives are related to sub-sentential syntactic units.

[2] In the German grammar tradition, the term 'Satzglied' is used here.

(18) Er kann schon schwimmen, was sie noch nicht kann.
He is able to already swim which she yet not is able to
'He is able to swim, which she isn't, yet.'

However, the phenomenon she describes cannot solely be attributed to syntax. As suggested by example (19), the data should rather be explained in semantic terms.

(19) a. Die Geologen erforschen einen neuen Vulkan, was sehr interessant ist.
the geologists explore a new volcano which very interesting is
'The geologists explore a new volcano, which is very interesting.'
b. "Dass sie einen neuen Vulkan erforschen, ist sehr interessant."
'That the geologists explore a new volcano is very interesting.'
c. "Einen neuen Vulkan zu erforschen ist sehr interessant."
'To explore a new volcano is very interesting.'
d. "Das Erforschen eines neuen Vulkans ist sehr interessant."
'The exploring of a new volcano is very interesting.'

(19a) has three readings, (19b) to (19d), depending on the interpretation of the *wh*-anaphor. *Was* ('*which*') can be resolved (i) by the proposition denoted by the matrix clause, cf. reading (19b), or (ii) by an eventuality such as the process of exploring, cf. reading (19c), or (iii) by the exploration-event, cf. reading (19d). Because the string of the matrix clause standing alone is not ambiguous at all, examples like (19) prove that the crucial grammatical relation between a *wh*-relative and its matrix clause is a semantic one. This view is also supported by the data given in (20).

(20) a. Maria will sich ihre Haare kämmen, was Hans auch will.
Maria wants REFL *her hair comb which Hans too wants*
'Maria wants to comb her hair, which Hans wants to do, too.'
b. "Hans$_i$ will sich$_i$ seine Haare kämmen."
'Hans wants to comb his hair.'

(20a) has a reading where the reflexive pronoun *sich* ('*herself*') gets a sloppy interpretation as expressed by (20b). This reading could not be explained by a syntactic operation that just transforms parts of the matrix clause into a component part of the *wh*-relative.

The semantic nature of the reference relation is further substantiated by (21). The indefinite NP in the matrix clause is interpreted generically, whereas it gets a specific interpretation within the *wh*-relative. Thus, the semantic information of the matrix clause is accessible from the *wh*-relative clause.

(21) Maria wollte keinen Linguisten heiraten, was sie dann aber doch getan hat.
Maria wanted no linguist marry which she then PART PART *done has*

'Maria didn't want to marry a linguist, which she did in the end.'

Consequently, one must strictly distinguish between the syntactic and the semantic relations established within the *wh*-relative construction: Whereas the semantic relation is triggered by the left-peripheral *wh*-anaphor, the syntactic relation affects the way of how the *wh*-relative is attached to its preceding clause.

With regard to the syntactic relation, it becomes apparent that a *wh*-relative is not licensed by the predicate of the matrix clause.[3] The *wh*-relative neither saturates one of the argument positions of the matrix predicate nor modifies the matrix predicate. Nevertheless, it is obvious that *wh*-relatives are depending clauses.

Reis (1997) argued that some clauses in German may be dependent on a matrix clause although they are not licensend by the matrix predicate. In other words, these clauses are linked to the complex sentence structure without being part of the verbal projection of the matrix clause. Reis (1997) calls these clauses 'non-integrated'. She lists four main properties of this clausal class. Firstly, non-integrated clauses are prosodically and pragmatically independent from the matrix clause which is indicated by an independent focus domain. Secondly, variable binding is not allowed from the matrix clause into the non-integrated clause. Thirdly, a non-integrated clause is syntactically dispensable, and fourthly, a non-integrated clause always stands at the end of a complex sentence.

Taking these criteria into account, *wh*-relatives can be classified as non-integrated clauses. As shown in section 2.1.4, they establish an independent focus domain; they are impermeable for variable binding from outside; and they are syntactically dispensable as they can be transformed into a main clause. Thus, the first three of Reis's criteria clearly apply to *wh*-relatives. In addition, the fourth criterion is met as well. (22) and (23) illustrate that a *wh*-relative always comes last because it has to follow an extraposed complement clause (22) or relative clause (23).

(22) a. Es fiel Maria nicht auf, dass sie sich verrechnet hatte,
EXPL *realized Maria not* PART *that she* REFL *mistaken had*
weswegen sie sich jetzt ärgert.
that's why she REFL *now annoyed*
'Maria didn't realize that she made a mistake, and that's why she is annoyed now.'

b. * Es fiel Maria nicht auf, weswegen sie sich jetzt ärgerte,
EXPL *realized Maria not* PART *that's why she* REFL *now annoyed*
dass sie sich verrechnet hatte.
that she REFL *mistaken had*

(23) a. Anna hat einen Ring verloren, der sehr wertvoll war, weshalb sie
Anna has a ring lost that very valuable was that's why she
sich jetzt maßlos ärgerte.
REFL *now extremely annoyed*

[3] This can be shown by applying the traditional constituent tests, which clearly reveal that a *wh*-relative is neither attached to a verb nor a verbal phrase of the matrix clause, cf. Holler (2001).

‘Anna lost a ring that was very valuable, and that’s why she was annoyed now.’

b. * Anna hat einen Ring verloren, weshalb sie sich jetzt maßlos
Anna has a ring lost that’s why she REFL *now extremely*
ärgerte, der sehr wertvoll war.
annnoyed that very valuable was

The above listed syntactic facts can be accounted for by analysing the *wh*-relative as a syntactic sister of the sentential projection introduced by the matrix clause. Before discussing how this can be formalized within the HPSG theory, the semantic and discourse functional properties of *wh*-relatives will be described in more detail.

2.2 Semantic properties

In the literature going back to philologic grammar tradition, it is generally claimed that a *wh*-relative must refer to a fact. Although a reference to facts and propositions is indeed possible as (24) shows,

(24) Grass sagte die Lesung ab, was bedauerlich ist.
Grass cancelled the reading PART *which regrettable is*
‘Grass cancelled the reading, which is regrettable.’

the afore mentioned example in (19) and the ones in (25) indicate that a *wh*-relative refers to non-propositional entities as well.

(25) a. Nachbars Hund bellte, was sogar Anna hörte, obwohl sie zwei
neighbor’s dog barked which even Anna heard although she two
Straßen weiter wohnt.
blocks away lives
‘The neighbor’s dog barked, which even Anna heard although she lives two blocks away.’

b. Max rasierte sich, was eine halbe Stunde dauerte.
Max shaved REFL *which an half hour took*
‘Max shaved, which took him half an hour.’

c. Anna gewinnt immer die Schachpartie, was Peter ärgert.
Anna wins always the game of chess which Peter annoys
‘Anna always wins the game of chess, which annoys Peter.’

d. Karl hat den K2 bestiegen, was Otto auch gelungen ist.
Karl has the K2 climbed which Otto as well achieved is
‘Karl climbed the K2, which Otto achieved as well.’

In (25a), the predicate of the *wh*-relative consists of a recognition verb, namely *hören* (‘*to hear*’), and the *wh*-anaphor *was* (‘*which*’) refers to the event of a dog barking. Similarly, the *wh*-anaphor in (25b) restricted by the verb *dauern* (‘*to*

take') refers to an event. (25c) and (25d) show that even eventualities are possible antecedents of a *wh*-relative. (25c) means that Peter is annoyed *every time* Anna wins the game of chess. The verb *gelingen* ('*to achieve*') in (25d) generally selects an eventuality if the respective argument is verbal. If *was* ('*which*') of example (25d) referred to a fact or an event, Otto would have given Karl a piggyback, which is certainly not the meaning of (25d). Even if one restricts the antecedents of the *wh*-relative to propositional ones, *wh*-relatives are not only fact-related. In (26) for instance the *wh*-relative is related to an attitude and not to a fact.

(26) Fred glaubte, dass Grass die Lesung abgesagt hatte, was Anna nicht
Fred believed that Grass the reading cancelled had which Anna not
gedacht hätte.
expect had
'Fred believed that Grass cancelled the reading, which Anna didn't expect.'

Finally, the examples in (27) show that so-called projective propositions, such as interrogative clauses or the infinitival complements of modal verbs, can be appropriate antecedents of a *wh*-relative.

(27) a. Maria will wissen, welche Prüfungen sie ablegen muss, was ihr
Maria wonders which exams she take must which her
aber niemand sagte.
PART *nobody told*
'Maria wonders which exams she has to take, which nobody told her.'

b. Karl wollte eine Maus halten, was seine Mutter ihm aber nicht
Karl wanted a mouse keep which his mother him PART *not*
erlaubte.
allowed
'Karl wanted to keep a mouse, which his mother didn't allow.'

Thus, we have to conclude that a fact is one possible antecedent of the *wh*-anaphor, but not the only possible antecedent. However, there are semantic restrictions that control the *wh*-relative construction. They limit the class of admissible *wh*-relative predicates and restrict the potential antecedents of the *wh*-anaphor. More precisely, the restriction given in (28) holds.

(28) In a *wh*-relative construction, the semantic type of the *wh*-anaphor must correspond to the semantic type of at least one entity that can be abstracted from the matrix clause.

Restriction (28) accounts for the fact that (29a) but not (29b) is ungrammatical. The *wh*-anaphor is an argument of the verb *glauben* ('*to believe*') and therefore denotes a belief. An attitude, however, can be abstracted from the matrix clause only in (29b), but not in (29a).

(29) a. * Fred heiratet Anna, was Max glaubt.
Fred married Anna which Max believes.

b. Karl glaubt, dass Fred Anna heiratet, was Max auch glaubt.
Karl believes that Fred marries Anna which Max as well believes
'Karl believes that Fred marries Anna, which Max believes, too.'

Within the approach of Asher (1993) it is possible to account for these empirical facts. Asher (1993) provides a semantics for abstract objects in the framework of DRT. Adapting Asher's theory, the semantic relation between the *wh*-relative clause and the matrix clause is based on the anaphoric relation established between the *wh*-ahapher and a preceding object abstracted from the matrix clause. Thereby it is assumed that the *wh*-anaphor introduces into the representation a discourse referent that needs to be resolved. The semantic type of this discourse referent is restricted by the predicate of the *wh*-relative in case the *wh*-anaphor is an argument of the relative clause's predicate. Otherwise it is propositional. A *wh*-construction is valid, if the matrix clause contains at least one abstract object that can resolve the *wh*-anaphor. A *wh*-construction is ambiguous, if the matrix clause contains several abstract objects that can act as an antecedent of the *wh*-anaphor.[4]

2.3 Discourse-functional properties

Let us finally turn to the discourse-functional properties of the *wh*-relative construction. A *wh*-relative construction is coherent as stated by Brandt (1990) and others. Brandt (1990) concluded that the matrix clause and the *wh*-relative bear the same communicative weight. She attributes this to the root clause character of the *wh*-relative. At a closer look, however, the communicative balance in fact arises from a symmetric discourse relation established between the matrix clause and the *wh*-relative. Following Asher's discourse-structural theory, in a symmetric discourse relation at least the axioms of Continuation(α, β) have to be satisfied. Stated in Asher's axiomatic system, (30) is a typical example for a CAUSE relation and (31) for a CONTRAST relation implemented in the *wh*-construction. Both relations continue the discourse and hence count as symmetric discourse relations.

(30) a. Hans hatte einen Unfall, weswegen er im Bett liegen muss.
Hans had an accident that's why he in bed lie must
'Hans had an accident, and that's why he has to stay in bed.'
b. $\langle\alpha,\beta\rangle$ & **have_an_accident**(α) & **stay_in_bed**(β) $>$ *Cause*(α,β)

(31) a. Hans schreibt gerne Bücher, wohingegen Emma lieber tanzt.
Hans writes willingly books whereas Emma rather dance
'Hans likes to write books, whereas Emma prefers dancing.'
b. $\langle\alpha,\beta\rangle$ & **write_books**(α) & **dance**(β) $>$ *Contrast*(α,β)

[4] For formal explication, see Holler (2001).

3 HPSG analysis

The last part of this paper concentrates on the HPSG analysis that is proposed to account for the empirical facts afore described. The *wh*-relative construction is of particular interest for the further development of the HPSG formalism. Standard HPSG theory has focussed on restrictive relative clauses, and hence, in this formalism a relative clause can only be attached to a preceeding NP. It is shown in the next section how the standard theory can be extended to account for the special properties of the *wh*-relative construction.

The standard phrasestructural analysis of relative clauses in HPSG going back to Pollard und Sag (1994) is based on the assumption that a relative clause is a projection of a phonologically empty relativizer, cf. (32). This relativizer is subcategorized for two complements: a phrase containing a relative constituent expressed by a non-empty REL value and a finite verbal projection which is slashed by this relative phrase. The SLASH dependency is bound off by the relativizer. The relative clause is attached to a preceding noun by applying the HEAD-ADJUNCT Schema triggered by the attribute MOD. The relative clause is interpreted as a property, since the indices of the noun and the relative phrase are identified and their RESTRICTION values are unified.

(32)
$$\left[\begin{array}{l}\text{LOC}\left[\begin{array}{l}\text{CAT}\left[\begin{array}{l}\text{HEAD}\left[\begin{array}{l}\textit{rltvzr}\\ \text{MOD}\ \text{N'}\left[\text{TO-BD}\mid\text{REL}\left\{\boxed{1}\right\}\right]\text{:}\left[\begin{array}{l}\text{INDEX}\ \boxed{1}\\ \text{RESTR}\ \boxed{3}\end{array}\right]\end{array}\right]\\ \text{SUBC}\ \langle\left[\text{LOC}\ \boxed{4}, \text{INHER}\mid\text{REL}\left\{\boxed{1}\right\}\right],\\ \qquad \text{S}\left[\textit{fin, unmarked}, \text{INHER}\mid\text{SLASH}\left\{\boxed{4}\right\}\right]\text{:}\ \boxed{5}\rangle\end{array}\right]\\ \text{CONT}\left[\begin{array}{l}\text{INDEX}\ \boxed{1}\\ \text{RESTR}\left\{\boxed{5}\right\}\cup\boxed{3}\end{array}\right]\end{array}\right]\\ \text{NLOC}\mid\text{TO-BD}\mid\text{SLASH}\left\{\boxed{4}\right\}\end{array}\right]$$

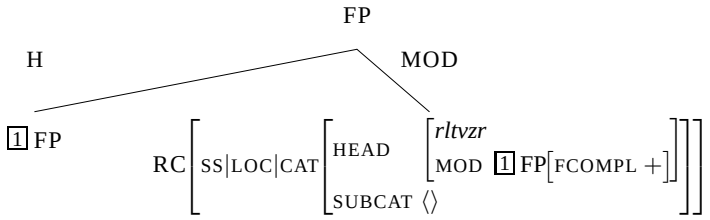
In section 2, it has been argued that (a) a *wh*-relative is a non-restrictive clause and (b) that its syntactic antecedent may differ from its semantic one. Whereas the syntactic relation is always unique as there is only one way *wh*-relative is attached to its matrix clause, the semantic relation depends on the potential antecedents resolving the left-peripheral *wh*-anaphor.

To cope with these properties, a second relativizer is defined besides the restrictive one that serves as the head of a non-restrictive *wh*-relative clause.[5] Similar to the restrictive relativizer, the non-restrictive relativizer takes two complements: a relative phrase and a finite verbal projection slashed by this phrase. The non-restrictive relativizer also bears an non-empty MOD-attribute. In contrast to the restrictive relativizer, however, the value of the MOD attribute is specified as FP, as indicated by the schematic analysis in (33). The *wh*-relative thus syntactically

[5]The proposed analysis could easily be restated in a construction-based setting, cf. Sag (1997). I adhere to the phrasestructural account since i.a. it is not clear how the proliferation of types is prevented within a construction-based analysis. See Holler-Feldhaus (2001) for further arguments.

combines with a functionally complete and fully saturated sentential projection (i.e. FP) and not – as in the restrictive case – with a nominal phrase.

(33)



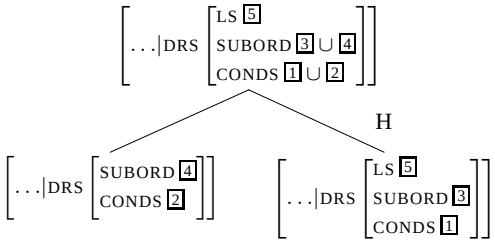
Leaving the details of German sentence structure aside, I assume binary branching and the concept of functional completeness (Netter, 1996). Functional completeness is expressed by a binary feature FCOMPL, which is specified as 'plus' if a sentential head (e.g. a complementizer) has been realized and as 'minus' otherwise. The analysis described so far accounts for the fact that a *wh*-relative syntactically relates to a sentence.

To cover the semantic relation between the *wh*-relative and its antecedent, we depart from the semantics used in standard HPSG. Following Frank und Reyle (1995), the structure of the CONTENT attribute as well as the Semantics Principle are changed, thereby integrating aspects of the framework of DRT into the semantic component of HPSG. As presented in (34), the CONTENT attribute is replaced by a complex feature structure, called DRS, which consists of three attributes, LS, SUBORD and CONDS. CONDS is a set of labelled DRS conditions, SUBORD contains information about the hierarchical structure of a DRS and LS defines distinguished labels within this hierarchy. Additionally, we assume that the DRS conditions instantiating the CONDS value are represented by a set of objects of type *p*(*artial_*)*drs*.

(34)
$$\begin{bmatrix} \textit{drs} & \\ \text{LS} & \begin{bmatrix} \text{L-MAX} & \mathbf{l}_{max} \\ \text{L-MIN} & \mathbf{l}_{min} \end{bmatrix} \\ \text{SUBORD} & \{\mathbf{L} \leq \mathbf{L}'\} \\ \text{CONDS} & \textit{set-of-pdrs} \end{bmatrix}$$

The Semantic Principle adapted from Frank und Reyle (1995) is depicted in (35). It controls the inheritance of the partial DRSes defined in the CONDS attributes of the daughters to the CONDS value of the phrase. The semantic conditions are always inherited from both daughters and therefore project to the uppermost sentential level. Thus, the Semantics Principle applies to *head-comp-* and *head-adjunct-structures* in exactly the same way.

(35)

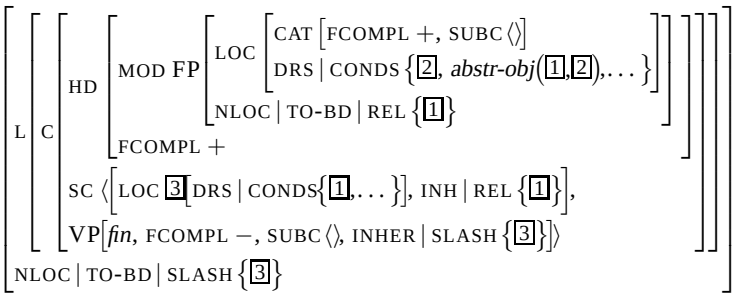


Moreover, an attribute DREF appropriate for objects of type *pdrs* that introduce a discourse referent is defined. The value of DREF is lexically instantiated. For instance, a verb introduces an event variable and a definite determiner an individual variable.

Given this theoretical framework, the semantic analysis sketched in section 2.2. can be implemented into HPSG. The *wh*-anaphor introduces a discourse referent by instantiating its DREF-attribute, and this discourse referent has to be related to an appropriate semantic object abstracted from the DRS of the matrix clause. This is ensured by a two-place function called *abstr*(*act*)-*obj*(*ect*), which takes the discourse referent of the *wh*-anaphor and the partial DRS of the matrix clause, and yields an abstract object appropriate to resolve the *wh*-anaphor.

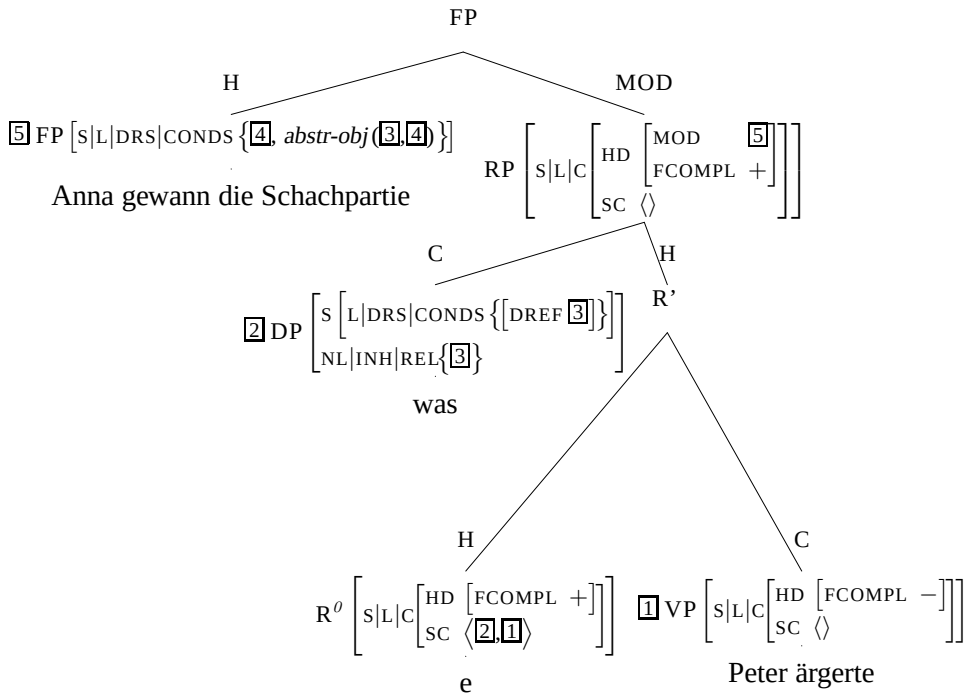
This analysis is made possible by the SYNSEM value of the relativizer given in (36). In (36), the value of REL contains the *d*(*iscourse_*)*ref*(*erent*) of the *wh*-anaphor marked by tag 1. The tag 2 represents the DRS conditions of the matrix clause whereas *abstr-obj*(1,2) represents the abstracted object which is the antecedent of the *wh*-anaphor's discourse referent.

(36)



The simplified partial structure for the sentence *Anna gewann die Schachpartie, was Peter ärgerte* ('*Anna won the game of chess, which annoyed Peter*.') given in figure (37) illustrates the proposed analysis.

(37) Anna gewann die Schachpartie, was Peter ärgerte.
Anna won the game of chess which annoyed Peter
'Anna won the game of chess, which annoyed Peter.'



In this example, the *wh*-relative clause (= RP) is a projection of a functionally complete empty relativizer subcategorized for a fully saturated, but functionally incomplete VP (= 1) and a relative phrase (= 2). This relative clause is syntactically attached to a matrix clause that is functionally complete (= 5FP) by applying the HEAD-ADJUNCT Schema. The semantic relation between the matrix clause and the *wh*-relative is established by the anaphor *was*. According to the selection properties of the predicate *ärgern* ('*to annoy*'), *was* ('*which*') introduces a propositional discourse referent (= 3) into the representation. This referent is resolved by an object (= *abstr-obj*(3,4)) that is abstracted from the proposition introduced by the matrix clause (= 4).

4 Conclusion

It was shown that *wh*-relatives behave like non-integrated clauses, and that they establish a class of German relative clauses of their own. It was argued that *wh*-relatives are related to a sentence only in syntactic respects. Semantically, however, *wh*-relatives can refer to entities of various semantic types (e.g. events, eventualities, propositions, projective propositions, attitudes, and facts.) Pragmatically, *wh*-relative constructions evoke coherence because of a symmetric discourse relation established between the matrix clause and the *wh*-relative. To account for these

facts an HPSG analysis has been developed that copes with non-restrictive relative clauses and allows an adequate description of the grammatical properties of the *wh*-relative construction. A *wh*-relative is analyzed as being attached to a sentential projection that is functionally complete. The left-peripeheral *wh*-anaphor introduces a discourse referent into the semantic representation. The semantic type of this referent is restricted by the predicate of the *wh*-relative. The antecedent of the *wh*-anaphor is abstracted from the matrix clause whereby the semantic type of the object to be abstracted depends on the type of the discourse referent representing the *wh*-anaphor.

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