Wh-Copying in German as Replacement

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Abstract

This paper offers an argument for the necessity of adopting grammatical relations as primitives in syntactic theory. The argument is based on the phenomenon of wh-copying in German. Wh-copying in German poses a problem for approaches based on phrase structure (PS) representations because the construction is governed by two generalizations which a PS approach fails to capture. As soon as a relational perspective on syntactic structures is adopted, however, the generalizations can be captured. I will present an analysis for wh-copying in German within the Arc Pair Grammar framework, which does adopt such a relational view. It will be shown that the operation *Replace* in interaction with other principles of that framework successfully captures the two generalizations of wh-copying in German, and that it eventually even allows one to reduce the two generalizations to a single one.

1 Introduction

In this paper, I will deal with the proper analysis of wh-copying in German and argue that such an analysis can only be arrived at if grammatical relations are adopted as primitives for syntactic theory. The paper is organized as follows. In section 2, I will give a brief overview of the construction in German and argue that it is a regular extraction construction. In section 3, two specific generalizations of wh-copying in German will be established. Section 4 shows that phrase structure approaches fail to express these generalizations. Section 5 presents an analysis for wh-copying within Arc Pair Grammar that succeeds expressing these two generalizations. I will finally deal with a restriction found in German that restricts the shape of both extracted and resuming element simultaneously and show that this variation can be easily explained by the analysis.

2 Wh-Copying in German

Wh-copying is a construction in which an **extracted**[1] **wh-phrase** originating in an embedded clause is taken up by a resuming element in the initial position of the embedded clause, cf. (1).

(1) **Wen** glaubst du wen sie t[2] liebt?
who believe you who she loves
'Who do you think she loves?'

In (1), the direct object of the verb *lieben* (to love) is extracted to sentence initial position. The construction is however not confined to direct objects: subjects (cf. (2)) and indirect objects (cf. (3)) are extractable, too, among others.

(2) Wer glaubst du wer t Maria liebt?
who believe you who Mary loves
'Who do you think loves Mary?'

(3) Wem denkst du wem sie t geholfen hat?
who think you who she helped has
'Who do you think she helped?'

Wh-copying is arguably a subspecies of regular extraction, that is, it is structurally similar to the more familiar type of extraction as in (4).

(4) Wen glaubst du dass sie t liebt?
who believe you that she loves
'Who do you think she loves?'

This is backed up by a couple of arguments of which I would like to mention four. First, similar to more regular extraction, wh-copying is in principle unbounded, that is, it can target any embedded clause.

(5) Wen denkst du wen sie meint wen er t liebt?
who think you who she means who he loves
'Who do you think she believes he loves?'

Second, it is island sensitive, which I have illustrated with the subject island in (6) and the complex NP island in (7).

(6)*Wen hat [$_{SUBJ}$ wen sie t liebt] alle überrascht?
who has who she loves all surprised
'Who did that she loves surprise everyone?'

[1] 'Extraction' refers to a class of construction and not to an operation where an element is linearly reordered.
[2] 't' is a mnemonic device indicating the position of the extracted element in the structure without extraction.

(7) * Wen machte Peter [$_{NP}$ die Behauptung
who made Peter the claim
[$_{S}$ wen sie t liebt]]?
who she loves
'Who did Peter make the claim that she loves?'

Third, wh-copying is possible only with a handful of verbs in the matrix clause, viz. only with so called bridge verbs, to which *fragen* (to ask) does not belong.

(8) * Wen fragst du wen sie t liebt?
who ask you who she loves
(9) * Wen fragst du dass sie t liebt?
who ask you who she loves
'Who did you ask she loves?'

Fourth, wh-copying shows connectivity effects (Jacobson 1984), by which one refers to the fact that an extracted element has to satisfy restrictions imposed on it by the selecting element. For example, the German predicate '*sich sicher sein*' (to be sure of) selects a genitive marked NP.

(10) Sie ist sich dessen sicher.
she is self that sure
'She is sure of that.'

If this element is extracted, the case is retained.

(11)Wessen glaubst du wessen sie sich sicher ist?
whose believe you whose she self sure is
'What do you think she is sure of?'

The last two points are not trivial, because they indicate that wh-copying is not a subtype of the 'scope marking' construction, illustrated in (12), which is often treated on a par with wh-copying (Höhle 2000)[3], and for which an analysis similar to regular extraction is very problematic, at least for German (cf. Klepp (2002)).

(12) Was glaubst du wen sie t liebt?
what believe you who she loves
'Who do you think she loves?'

The set of bridge verbs for scope marking is different from the one for wh-copying and regular extraction. On the one hand, it excludes raising predicates and volitional verbs, both of which are possible for wh-copying and regular extraction. I have illustrated this for raising predicates.

(13) *Was scheint es wen Hans t geschlagen hat?
whom seems it that Hans beaten has
(14) Wen scheint es wen Hans t geschlagen hat?
whom seems it whom Hans beaten has
(15) Wen scheint es dass Hans t geschlagen hat?
whom seems it that Hans beaten has
'Who does it seem that Hans hit?'

On the other hand, it includes verbs that are impossible as bridge verbs for wh-copying and regular extraction, such as *vermuten* (engl. to suppose) or *befürchten* (engl. to fear); it is illustrated only for the first verb.

(16) Was vermutest du wem sie t hilft?
what suppose you who she helps
(17) * Wem vermutest du wem sie t hilft?
who suppose you who she helps
(18) * Wem vermutest du dass sie t hilft?
who suppose you that she helps
'Who do you suppose she helps?'

Regarding connectivity effects, they do not hold in scope marking, in which the extracted element nearly always surfaces as *was* (what), which is not genitive marked, as shown in (20).

(19) Was glaubst du wessen sie sich t sicher ist?
what believe you whose she herself sure is
'What do you think she is sure of?'
(20) * Was ist sie sich t sicher?
what is she self sure
'What is she sure of?'

3 Two Generalizations about Wh-Copying

Wh-copying in German is characterized by two specific generalizations concerning extracted and resuming element, which I will describe now.

3.1 Generalization I: Agreement

Many speakers license PPs in wh-copying.

(21) Mit wem meinst du mit wem sie t tanzt?
with whom mean you with whom she dances
'Who do you think she dances with?'

In this case, the extracted and the resuming element have to agree in category. The non-agreeing forms of (21) are all ungrammatical.

(22) * Wem meinst du mit wem sie t tanzt?
who mean you with whom she dances
(23) * Mit wem meinst du wem sie t tanzt?
with whom mean you whom she dances
'Who do you think she dances with?'

Crucially, this is not a connectivity effect because this agreement requirement extends to cases where extracted and resuming element do not agree, but satisfy connectivity. Consider the verb *schreiben* (to write). The indirect object either surfaces as a PP or as a dative-marked NP.

(24) Sie schreibt (ihm) einen Brief (an ihn).
she writes him a letter on him
'She writes (him) a letter (to him).'

[3] The proper analysis of this construction is hotly debated (Fanselow 2006). For some, the *was* in (12) is a dummy element indicating directly the scope of the real wh-phrase *wen* in clause initial position. For others, the *was* is an extracted sentential expletive of the matrix verb, and the scope of the real wh-phrase *wen* comes about indirectly such that the embedded clause defines the relevant restriction for the beliefs the speaker asks for. If true, a more adequate translation for (12) is 'What do you think? Who does she love?'.

Now consider the following examples.

(25) * Wem denkst du an wen sie t schreibt?
(26) *An wen denkst du wem sie t schreibt?
(27) Wem denkst du wem sie t schreibt?
(28) An wen denkst du an wen sie t schreibt?
(on) whom think you (on) whom she writes
'Who do you think she writes to?'

If only connectivity were at work in wh-copying, all sentences in (25)-(28) should be grammatical because in all cases both extracted and resuming element are compatible with the verb (cf. (24)), and should therefore be correctly connected. But only (27) and (28) are grammatical. The reason is that only in these sentences, extracted and resuming element agree, viz. in their categorial status. Agreement shows up in other contexts as well. The indirect object NP of the verb *lehren* (to teach) bears either accusative or dative.

(29) Ich lehre ihm/ihn Latein.
I teach him.dat/him.acc Latin
'I teach him Latin.'

In wh-copying, the following pattern emerges.

(30) * Wem denkst du wen er t Latein lehrt?
(31) * Wen denkst du wem er t Latein lehrt?
(32) Wem denkst du wem er t Latein lehrt?
(33) Wen denkst du wen er t Latein lehrt?
who think you who he Latin teaches
'Who do you think he teaches Latin?'

Again, only those sentences are grammatical in which extracted and resuming element agree, this time for case. Finally, agreement extends to NPs as complements of prepositions. For example, the German verb *sich verlieben* (to fall in love) requires a PP headed by *in*, whose complement NP can bear any gender marking.

(34) Er verliebte sich in den/das.
He fell.in.love self in $that_{masc}$/$that_{neut}$
'He has fallen in love with him/that.'

If extracted, the gender marking has to remain constant on both extracted and resuming element, that is, they have to agree for this feature.

(35)* In wen denkst du in was er sich t verliebte?
(36)* In was denkst du in wen er sich t verliebte?
(37) In wen denkst du in wen er sich t verliebte?
(38) In was denkst du in was er sich t verliebte?
in wh. think you in wh. he self fell.in.love
'Who/what do you think he fell in love with'

The agreement requirement for NPs as complements to PPs holds for other morphological features, too, such as number and case, which due to lack of space I have not illustrated.

To sum up, agreement between extracted and resuming element extends to cases not covered by connectivity so that consequently it must be treated as a separate generalization.

3.2 Generalization II: Proforms Only

Wh-copying in German is subject to the curious restriction that complex wh-phrases, that is, wh-phrases consisting of a determiner and a restriction, are excluded (McDaniel 1986; Höhle 2000).

(39) * Welchen Mann glaubst du
which man believe you
welchen Mann sie t liebt?
which man she loves
'Which man do you think she loves?'

In the literature on wh-copying, this is often interpreted as a constraint licensing only wh-pronouns in the construction, while barring complex wh-phrases from it in general (Felser 2004, Höhle 2000, Nunes 2004). This view however is too simplistic in light of data that are almost never taken into account. First of all, it is not the case that only wh-pronouns appear as resuming elements. Already McDaniel (1986) noted that some speakers license d-pronouns.

(40) Wen glaubst du den sie t liebt?
who believe you who she loves
'Who do you think she loves?'

She also noted that this extends PPs, that is, in case a PP is extracted, the speakers also license d-pronouns as complements to a preposition.

(41) Mit wem denkst du mit dem er t spricht?
with whom think you with whom he speaks
'With whom do you think he talks?'

Second, it is equally not true that complex wh-phrases are generally excluded. Anyadi & Tamrazian (1993) reported that some speakers license structures such as (42) and (43).

(42) Welchem Mann glaubst du wem sie das
which man believe you who she the
Buch t gegeben hat?
book given has
'Which man do you think she gave the book to?'

(43) Mit welchem Werkzeug glaubst womit Ede
with which tool believe you with.what Ede
das Auto t repariert?
the car fixes
'With which tool do you think Ede fixes the car?'

Although not all speakers license such sentences, they are robustly attested. In a data collection carried out recently, I was able to find five speakers[4] licensing them. As such structures were not investigated before, their properties were unclear. The aim of the data collection was to fill this gap. Eventually, four results could be established. First, only a specific set of pronouns

[4] Three came from the Lower Rhine area, one from Saxony, one from Bavaria. This is in line with the observation that wh-copying is not a dialectal phenomenon (Höhle 2000).

is available as resuming elements. Personal pronouns, for example, are excluded altogether.

(44) * Wen glaubst du ihn sie t liebt?
whom believe you him she loves
'Who do you think she loves?'

(45) * Mit wem glaubst du mit ihm sie t tanzt?
with wh. believe you with wh. she dances
'With whom do you think she dances?'

Second, if a speaker licenses d-pronouns as resuming elements, then he will also license them as free relative pronouns, that is, as elements introducing free relative clauses. In other words, the same speakers accepting (40) and (41) also accepted the sentences (46) and (47).

(46) Ich lade ein den alle t mögen.
I invite who everyone likes
'I invite who everyone likes.'

(47) Ich treffe mich mit dem sie t getanzt hat.
I meet with whom she danced has
'I met up with whom she danced.'

Third, if speakers license complex wh-phrases in wh-copying, then they only license them as extracted elements. Sentences such as (48) and (49) were uniformly rejected.

(48) * Wem glaubst du welchem Mann sie das
whom believe you which man she the
Buch t gegeben hat?
book given has
'Which man do you think she gave the book to?'

(49) * Mit wem glaubst du mit welchem Mann
with whom believe you with which man
sie t getanzt hat?
she dances has
'Which man do you think she has danced with?'

Fourth, speakers licensing complex wh-phrases as extracted elements also only license wh- or d-pronouns as resuming elements (note that d-pronouns were only available in these structures if they were also available in structures with simple wh-phrases as extracted elements, as in (40) and (41)).

(50) Welchen Mann glaubst du wen sie t liebt?
Welchen Mann glaubst du den sie t liebt?
which man believe you who she loves
'Which man do you think she loves?'

(51) Mit welchem Mann glaubst du mit wem sie
Mit welchem Mann glaubst du mit dem sie
with which man believe you with whom she
t tanzt?
dances
'With which man do you think she dances?'

Full NPs as resuming elements on the other hand were never judged grammatical by any speaker.

(52) * Welchem Mann glaubst du dem Mann sie
which man believe you the man she
das Buch t gegeben hat?
the book given has
'Which man do you think she gave the book to?'

(53)* Mit welchem Mann glaubst du mit dem
with which man believe you with the
Mann sie t getanzt hat?
man she danced has
'With which man do you think she dances?'

What all four results have in common is that they restrict the set of resuming elements. This leads to the question whether they can be subsumed under a single generalization; and in fact they can, as shown in (54).

(54) If x is licensed as a resuming element then x is also licensed as a free relative proform

Before I turn to the use of "proform" in this statement, let me briefly explain how this generalization covers all four results. The first result is covered because personal pronouns are not licensed as free relative pronouns.

(55) * Ich lade ein ihn alle t mögen.
I invite him everyone likes
'I invite who everyone likes.'

(56) * Ich treffe mich mit ihm sie t getanzt hat.
I meet with whom she danced has
'I met up with whom she danced.'

The second result follows from the generalization without further explication as it is nearly identical to it. The third result is subsumed because the elements appearing as resuming elements in (48) and (49) are not pronouns but full NPs. For the same reason, the fourth result is covered too: the resuming elements in (52) and (53) are full NPs, too, and not pronouns. Note that the generalization in (54) is silent on what categorial and morphological features the resuming element has to bear. However, this is no problem. For this is taken care of by the first generalization, according to which extracted and resuming element have to agree. Let me finally turn to the use of the term "proform" in (54). As the discussion in this section has shown, not only pronouns are licensed as resuming elements, but also PPs containing pronouns which are in themselves not pronouns, but rather "pro-PPs". In order to capture this, I preferred using the word "proform" instead of "pronoun" in (54). The advantage of the term "proform" is that it doesn't imply a category for the element it refers to, which the term "pronoun" does, as it implies that the element is nominal.

4 A Problem with PS Analyses

As shown in the previous section, wh-copying is characterized by two generalizations that constrain the relation between extracted and resuming element. In this section, I would like to show that PS approaches cannot express the generalizations in a uniform way: NPs and PPs are equally subject to the generalizations but either of them requires a separate analysis. I will first sketch the analyses, and then discuss why having two analyses would be a problem at all.

4.1 The PS Analyses

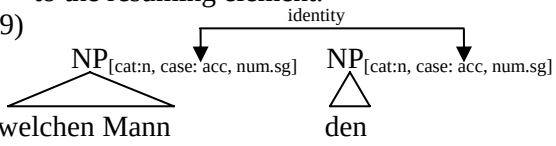
Consider the sentence in (57).

(57) Welchen Mann glaubst du den sie t liebt?
which man believe you who she loves
'*Which man do you think she loves?*'

The extracted element in (57) is an accusative marked NP. That an accusative marked pronoun appears as a resuming element can be accounted for quite easily: all that is required is the operation given in (58), and illustrated in (59)[5].

(58) Establish identity for syntactic features between the node corresponding to the extracted element and the node corresponding to the resuming element.

(59)



The node corresponding to the extracted element is labeled 'NP' and specifies both category and morphological features, among others. The shape of the resuming element then follows because (58) requires the syntactic features of the extracted element to be identical to the syntactic features of the resuming element. As (58) requires identity only for syntactic but not for semantic features, it also follows that a pronoun will appear, as only they are semantically vacuous. (58) is attractive because it reduces the two generalizations to a single requirement, viz. one of agreement for syntactic features between two nodes. Unfortunately, (58) doesn't work for PPs; consider the sentence in (60).

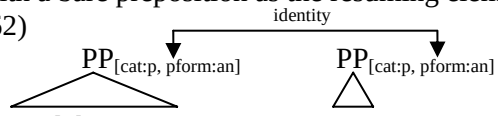
(60) An welchen Mann meint er an den Jo denkt?
on which man means he on whom Jo thinks
'*Which man does he believe Jo thinks of?*'

The extracted element *an welchen Mann* is taken up by the resuming element *an den*. If (58) were to hold for PPs, we expect the sentence in (60) to be ungrammatical; instead, the sentence in (61) should be grammatical, contrary to fact.

(61) * An welchen Mann meint er an Jo denkt?
on which man means he on Jo thinks
'*Which man does he believe Jo thinks of?*'

The reason is that the PP node is specified only for features of its head but not for morphological features of its complement NP. If according to (58) identity between this node and the node for the resuming element is established, one ends up with a bare preposition as the resuming element.

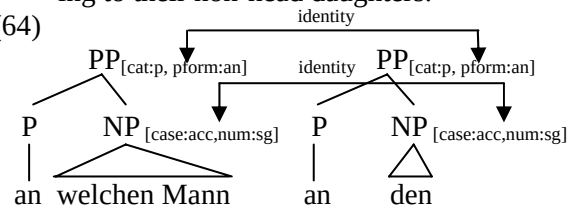
(62)



To obtain the right result for PPs, one needs a separate statement requiring a dependency between pairs of nodes, as described in (63) and illustrated in (64).

(63) Establish identity for category between the nodes corresponding to the extracted and the resuming element, and for morphological features between the nodes corresponding to their non-head daughters.

(64)



4.2 The Problem

Although both (58) and (63) give correct results, a problem arises. The problem is that by having one analysis for NPs and another one for PPs, one fails to express the uniform behavior of NPs and PPs in wh-copying. For each category requires a separate rule that incorporates the generalizations in a different way. In other words, the two generalizations cannot be uniformly expressed in a PS approach. What this means in the end though is that they are in fact lost in such an approach. No connection can be established between the two analyses because each analysis defines a requirement that is completely different from the requirement of the other analysis. Eventually, one also fails to express the fact that both analyses exist simultaneously in a language.

In sum, PS approaches cannot provide a tool for capturing in a descriptively adequate manner the two generalizations governing wh-copying.

[5] (58) – and also (63) – is compatible with transformational (for example, GB) and non-transformational PS approaches (for example, HPSG); the difference is only whether the identity for syntactic features is analyzed as feature sharing or as a copying transformation. This difference is irrelevant, though, because either analysis is defined for PS trees.

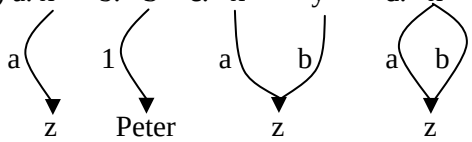
5 A Relational Analysis

In this section, I will present an analysis of wh-copying within the framework of Arc Pair Grammar (Johnson & Postal 1980; Postal 2010), henceforth *APG*. I will show that due to its relational orientation, APG is not only capable of covering the two generalizations, it even allows unification of them into a single one. I will start by giving a brief overview of the characteristics of APG, then introduce APG's analyses of proforms, agreement, PPs, and extraction, and will then show how these assumptions provide the relevant tools for capturing the two generalizations of wh-copying in German.

5.1 Brief Overview of APG

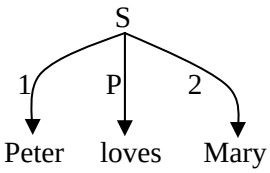
APG is a descendent of Relational Grammar (cf. Perlmutter & Postal (1983) for an overview). APG differs from PS grammars in three ways. First, it assumes that grammatical relations – such as subject, object, indirect object – are primitive theoretical notions and that syntactic generalization need to be stated in terms of such relations. Formally, these relations are expressed via labeled, directed arcs. Second, APG allows what is called multidominance in a PS grammar, that is, a node can have more than one mother node. Both assumptions are illustrated in (65).

(65) a. x b. S c. x y d. x



The representation in (65a) is called an *arc* and has to be read as: the node labeled 'z', the *head* node, bears the grammatical function 'a' to the node labeled 'x', the *tail* node. As an example, (65b) says that the node labeled 'Peter' bears the grammatical relation 'subject' – indicated as '1' – to the node labeled 'S', which is meant to indicate the sentence node. (65c) and (65d) give examples for multidominance, which is called *overlapping* in APG. Sentences are analyzed as graphs of a specific type[6] that are 'composed' of arcs. As an example, consider the highly oversimplified structure for 'Peter loves Mary'.

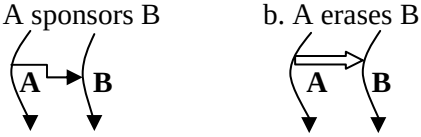
(66)



[6] Cf. Johnson & Postal (1980), p. 51.

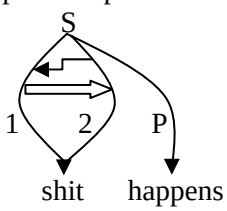
'P' indicates the predicate-of relation, '2' the direct-object relation. Third, APG also assumes primitive relations holding between arcs, in total two, viz. *Sponsor* and *Erase*. Saying that an arc A sponsors another arc B means that A is a necessary condition for the presence of B. And saying that an arc A erases another arc B means that the presence of A is a sufficient condition for nonpresence of B in surface structure. These relations, both of which are binary, are represented in the following way (bold capital letters are used to indicate arcs, not labels).

(67) a. A sponsors B b. A erases B



If an arc A bears such a relation to an arc B with which it shares the tail node, then the relation is called *local*, otherwise *foreign*. Sponsor and Erase are relevant for dealing with surface and non-surface aspects of sentence structure. In a nutshell, the set of non-sponsored arcs (called *initial* arcs) represents the initial structure of a sentence, and it – and only it – is therefore relevant for semantic interpretation; the set of non-erased arcs is irrelevant for semantic concerns and only represents the surface structure of a sentence. The sentence 'Shit happens' might serve as an example for Sponsor and Erase.

(68)



Happen belongs to the set of unaccusative predicates, which initially take direct objects that surface as subjects though. This property is represented through Sponsor and Erase in (68): the direct-object arc sponsors a subject arc which in turn erases the direct-object arc. As only the direct-object arc and the predicate arc are initial arcs, only they will be relevant for semantics. And since the subject and the predicate arc are the only non-erased arc, only they will surface.

5.2 Proforms

Proforms in APG are analyzed as elements heading non-initial arcs, that is, as arcs that are not relevant for semantics concerns. More specifically, they are analyzed as elements detaching, that is, *replacing* an initial, overlapping arc. The relevant definitions for *Replace* are given in (69)-(71).

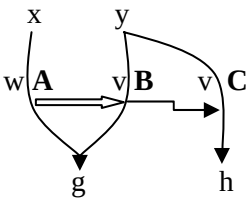
(69) An arc A (pronominally) detaches an arc B iff there is a an arc C such that C replaces B, A seconds C, and A is not a branch of C

(70) Replace/Second: an arc C replaces an arc B iff C and B are equivalent colimbs, B sponsors C, and there exists an arc A distinct from C that erases B. In this case, A is said to second C.

(71) The Seconder Condition: If an arc C replaces an arc B and an arc A seconds C, then A overlaps B[7].

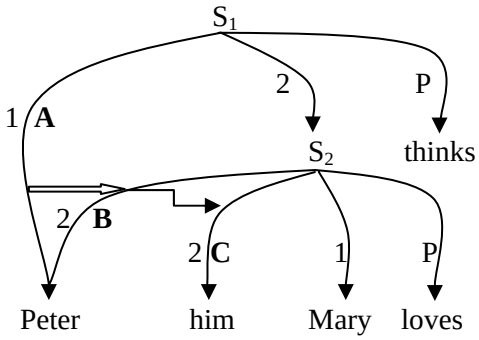
'Equivalent' in definition (70) means that the label on the arcs C and B are identical; 'colimbs' mean that the two arcs C and B share the same tail node. Taken together, the definitions license a partial graph of the form given in (72); the letters for the arcs in (72) are held constant with respect to the ones in the definitions.

(72)



In order to understand the form of the graph, consider the definitions in (69)-(71). As required by (70), C and B bear the same label, viz. 'v', are colimbs (they share the same tail node, viz. 'y'), B sponsors C, and a distinct arc A erases B. Accordingly, A seconds C. That A overlaps B follows from (71): since A seconds C, A is required to overlap B. Finally, (69) guarantees that this type of Replace will be one of pronominal detachment because A is not a branch of C. The idea behind this approach becomes clearer by inspecting a concrete example for such a graph[8].

(73)



In this example, the element 'Peter' bears two grammatical relations: the subject relation within, and therefore to, S_1, and the direct-object relation to S_2. Due to the erasure of the direct-object B arc heading 'Peter', Replace inserts the equivalent arc C headed by the proform 'him'. The equivalence is taken care of by the requirement that the replacer arc has to have the same label as the replaced arc. Crucially, although Replace eventually constrains which elements can head a replacer arc, Replace substitutes arcs for arcs, not the elements heading them.

5.3 Agreement

Agreement between two elements is established via the *Lateral Feature Passing Law* in (74), adapted from Aissen (1990), p. 286.

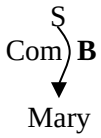
(74) If a and b head nominal arcs, such that neither a nor b is a dependent of the other then, if a passes its morphological features to b, then the arc headed by b is equivalent to, and sponsored by, the arc headed by a

'Dependent' means that neither is 'b' the tail of the arc headed by 'a', nor is 'a' the tail of the arc headed by 'b'. Applied to (73), 'Peter' corresponds to head 'a' and 'him' to head 'b', and both head nominal arcs. Transmission of the morphological features of 'Peter' to 'him' is licit because the arc headed by 'him' is equivalent to, and sponsored by, the arc headed by 'Peter'.

5.4 Prepositional Phrases

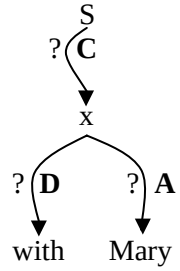
APG adopts a relational view on sentence structure. Similar to proforms, categorial information such as being a PP represents only a surface aspect of sentence structure. In other words, prepositions are not analyzed as *bearing* a grammatical relation, but as elements *indicating* a grammatical relation, called *flags*. Consequently, the PP 'with Mary' is initially not a PP, but a nominal heading an arc that bears the label 'Com', indicating the comitative relation.

(75)



The question then arises is how to turn this initial structure into the structure appearing on the surface, which is approximately of the form in (76).

(76)



The answer given by APG is that the structures in (75) and (76) are connected via Sponsor and Erase. The relevant condition establishing this connection is the *flagging condition* in (77).

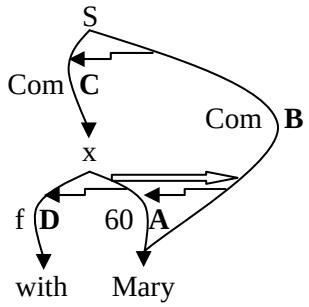
[7] All definitions are taken from Postal (2010, ch. 1).

[8] Linear order is generally *not* represented in the structures.

(77) Iff an arc B is an output arc and not attached to a flag arc, then (i) B foreign sponsors a 60 arc A overlapping B, (ii) B is replaced by an arc C, (iii) A is a branch of C iff B's label is one of {Com, …}, and (iv) A locally sponsors an arc D

This definition will license the following graph (the letters are again held constant).

(78)



In order to understand how the definition (77) licenses the graph in (78), one needs the definition for output arc.

(79) An arc B is an output arc iff B is a domestic arc and has no local eraser.

The definition for domestic arc is given in (80).

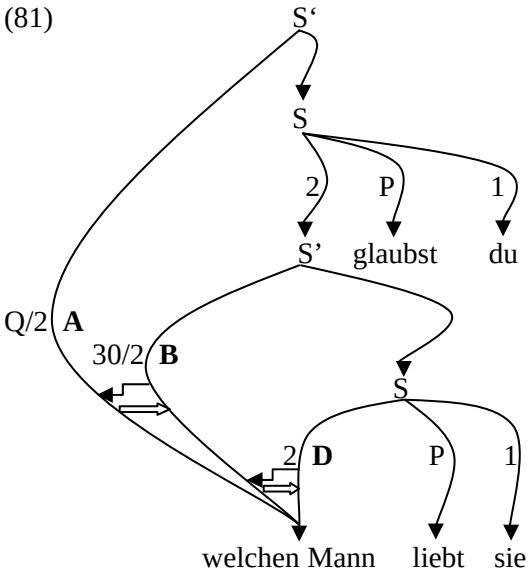
(80) An arc B is a domestic arc iff any sponsor of B is a colimb of B.

In other words, an output arc is an arc that is (i) either unsponsored or locally sponsored and (ii) if erased, then not locally erased. Turning back to the graph in (78), let me explicate how (77) licenses it. First of all, B is an output arc: it is unsponsored and not locally erased. Second, B is not attached to flag arc: no arc bearing the 'f' relation is connected to either the tail or the head node of B. Therefore, B foreign sponsors the 60 arc A overlapping B. Then, B is replaced by the arc C such that the 60 arc A is branch of C; that is, A's head node is C's tail node. Finally, the 60 arc locally sponsors the flag arc D. Note that although C replaces B, this replace relation is not one of pronominal detachment because in this case, A is a branch of C; but pronominal detachment forbids A to be a branch of C. That B has to be flagged in the first place is due its label 'Com', which appears in the set specifying those relations that need to be labeled. Which relations this set contains is ultimately subject to language particular rules: whereas the comitative relation requires the prepositional flag 'with' in English, it doesn't in Hungarian (instead, the case suffix '-vel/-val' is added). Finally, that C itself is not subject to flagging also follows from (77). C is an output arc already attached to a flag arc; if it were attached to another flag arc, the condition in (77) would be violated, due to its formulation as a biconditional.

5.5 Extraction

The APG analysis of extraction has three ingredients. First, it is modeled via multidominance, which means that the extracted element will appear as the head of two overlapping arcs. One arc will indicate the initial relation of the element, for example direct-object. The other arc will indicate the relevant extraction, for example question-extraction, the label for which will be 'Q'. Second, extraction proceeds through positions that correspond neither to the initial nor to the final position of the extracted element. More specifically, I assume that extraction proceeds through every clause peripheral position between initial and final position of the extracted element. The arc that the element heads in this position will be labeled for convenience by '30'. Third, the labels of the relevant extraction arcs have to conserve the initial relation of the extracted element; this is expressed by simply adding the initial label to the label of both the 30- and the Q-arc[9]. This analysis gives the following structure for the sentence *Welchen Mann glaubst du liebt sie?* (Which man do you think she loves?).

(81)



Welchen Mann is the direct object of the embedded clause and the extracted element of the main clause. This is expressed by letting the Q/2-arc overlap the 2-arc. As the extraction targets a position outside the clause the 2-arc originates in, a 30/2-arc appearing in the clause peripheral position of the embedded clause is required. Finally, D sponsors B, B sponsors A, and A erases B, and B erases D.

[9] Cf. Postal (2004), pp. 61-68, for a detailed discussion of the mechanism accomplishing this.

5.6 Wh-Copying in APG

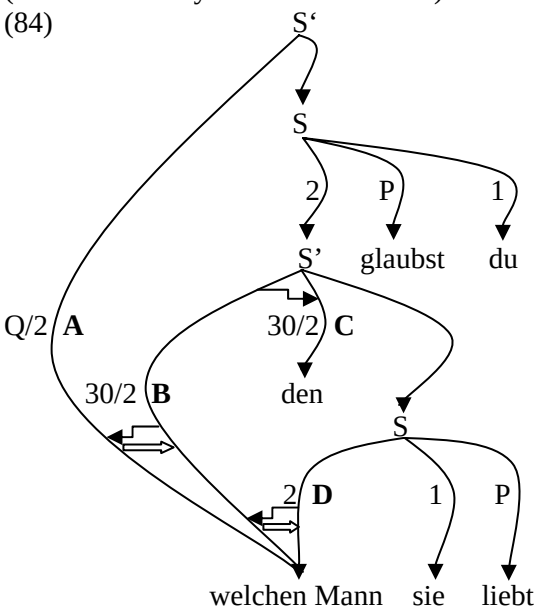
What I would like to show now is that (82) and (83) hold.

(82) The resuming element is a replacer arc.

(83) The two generalizations follow from independent requirements.

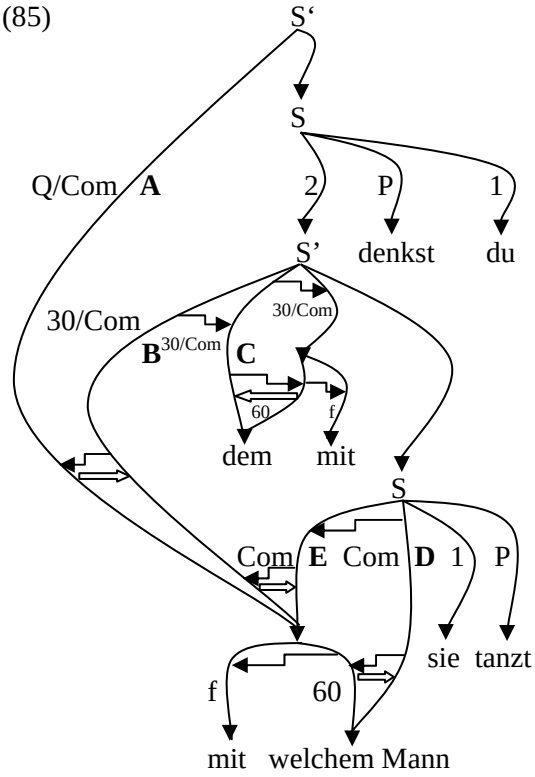
More specifically, they follow from Replace in interaction with the analyses for agreement, PPs, and extraction. Let me start with (82). A replacer arc is licensed if there are two overlapping arcs A and B such that one erases the other. Note that such an erase relation is present in (81): the Q-arc A overlaps the 30-arc B and A erases B. Therefore, as nothing prohibits inserting a replacer arc C for B to the structure[10], I consequently assume that the resuming element in wh-copying is nothing but a replacer arc for the erased 30-arc, which was created in order to obtain a licit extraction structure. This is illustrated in (84) for the corresponding wh-copying sentence *Welchen Mann glaubst du den sie liebt?* (Which man do you think she loves?).

(84)



Under this analysis, the two generalizations now follow without further saying. That only a proform is licensed follows because the Replace configuration in (84) is one of pronominal detachment, and consequently only a proform is licensed for insertion. Agreement between resuming element and extracted element obtains in the same way via (74), as shown for the example in (73). Let us now look at an example with an extracted PP, as in *Mit welchem Mann denkst du mit dem sie tanzt?* (Which man do you think she dances with?), whose structure is given in (85).

(85)



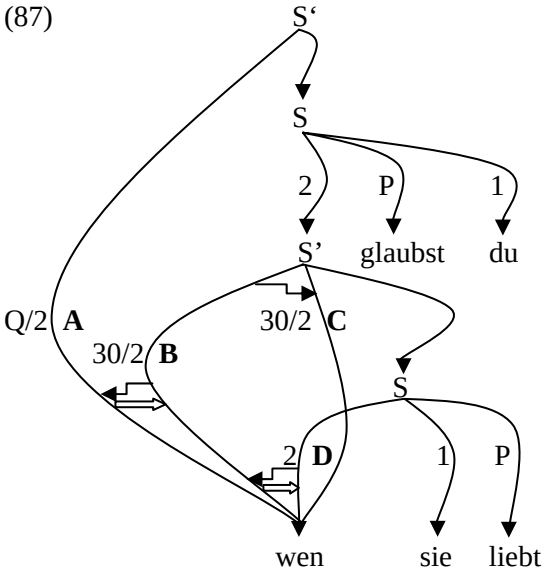
The presence of E and the extraction of E instead of D need explication. First, that E is present follows from the flagging condition, which requires a Com-arc not attached to a flag to be replaced by a Com-arc attached to a flag. Second, if D were extracted, it would be erased by both B and the 60-arc. However, an arc can have at most one eraser (Postal 2010, p. 24). As the presence of the erasing 60-arc is required by the flagging condition, it cannot be omitted. Consequently, both D and E have to present in the structure and only E can be the target of extraction. Let me now explain how the two generalizations follow also for extracted PPs. First, the erase relation between A and B licenses a replacer arc C equivalent to B, and therefore only of a proform can appear. Second, agreement between the proform and the extracted element follows from (74), even though the extracted element does not head a nominal arc. But note that (74) is stated an implication, and the requirement for heading a nominal arc is stated in the antecedent, whose truth value does not affect the truth of the consequent. In other words, the extracted element can pass its features to the proform in accordance with (74), even though only the proform heads a nominal arc. Third, as Replace only inserts C, that C fi-

[10] According to APG, language particular rules have the function of *restricting* the possible structures in a language. In other words, English for example must have a rule explicitly excluding replacer arcs in a structure like (84). Similarly, the grammars for those varieties of German with wh-copying must restrict the insertion of replacer arcs in such a way that only 30-arcs get replaced; cf. (Johnson and Postal) 1980, ch. 14, for details.

nally shows up as a PP must have an independent reason. This reason is the flagging condition: C is an output Com-arc not attached to a flag arc and must be replaced by a Com-arc attached to a flag arc. The identity for labels between C and B, which is due to Replace, guarantees that C will be attached to the same flag as B, viz. to *mit*, which gives agreement for category.
In sum, wh-copying always involves replacer arcs. As such, they can only be proform, must agree, and – depending on their label – sometimes require flagging, and sometimes not.

5.7 Outlook: Variation within German

Many speakers of German do not allow complex wh-phrases as extracted elements nor d-pronouns as resuming elements: only wh-proforms are licensed. The characteristic of d-pronouns is that they are not question words, whereas the characteristic of complex wh-phrases is that they are not proforms. This suggests that the constraint in (86) is at work for these speakers.
(86) The replacer arc overlaps the replaced arc
To satisfy this constraint, the replaced element has to be a proform because a replacer arc can only head a proform. This excludes complex wh-phrases as extracted elements, as the extracted element always overlaps the replaced arc. As the replaced arc can only head a proform that is available as a question word, only wh-proforms are licensed as replacers. It follows then that only wh-proforms can appear in general. A structure compatible with (86) is given in (87).
(87)



6 Conclusion

Due to its relational nature, APG allows one to give a uniform characterization of the resuming element as a specific type of arc, viz. as a replacer arc. From this, the two generalizations governing the resuming element in wh-copying simply reduce to independently motivated constraints on well-formed arcs in general.

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