Personal pronouns can not refer to an antecedent within the same domain of locality:

(5) a. Peter$_i$ thinks that Mary$_j$ likes her$_{*i/*j/k}$.
b. Peter$_i$ thinks that Mary$_j$ likes him$_{i/*j/k}$.
c. Mary$_i$ thinks that Peter$_j$ likes her$_{i/*j/k}$.
d. Mary$_i$ thinks that Peter$_j$ likes him$_{*i/*j/k}$.

As the examples show, the pronouns *her* and *him* cannot be coreferent with the subject of *likes*. If a speaker wants to express coreference, he or she has to use a reflexive pronoun as in (??).

Interestingly, the binding of pronouns is less restricted than that of reflexives, but this does not mean that anything goes. For example, a pronoun cannot bind a full referential NP if the NP is embedded in a clause and the pronoun is in the matrix clause:

(6) a. He$_{*i/*j/k}$ thinks that Mary$_i$ likes Peter$_j$.
b. He$_{*i/*j/k}$ thinks that Peter$_i$ likes Mary$_j$.

The sentences discussed so far can be assigned a structure like the one in Figure ??. Chomsky (1981; 1986) suggested that tree-configurational properties play a role in accounting for binding facts. He uses the notion of c(onstituent)-command going back to work by Reinhart (1976). c-command is a relation that holds between nodes in a tree. According to one definition, a node c-commands its sisters and the constituents of its sisters.[6]

To take an example, the NP node of *John* c-commands all other nodes dominated by S. The V of *thinks* c-commands everything within the CP including the CP node, the C of *that* c-commands all nodes in S including also S and so on. The CP c-commands the *think*-V, and the *likes him*-VP c-commands the *Paul*-NP. Per definition, a Y binds Z just in case Y and Z are coindexed and Y c-commands Z. One precondition for being coindexed (in English) is that the person, number, and gender features of the involved items are compatible. Coindexing can be established with all kinds of nominal expressions including quantified ones and negated NPs like *no animal* (see **BP81a**).

[6] "Node A c(onstituent)-commands node B if neither A nor B dominates the other and the first branching node which dominates A dominates B." Reinhart (1976: 32)

Chomsky (1986) uses another definition that allows one to go up to the next maximal projection dominating A. As of 2020-02-25 the English and German Wikipedia pages for c-command have two conflicting definitions of c-command. The English version follows Sportiche et al. (2013: 168), whose definition excludes c-command between sisters: "Node X c-commands node Y if a sister of X dominates Y."

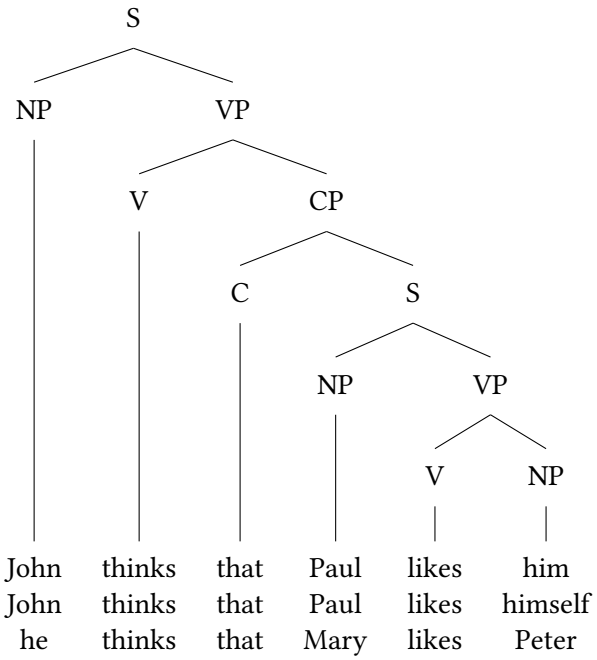

Figure 1: Tree configuration of examples for binding

Now, the goal is to find restrictions that ensure that reflexives are bound locally, personal pronouns are not bound locally and that referential expressions like proper names and full NPs are not bound by other expressions (anaphors, pronouns or fully referential expressions). The conditions that were developed for GB's Binding Theory are complex. They also account for the binding of traces that are the result of moving elements by transformations (Chomsky 1981, but given up in Chomsky 1986). While it is elegant to subsume filler-gap relations (and other relations between moved items and their traces) under a general Binding Theory, proponents of HPSG think that coindexed semantic indices and filler-gap dependencies are crucially different.[7] The places of occurrence of traces (if

[7] The HPSG treatment of relative and interrogative pronouns is special, but they have a special distribution that has to be accounted for. See Arnold & Godard (2021), Chapter ?? of this volume on relative clauses in HPSG. Bredenkamp (1996: Section 7.2.3) was an early suggestion to model binding relations of personal pronouns and anaphors by the same means as filler-gap dependencies (see Borsley & Crysmann (2021), Chapter ?? of this volume for an overview of the mechanisms for dealing with unbounded dependencies). Bredenkamp did not work out his proposal in detail (see p. 104–105). He used the SLASH feature for percolation of binding

they are assumed at all) is restricted by other components of the theory. For an overview of the treatment of nonlocal dependencies in HPSG see Borsley & Crysmann (2021), Chapter ?? of this volume.

We will not go into the details of the Binding Theory in Mainstream Generative Grammar (MGG)[8], but we give a verbatim description of the ABC of Binding Theory (ignoring movement). Chomsky distinguishes between so-called R-expressions (referential expressions like proper nouns or full NPs/DPs), personal pronouns and reflexives and reciprocals. The latter two are subsumed under the term *anaphor*. Principle A says that an anaphor must be bound in a certain local domain. Principle B says that a pronoun must not be bound in a certain local domain and Principle C says that a referential expression must not be bound by another item at all.

Some researchers questioned whether syntactic principles like Chomsky's Principle C and the respective HPSG variant should be formulated at all and it was suggested to leave an account of the unavailability of bindings like the binding of *he* to full NPs in (??) to pragmatics (Bolinger 1979: 302; Bresnan 2001: 227–228; Bouma, Malouf & Sag 2001: 44). Walker (2011: Section 6) discussed the claims in

information, which probably would result in conflicts with true non-local dependencies. A possible way to fix this seems to be the introduction of special nonlocal features for binding as was suggested by Hellan (2005). Bredenkamp relies on the use of the SUBJ feature for binding subject-related pronouns, but the SUBJ feature is not used for finite verbs in German. Usually all arguments of finite verbs are selected via one list: COMPS (see Müller 2021a: Section ??, Chapter ?? of this volume for details). Furthermore the subject of non-finite verbs in control constructions is usually not realized and hence there is no subj-head schema that could take care of binding off the respective nonlocal dependency. Bredenkamp did not formulate disjointness constraints, but Hellan (2005) developed a way to do this. Like Bredenkamp's approach Hellan's approach has problems with binding by implicit subjects in control constructions since his schemata for combining the subject with a VP containing a reflexive are not applicable because of the lack of an overt subject (see also Abeillé 2021, Chapter ?? of this volume on the treatment of control in HPSG). The only way out of this dilemma seems to be to assume a unary branching projection discharging the pronoun information and binding it to the unexpressed subject. This entails that pronoun binding has a reflex in syntactic structure (an additional unary projection), in our opinion an unwanted consequence of this proposal.

Note that percolating binding information seems to be the only way to account for binding data for HPSG variants assuming that linguistic objects do not have internal structure, e.g. Sign-Based Construction Grammar. See Müller (2021b: Section ??), Chapter ?? of this volume for discussion.

A variant of Binding Theory that uses the HPSG mechanism for nonlocal dependencies in an innovative way is discussed in Section ??.

[8] We follow Culicover & Jackendoff (2005: 3) in using the term *Mainstream Generative Grammar* when referring to work in Government & Binding (Chomsky 1981) or Minimalism (Chomsky 1995).

detail and showed why Principle C is needed and how data that was considered problematic for syntactic binding theories can be explained in a configurational binding theory in HPSG. Hence the following discussion includes a discussion of Principle C in its various variants.

2 A non-configural Binding Theory

As was noted above, English pronouns and reflexives have to agree with their antecedents in gender. In addition there is agreement in person and number. This is modeled by assuming that referential units come with a referential index in their semantic representation. (On referential indices and coindexation vs. coreference see Bach & Partee 1980: Section 6.3.) The following makeup for the semantic contribution of nominal objects is assumed:

(7) Representation of semantic information contributed by nominal objects adapted from Pollard & Sag (1994: 248):

$$\begin{bmatrix} \textit{nom-obj} \\ \textsc{index} \begin{bmatrix} \textit{index} \\ \textsc{per} \ \textit{per} \\ \textsc{num} \ \textit{num} \\ \textsc{gen} \ \textit{gen} \end{bmatrix} \\ \textsc{restrictions} \ \textit{set of restrictions} \end{bmatrix}$$

Every nominal object comes with a referential index with person, number and gender information and a set of restrictions. In the case of pronouns, the set of restrictions is the empty set, but for nouns like *house*, the set of restrictions would contain something like $\textit{house}'(x)$ where x is the referential index of the noun *house*. Nominal objects can be of various types. The types are ordered hierarchically in the inheritance hierarchy given in Figure **??**. Nominal objects (*nom-obj*) can either be pronouns (*pron*) or non-pronouns (*npro*). Pronouns can be anaphors (*ana*) or personal pronouns (*ppro*) and anaphors are devided into reflexives (*refl*) and reciprocals (*recp*).

HPSG's Binding Theory differs from GB's Binding Theory in referring less to tree structures but rather to the notion of obliqueness of arguments of a head. The arguments of a head are represented in a list called the argument structure list (Wechsler, Koenig & Davis 2021, Chapter **??** of this volume). The list is the value of the feature ARG-ST. The ARG-ST elements are descriptions of arguments of a head containing syntactic and semantic properties of the selected arguments

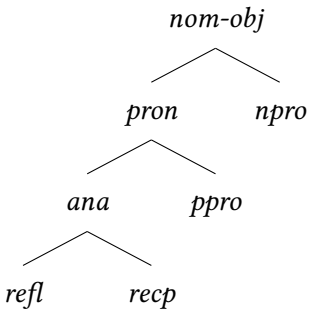

Figure 2: Type hierarchy of nominal objects

but not their daughters. So they are not complete signs but *synsem* objects. See Abeillé & Borsley (2021), Chapter 1 of this volume for more on the general setup of HPSG theories. The list elements are ordered with respect to their obliqueness, the least oblique element being the first element Pollard & Sag (1992: 266):[9]

(8) SUBJECT > PRIMARY OBJECT > SECONDARY OBJECT > OTHER COMPLEMENTS

This order was suggested by Keenan & Comrie (1977: 66). It corresponds to the level of syntactic activity of grammatical functions. Elements higher in this hierarchy are less oblique and can participate more easily in syntactic constructions, like for instance, reductions in coordinated structures (Klein 1985: 15), topic drop (Fries 1988), non-matching free relative clauses (Bausewein 1990: Section 3; Pittner 1995: 195; Müller 1999a: 60–62), passive and relativization (Keenan & Comrie 1977: 96, 68), and depictive predicates (Müller 2008: Section 2). In addition, Pullum (1977) and Pollard & Sag (1987: 174) argued that this hierarchy plays a role in constituent order. And, of course, it was claimed to play an important role in Binding Theory (Grewendorf, 1983: 176; 1985: 160; 1988: 60; Pollard & Sag 1994: Chapter 6).

The ARG-ST list plays an important role for linking syntax to semantics (Wechsler, Koenig & Davis 2021, Chapter ?? of this volume). For example, the index of the subject and the object of the verb *like* are linked to the respective semantic

[9] While Pollard & Sag (1987: 120) use Keenan & Comrie's (1977) version of the Obliqueness Hierarchy in (i), they avoid the terms *direct object* and *indirect object* in Pollard & Sag (1992: 266, 280) and Pollard & Sag (1994: 24).

(i) SUBJECT > DIRECT OBJECT > INDIRECT OBJECT > OBLIQUES > GENITIVES > OBJECTS OF COMPARISON

roles in the representation of the verb:[10]

(9) *like*:

$$\begin{bmatrix} \textsc{arg-st} & \langle \text{NP}_{\boxed{1}}, \text{NP}_{\boxed{2}} \rangle \\ \textsc{cont} & \begin{bmatrix} \textsc{ind} & \textit{event} \\ \textsc{rels} & \left\langle \begin{bmatrix} \textit{like} \\ \textsc{actor} & \boxed{1} \\ \textsc{undergoer} & \boxed{2} \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix}$$

A lot more can be said about linking in HPSG and the interested reader is referred to Wechsler (1995), Davis (2001), Davis & Koenig (2000), and Wechsler, Koenig & Davis (2021), Chapter ?? of this volume for this.

After these introductory remarks, we can now turn to the details of HPSG's Binding Theory: Figure ?? shows a version of Figure ?? including ARG-ST information. The main points of HPSG's Binding Theory can be discussed with respect to this simple figure: (non-exempt) anaphors have to be bound locally. The definition of the domain of locality is rather simple. One does not have to refer to tree configurations, since all arguments of a head are represented locally in a list. Simplifying a bit, reflexives and reciprocals must be bound to elements preceding them in the ARG-ST list (but see Section ?? for so-called exempt anaphors) and a pronoun like *him* must not be bound by a preceding element in the same ARG-ST list.

To be able to specify the conditions on binding of anaphors, pronouns and non-pronouns, some further definitions are necessary. The following definitions are definitions of local *o-command*, *o-command* and *o-bind*. The terms are reminiscent of *c-command* and so on but we have an "o" rather than a "c" here, which is supposed to indicate the important role of the obliqueness hierarchy. The definitions are as follows:

(10) Let Y and Z be *synsem* objects with distinct LOCAL values, Y referential. Then Y *locally o-commands* Z just in case Y is less oblique than Z.

(11) Let Y and Z be *synsem* objects with distinct LOCAL values, Y referential. Then Y *o-commands* Z just in case Y locally o-commands X dominating Z.

[10] $\text{NP}_{\boxed{1}}$ is an abbreviation for a feature description of a nominal phrase with the index $\boxed{1}$. The feature description in (9) is also an abbreviation. Path information leading to CONT is omitted, since it is irrelevant for the present discussion.

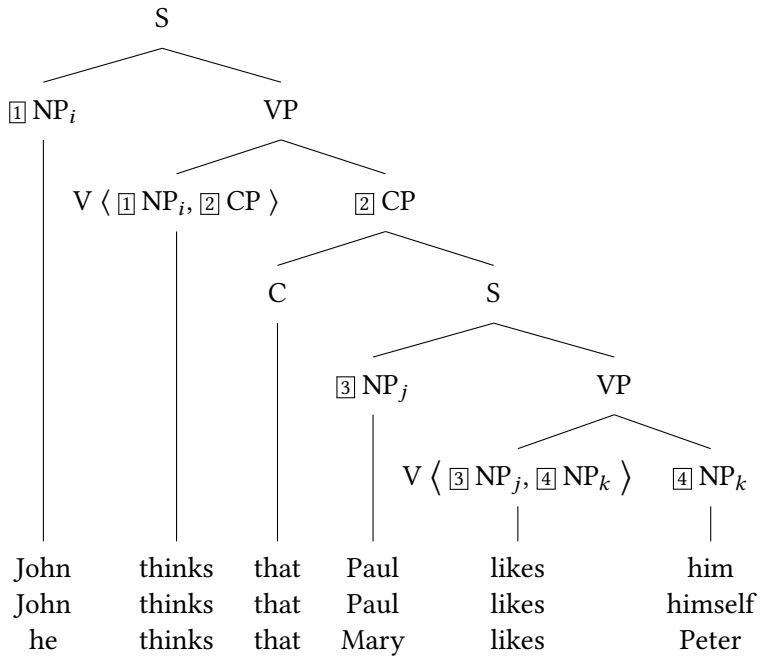

Figure 3: Tree configuration of examples for binding with ARG-ST lists

(12) Y (*locally*) *o-binds* Z just in case Y and Z are coindexed and Y (locally) o-commands Z. If Z is not (locally) o-bound, then it is said to be (*locally*) *o-free*.

(??) says that an ARG-ST element locally o-commands any other ARG-ST element further to the right of it. The condition of non-identity of the two elements under consideration in (??) and (??) is necessary to deal with cases of raising, in which one element may appear in various different ARG-ST lists. It is also needed to rule out unwanted command relations in the case of nonlocal dependencies since the local value of a filler is shared with its gap. See Abeillé (2021), Chapter ?? of this volume for discussion of raising in HPSG and Borsley & Crysmann (2021), Chapter ?? of this volume on unbounded dependencies in HPSG. The condition that Y has to be referential excludes expletive pronouns like *it* in *it rains* from entering o-command relations. Such expletives are part of ARG-ST and valence lists, but they are entirely irrelevant for Binding Theory, which is the reason for their exclusion in the definition. Pollard & Sag (1994: 258) discuss the following examples going back to observations by Freidin & Harbert (1983: 65) and Kuno

(1987: 95):

(13) a. They$_i$ made sure that it was clear to each other$_i$ that this need to be done immediately.
b. They$_i$ made sure that it wouldn't bother each other$_i$ to invite their respective friends to dinner.

According to Pollard & Sag (1994: Section 3.6), the *it* is an expletive. They assume that extrapositions with *it* are accounted for by a lexical rule that introduces an expletive and a *that* clause or an infinitival verb phrase into the valence list of the respective predicates. Since the *it* is not referential it is not a possible antecedent for the anaphors in sentences like (13) and hence a Binding Theory build on top of the definitions in (??) and (??) will make the right predictions.

The definition of o-command uses the relations of locally o-command and dominate. With respect to Figure ??, we can say that NP$_i$ o-commands all nodes below the CP node since NP$_i$ locally o-commands the CP and the CP node dominates everything below it. So NP$_i$ o-commands C, NP$_j$, VP, V, and NP$_k$.

The definition of *o-bind* in (??) says that two elements have to be coindexed and there has to be a (local) o-command relation between them. The indices include person, number and gender information (in English), so that *Mary* can bind *herself* but not *themselves* or *himself*. With these definitions, the binding principles can now be stated as follows:

Principle 2 (HPSG Binding Theory (preliminary))
Principle A A locally o-commanded anaphor must be locally o-bound.

Principle B A personal pronoun must be locally o-free.

Principle C A nonpronoun must be o-free.

Principle A accounts for the ungrammaticality of sentences like (14):

(14) * Mary likes himself.

Since both *Mary* and *himself* are members of the ARG-ST list of *likes*, there is an NP that locally o-commands *himself*. Therefore there should be a local o-binder. But since the indices are incompatible because of incompatible gender values, *Mary* cannot o-bind *himself*, *himself* is locally o-free and hence in conflict to Principle A.

Similarly, the binding in (15) is excluded, since *Mary* locally o-binds the pronoun *her* and hence Principle B is violated.

(15) Mary$_i$ likes her$_{*i}$.

Finally, Principle C accounts for the ungrammaticality of (16):

(16) He$_i$ thinks that Mary likes Peter$_{*i}$.

Since *he* and *Peter* are coindexed and since *he* o-commands *Peter*, *he* also o-binds *Peter*. According to Principle C, this is forbidden and hence bindings like the one in (16) are ruled out.

For ditransitives, there are three elements on the ARG-ST list: the subject, the primary object and the secondary object. If the secondary object is a reflexive, Principle A requires this reflexive to be coindexed with either the primary object or the subject. Hence, the bindings in (17) are predicted to be possible and the ones in (18) are out:

(17) a. John showed Mary$_i$ herself$_i$.
b. John$_i$ showed Mary himself$_i$.

(18) a. * John showed herself Mary.
b. * I showed you herself.

Note that configuration-based Binding Theories like the one entertained in GB and Minimalism require the objects to asymmetrically c-command each other, that is, the primary object c-commands the secondary object but not vice versa. This results in theories that have to assume certain branchings and in some cases even auxiliary nodes (Adger 2003: Section 4.4). In HPSG the branching that is assumed does not depend on binding facts and indeed, ternary branching VPs (Pollard & Sag 1994: 40) and binary branching VPs have been assumed (see Müller 2021a: Section ??, Chapter ?? of this volume for discussion).

The list-based Binding Theory outlined above seems very simple. So far we explained binding relations between coarguments of a head where the coarguments are NPs or pronouns. But there are also prepositional objects, which have an internal structure with the referential NPs embedded within a PP. Pollard & Sag (1994: 246, 255) discuss examples like (19):

(19) a. John$_i$ depends [on him$_{*i}$].
b. Mary talked [to John$_i$] [about himself$_i$].

As noted by Bach & Partee (1980: 137, Section 6.5.6), Chomsky (1981: 226), and Pollard & Sag (1994: 246), examples like the second one are a problem for the GB Binding Theory since *John* is inside the PP and does not c-command *himself*. Examples involving case-marking prepositions are no problem for HPSG however,

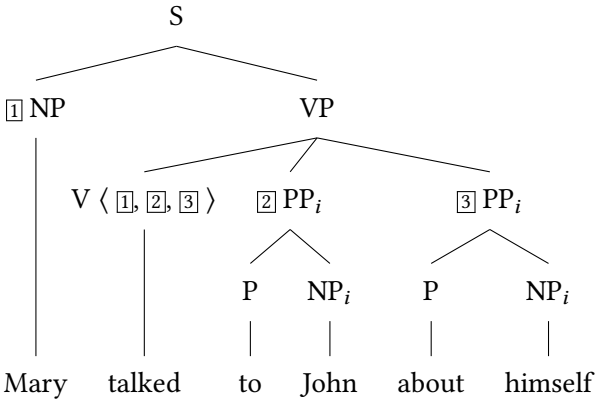

Figure 4: Binding within prepositional objects poses a challenge for GB's Binding Theory

since it is assumed that the semantic content of propositions is identified with the semantic content of the NP they are selecting. Hence, the PP *to John* has the same referential index as the NP *John* and the PP *about himself* has the same index as *himself*. The ARG-ST list of *talked* is shown in (20):

(20) ⟨ NP, PP, PP ⟩

The Binding Theory applies as it would apply to ditransitive verbs. Since the first PP is less oblique than the second one, it can bind an anaphor in the second one. The same is true for the example in (19a): since the subject is less oblique than the PP object, it locally o-commands the PP and even though the pronoun *him* is embedded in a PP and not a direct argument of the verb, the pronoun cannot be bound by *John*. An anaphor would be possible within the PP object though. Of course the subject NP can bind NPs within both PPs: both *to herself* and *about herself* would be possible as well.

A fourth binding principle is needed for languages that have so-called long-distance reflexives as for example Mandarin Chinese and Portuguese (Xue, Pollard & Sag 1994; Pollard & Xue 1998; Branco & Marrafa 1999). In such languages, there are pronouns that may be bound locally or non-locally. Such pronouns are called Z-pronouns and the binding principle responsible for them is Principle Z (Branco & Marrafa 1999: 171). Adding Principle Z to the preliminary version of HPSG's Binding Theory we get:

Principle 3 (HPSG Binding Theory)
Principle A A locally o-commanded anaphor must be locally o-bound.

Principle B A personal pronoun must be locally o-free.

Principle C A nonpronoun must be o-free.

Principle Z An o-commanded anaphor must be o-bound.

Principle Z is like Principle A but with the requirement that anaphors must be o-bound rather than locally o-bound. The requirement to be o-bound includes the option of being locally o-bound but nonlocal o-binding is possible as well.

When the symmetries between the various principles are further explored, the intriguing observation that emerges with respect to the empirical generalisations in the principles above is that they instantiate a square of logical oppositions shown in Figure ?? (Branco & Marrafa 1999: Section 11.4; Branco 2006: 227).

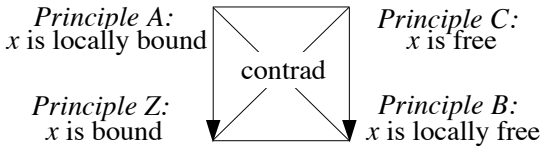

Figure 5: The Binding square of opposition

redraw figure

There are two pairs of *contradictory* constraints, which are formed by the two diagonals, (Principles A, B) and (C, Z). One pair of *contrary* constraints (they can be both false but cannot be both true) is given by the upper horizontal edge (A, C). One pair of *compatible* constraints (they can be both true but cannot be both false) is given by the lower horizontal edge (Z, B). Finally two pairs of *subcontrary* constraints (the first coordinate implies the second, but not vice-versa) are obtained by the vertical edges, (A, Z) and (C, B).

3 Reconstruction

Drop this section?

Examples like (21) are covered by HPSG's Binding Theory since *himself* is fronted via HPSG's nonlocal mechanism (see Borsley & Crysmann 2021, Chapter ?? of this volume) and there is a connection between the fronted element and the missing object.

(21) a. Himself$_i$, Trump$_i$ really admires _.
b. ⟨ Trump, himself ⟩

Therefore, the SYNSEM value of *himself* is identified with the object in the ARG-ST list of *admires* and since the object is local to the subject of admire, it has to be bound by the subject. But there is more to say about reconstruction and nonlocal dependencies in HPSG: Pollard & Sag (1994: 265) point out an interesting consequence of the treatment of nonlocal dependencies in HPSG: since nonlocal dependencies are introduced by traces that are lexical elements rather then by deriving one structure from another one as is common in Transformational Grammar, there is no way to reconstruct some phrase with all its internal structure into the position of the trace. Since traces do not have daughters, _$_j$ in (22a) has the same local properties (part of speech, case, referential index) as *which of Claire's$_i$ friends* without having its internal structure.[11]

(22) a. I wonder [which of Claire's$_i$ friends]$_j$ [we should let her$_i$ invite _$_j$ to the party]?
b. [Which picture of herself$_i$]$_j$ does Mary$_i$ think John likes _$_j$?

Since extracted elements are not reconstructed into the position where they would be usually located, (22a) is not related to (23):

Bob: Is the important point that filler and gap only share a local object and not a synsem object so that there is no sense in which the filler occupies the position of the gap? Presumably things are different in SCBG in which a sign is shared in an unbounded dependency.

Stefan: The point is that traces do not have daughters. Therefore the o-command relation does not reach inside of the trace. There is just nothing below the trace. It is a terminal symbol without daughters.

(23) We should let her$_i$ invite which of Claire's$_i$ friends to the party.

Claire would be o-bound by *her* in (23) and this would be a violation of Principle C, but since traces do not have daughters, no problem arises.

This is an interesting feature of the Binding Theory introduced so far, but as Müller (1999b: Section 20.2) pointed out, it makes wrong predictions as far as German and English are concerned. (24) is the English example:

(24) [Karl$_i$'s friend]$_j$, he$_{*i}$ knows _$_j$.

[11] Some of the more recent theories of nonlocal dependencies even do without traces (Bouma, Malouf & Sag 2001). See Borsley & Crysmann (2021), Chapter ?? of this volume for details.

According to the definition of o-command, *he* locally o-commands the object of *knows*. This object is realized as a trace. Therefore the local properties of *Karl's friend* are in relation to *he* but since traces do not have daughters, there is no o-command relation between *he* and *Karl*, hence *Karl* is o-free and Principle C is not violated. Hence there is no explanation for the impossibility to bind *Karl* to *he*. In order to fix this, some notion of reconstruction would have to be introduced in HPSG's BT but then the account of (??) would be lost.

4 A totally non-configurational binding theory

The initial definition of o-command contains the notion of dominance and hence makes reference to tree structures. Pollard & Sag (1994: 279) pointed out that the binding of *John* by *he* in (25a) is correctly ruled out since *he* o-commands the trace of *John* and hence Principle C is violated. But since they follow GPSG in assuming that English has no subject traces (Pollard & Sag 1994: Chapter 4.4), this account would not work for (25b).

(25) a. John$_{*i}$, he$_i$ said you like $\_\ _i$.
b. John$_{*i}$, he$_i$ claimed left.

Later work in HPSG abolished traces alltogether (Bouma, Malouf & Sag 2001; Borsley & Crysmann 2021, Chapter ?? of this volume but see Müller 2014; 2016: Chapter 19 on empty elements in general) and hence BT cannot rely on dominance any longer. This section deals with the revised version of Binding Theory not making reference to dominance. I will first discuss the revision of local o-command involving one additional aspect having to do with Control Theory and then the revision of o-command without the notion of dominance.

4.1 Local o-command including subjects of embedded verbs

Pollard & Sag (1994: Section 6.8.3) revise the definition of local o-command in a way that includes the subject of embedded verb phrases in order to combine Control and Binding Theory.

(26) Let Y and Z be *synsem* objects with distinct LOCAL values, Y referential. Then Y locally o-commands Z just in case either:
i. Y is less oblique than Z; or
ii. Y locally o-commands some X that subcategorizes for Z.

The second clause was intended to apply to verbs selecting VPs or predicative phrases. At the time HPSG's BT was developed, all valents of a head were represented in a list called SUBCAT list. Pollard & Sag (1994: Chapter 9) changed this and introduced the SPR feature for specifiers in NPs, the SUBJ feature for the representation of subjects and the COMPS feature for complements. The intention behind the second clause of the definition is to include the subject of an embedded verb into the local domain of control verbs. So the natural reformulation of (26) is (27):

(27) Let Y and Z be *synsem* objects with distinct LOCAL values, Y referential. Then Y locally o-commands Z just in case either:
   i. Y is less oblique than Z; or
   ii. Y locally o-commands some X having Z as its SUBJ value.

Pollard & Sag (1994: 303) assume the following valence for a subject control verb like *promise* (SUBCAT is replaced by SUBJ):

(28) ⟨ NP$_i$(, NP), VP[SUBJ ⟨ NP:*refl*$_i$ ⟩] ⟩

According to the definition of local o-command, the subject NP of the embedded verb is local to the subject NP and the object NP of the matrix verb and because of Principle A it has to be bound to the subject. Enforcing this binding is strictly speaking unnecessary since Pollard & Sag (1994: Chapter 7) developed a Control Theory taking care of this. But this type of organization has a nice side effect: it explains Visser's Generalization according to which subject control verbs do not passivize. Since passive suppresses the first argument (bearing structural case) and turning it into an optional *by* phrase one would get the following representation:

(29) ⟨ NP$_i$, VP[SUBJ ⟨ NP:*refl*$_i$ ⟩], PP[*by*]$_i$ ⟩

The coindexing between the downstairs subject and the *by*-PP is due to Control Theory and the coindexing between the NP$_i$ and the downstairs subject is enforced by Principle A of the BT. The result is that three items are coindexed in (29), which leads to all sorts of binding conflicts and hence examples like (30) are ruled out (Pollard & Sag 1994: 305):

(30) a. * Kim$_i$ was promised to leave by Sandy$_i$/Kim$_i$.
   b. * John$_i$ was promised to leave by him$_i$.
   c. ?* John$_i$ was promised to leave by himself$_i$.

Interestingly the situation seems to be parallel in German. Sentences like the following are rather strange:

(31) Klaus wurde versprochen, früher abzufahren.
Klaus.DAT was promised earlier to.leave
Intended: 'Somebody promised Klaus to leave early.'

The sentence is bad if the meaning is that somebody promises that he or she will leave early. It improves if Klaus will leave early together with the one who made the promise. And indeed, as Müller (2002: 129) showed, passivization of subject control verbs is possible in German:

(32) a. Wie oft schon wurde von der Stadtverwaltung versprochen,
like often yet was by the council promised
Abhilfe zu schaffen.[12]
remedy to manage
'As often, the council promised to resolve the matter.'

b. Erneut wird versprochen, das auf eine Dekade angesetzte Investitionsprogramm mit einem Volumen von 630 Billionen Yen (10,5 Billionen DM) vorfristig zu erfüllen, [...][13]
'Again, one promised to complete the investment program planned for one decade with the total amount of 630 trillion Yen before the agreed date.'

All of these examples are fine with *uns* 'us' as the object of *versprechen* 'to promise' as well. So, if one assumes that a central phenomenon like control is handled in parallel ways in English and German, the controlled subject should not be treated as a reflexive local to the arguments of control verbs.

A further problem for including the downstairs subject into the local o-command relation is posed by raising-to-subject verbs with an object. *believe* is an example:

(33) a. Donald$_i$ believes himself$_i$ to be a liar.

b. ⟨ 1 NP$_i$, NP$_i$, VP[SUBJ ⟨ 1 ⟩ ⟩

The ARG-ST list of *believe* contains the subject NP (*Donald*), the NP of the reflexive (*himself*) and the VP (*to be a liar*). Since the subject of the VP is regarded as local to *Donald* and *himself*, we have a situation in which *Donald* locally o-commands *himself* and *himself* o-commands *Donald* (in the SUBJ list of the embedded VP). Hence the second *Donald* is bound by *himself*, which is a violation of Principle C. Note that Pollard & Sag (1994: 253) took measures to deal with

[12] Mannheimer Morgen, 13.07.1999, Leserbriefe; Keine Abhilfe.
[13] Süddeutsche Zeitung, 28.06.1995, p. 28.

raising by excluding two elements with identical LOCAL values in the definition of o-command. So the two Donald's would not cause problems, but the example in (33a) involves one intermediate NP, namely *himself*. The definition of local o-command could be fixed by requiring that Z is not raised. This requirement is more general than the requirement to have a LOCAL value different from the one of Y since it includes the case in which Z is raised and different from Y.[14] But since the inclusion of the downstairs subject would make wrong predictions for German anyway and its merits for English short passives are unclear (Pollard & Sag 1994: 306), I suggest leaving the definition of local o-command the way it originally was, that is, without the reference to subjects of embedded verbs.

4.2 o-command

The revised non-configurational variant of o-command suggested by Pollard & Sag (1994: 279) has the form in (34):[15]

(34) Let Y and Z be *synsem* objects with distinct LOCAL values, Y referential. Then Y o-commands Z just in case either:
   i. Y is less oblique than Z; or
   ii. Y o-commands some X that has Z on its ARG-ST list; or
   iii. Y o-commands some X that is a projection of Z (i.e. the HEAD values of X and Z are token-identical).

This definition of course has the problem pointed out in the previous subsection. The o-command relation can be explained with respect to Figure **??**.

According to the definition, B o-commands E by clause i. B o-commands F, since it o-commands E and E is a projection of F (clause iii). B also o-commands G, since B o-commands F and F has G on its ARG-ST list (clause ii). Since B o-commands G, it also o-commands J, since G is a projection of J (clause iii). And because of all this B also o-commands H and K, since B o-commands J and both H and K are members of the ARG-ST list of J (clause ii).

This recursive definition of o-command is really impressive and it can account for binding phenomena in approaches that do not have empty nodes for traces

[14] Note that the general statement that something is not raised is much more involved than requiring that the LOCAL values of two elements are distinct, since the requirement that something is not raised requires a check of all other elements on the higher ARG-ST list for non-identity. Some approaches to valence mark the status of arguments with respect to raising explicitly by assuming a boolean feature RAISED (Przepiórkowski 1999; Meurers 1999). This would simplify things considerably.

[15] I replaced subcategorized by reference to the ARG-ST list.

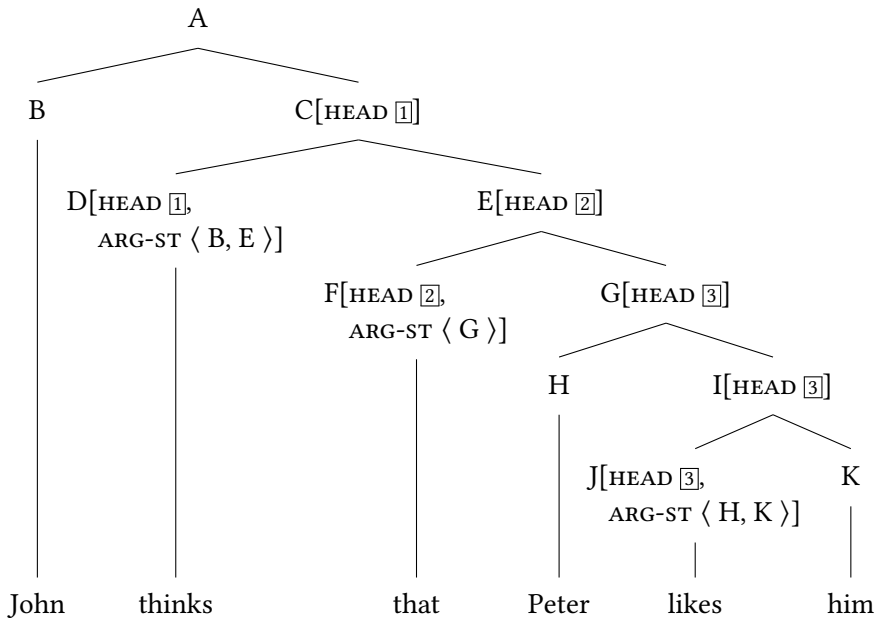

Figure 6: Tree for explanation of the o-command relation

in the tree structures, but there are still open issues.[16]

As was pointed out by Hukari & Levine (1996: 490), Müller (1999b: Section 20.4.1) and Walker (2011), adjuncts pose a challenge for the non-configurational Binding Theory. For example, a referential NP can be part of an adjunct and since adjuncts are usually not part of ARG-ST lists they would not be covered by the definition of o-command given above. *John* is part of the reduced relative clause modifying *woman* in (35).

(35) He_{*i} knows the woman loved by John_{i}.

Since the relative clause does not appear on any ARG-ST list, *he* does not o-

[16] Note that the label *totally non-configurational Binding Theory* seems to suggest that dominance relations do not play a role at all and hence this version of BT could be appropriate for HPSG flavors like Sign-Based Construction Grammar that do not have daughters in linguistic signs (see Sag (2012) and Müller (2021b: Section ??), Chapter ?? of this volume for discussion). But this is not the case. The definition of o-command in (??) contains the notion of projection. While this notion can be formalized with respect to a complex linguistic sign having daughters in Constructional HPSG as assumed in this volume, this is impossible in SBCG and one would have to refer to the derivation tree, which is something external to the linguistic signs licensed by a SBCG theory. See also footnote ??.

command *John* and hence there is no Principle C violation and the binding should be fine.

Several authors suggested including adjuncts into ARG-ST lists of verbs (Chung 1998: 168; Przepiórkowski 1999: 240; Manning, Sag & Iida 1999: 60), but this would result in conflicts with BT if applied to the nominal domain (Müller 1999b: Section 20.4.1.). The reason is that nominal modifiers have a semantic contribution that contains an index that is identical to the index of the modified noun.[17] If there are several such modifiers, we get a conflict since we have several coindexed non-pronominal indices on the same ARG-ST list, which would violate Principle C.

There are two possible solutions that come to mind. The first one is pretty ad hoc: one can assume two different features for different purposes. There could be the normal index for establishing coindexation between heads and adjuncts and heads and arguments and there could be a further index for binding. Adjectives would then have a referential index for establishing coindexation with nouns and an additional index referring to a state, which would be irrelevant for the binding principles.

The second solution to the adjunct problem might be seen in defining o-command with respect to the DEPS list. The DEPS list is a list of dependents that is the concatenation of the ARG-ST list and a list of adjuncts that are introduced on this list (Bouma, Malouf & Sag 2001: 12). Binding would be specified with respect to ARG-ST and dominance with respect to DEPS (which includes everything on ARG-ST). The lexical introduction of adjuncts has been criticized because of scope issues by Levine & Hukari (2006: 153) and there are also problems related to binding: Hukari & Levine (1996: 490) pointed out that there are differences when it comes to the interpretation of pronouns in examples like (36a,b) and (36c,d):

[17] See Arnold & Godard (2021: Section ??), Chapter ?? of this volume and Müller (1999a) on relative clauses. Sag (1997) suggests an approach to relative clauses in which a special schema is assumed that combines the modified noun with a verbal projection. This approach does not have the problem mentioned here. However, prenominal adjuncts would remain problematic as the following example (based on Müller (1999b: 412)) shows:

(i) Sie$_{*i}$ kennt das Kim$_i$ begeisternde Buch.
she knows the Kim enthusing book
'She knows the book enthusing Kim.'

The adjectival participle behaves like a normal adjectival modifier. For Principle C to make the right predictions, there should be a command relation between *er* and the parts of the prenominal modifier. PP adjuncts within nominal structures are a further instance of problematic examples.

(36) a. They$_i$ went into the city without anyone noticing the twins$_{*i/j}$.
b. They$_i$ went into the city without the twins$_{*i/j}$ being noticed.
c. You can't say anything to them$_i$ without the twins$_{i/j}$ being offended.
d. You can't say anything about them$_i$ without Terry criticizing the twins$_{i/j}$ mercilessly.

While the subject pronoun cannot be coreferential with *the twins* inside the adjunct, the object pronoun in (36c,d) can. If we just register adjuncts on the DEPS list, we are unable to refer to their position in the tree and hence we cannot express any statement needed to cover the differences in (36). Note that this is crucially different for elements on the ARG-ST list in English, since the ARG-ST of a lexical item basically determines the trees it can appear in in English: the first element appears to the left of the verb as the subject and all other elements to the right of the verb as complements. However, this is just an artifact of the rather strict syntactic system of English, this is not the case for languages with freer constituent order like German, which causes problems for Binding Theories not taking the linearization of elements into account (see Grewendorf 1985: 140 and Riezler 1995: 12 for crucial examples).

There is another issue related to the totally non-configurational version of the BT: in 1994, HPSG was strictly head-driven. There were rather few schemata and most of them were headed. Since then more and more constructional schemata were suggested that do not necessarily have a head. For example, relative clauses were analyzed involving an empty relativizer (Pollard & Sag 1994: Chapter 5; Arnold & Godard 2021: Section **??**, Chapter **??** of this volume). One way to eliminate this empty element from grammars is to assume a headless schema that combines the relative phrase and the clause from which it is extracted directly (Müller 1999a: Section 2.7). In addition there were proposals to analyze free relative clauses in a way in which the relative phrase is the head (Wright & Kathol 2003: 383). So, if *whoever* is the head of *whoever is loved by John*, the whole relative clause is not a projection of *loved*. Furthermore, *is loved by John* is not an argument of *whoever* and hence there is no appropriate connection between the involved elements, which means that the arguments of *loved* will not be found by the definition of o-command in (**??**). This means that *John* is not o-commanded by *he*, which predicts that the binding in (37) is possible, but it is not.

(37) He$_{*i}$ knows whoever is loved by John$_i$.

Further examples of phenomena that are treated using unheaded constructions are serial verbs in Mandarin Chinese: Müller & Lipenkova (2009) argue that VPs

are combined to form a new complex VP with a meaning determined by the combination. None of the combined VPs contributes a head. No VP selects for another VP.

There seems to be no way of accounting for such cases without the notion of dominance (but see Section ?? for a lexical solution). For those insisting on grammars without empty elements, the solution would be a fusion of the definition given in (??) with the initial definition involving dominance in (??). Hukari & Levine (1995) suggested such a fusion. This is their definition of vc-command:

(38) v(alence-based) c-command:
Let α be an element on a valence list that is the value of the valence feature γ and α' the DTRS element whose SYNSEM value is structure-shared with α. Then if the constituent that would be formed by α' and one or more elements β has a null list as its value for γ, α vc-commands β and all its descendants.

Rewritten in more understandable prose this definition means that if we have some constituent α' then its counterpart in the valence list vc-commands all siblings of α' and their decedents provided the valence list on which α' is selected is empty at the next higher node. We have two valence lists that are relevant in the verbal domain: SUBJ (some authors use SPR instead) and COMPS. The COMPS list is empty at the VP node and the SUBJ list ist empty at the S node. So, the definition in (38) makes statements about two nodes in Figure ??: the lower VP node and the S node. For Figure ??, this entails that the object NP *the car* vc-commands *bought* since *the car* is an immediate daughter of the first projection with empty COMPS list. The NP *they* vc-commands the VP *bought the car without anybody noticing the twins*, since both are immediately dominated by the node with the empty SUBJ list.

The proposal by Hukari & Levine was criticized by Walker (2011: 235), who argued that the modal component *would be formed* in the definition is not formalizable and suggested the following revision:

(39) Let α, β, γ be *synsem* objects, and β' and γ' signs such that β': [SYNSEM β] and γ': [SYNSEM γ]. Then α vc-commands β iff
i. γ': [SS|LOC|CAT|SUBJ ⟨ α ⟩] and γ' dominates β', or
ii. α locally o-commands γ and γ' dominates β'.

Principle C is then revised as follows:

(40) Principle C: A non-pronominal must neither be bound under o-command nor under a vc-command relation.

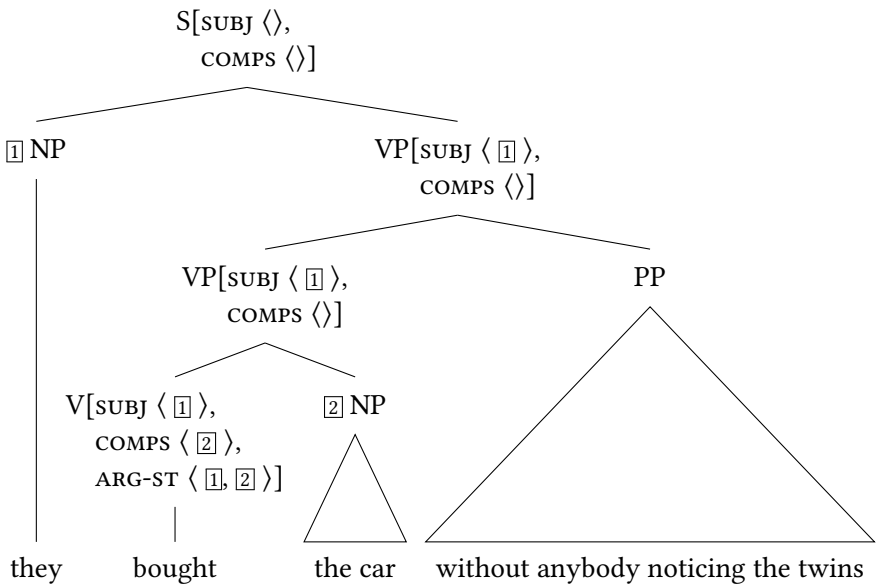

Figure 7: Example tree for explaining vc-command: the subject vc-commands the adjunct because it is in the valence list of the upper-most VP and this VP dominates the adjunct PP

Walker uses the tree in Figure **??** to explain her definition of vc-command. The second clause in the definition of vc-command is the same as before: it is based on local o-command and domination. What is new is the first clause. Because of this clause the subject vc-commands the adjunct since the subject 1 is in the SUBJ list of the top-most VP (α) and this top-most VP (γ') dominates the adjunct PP (β').

There is an interesting puzzle here as far as the formal foundations of HPSG are concerned (Richter 2021, Chapter 3 of this volume): usually binding theories are defined with respect to some tree structures. So the structures are assumed to exist and then there are constraints put onto them to rule out certain bindings. The definition of Hukari & Levine contains a modal component talking about structures that would be licensed. Walker criticizes this and formulates a definition that does without this part. However, by doing so the problem does not go away. If HPSG grammars are seen as a set of constraints describing models of linguistic objects, there would not be a linguistic object for * *Mary likes himself.* and hence one could not say that *Mary* o-commands *himself.* Hence,

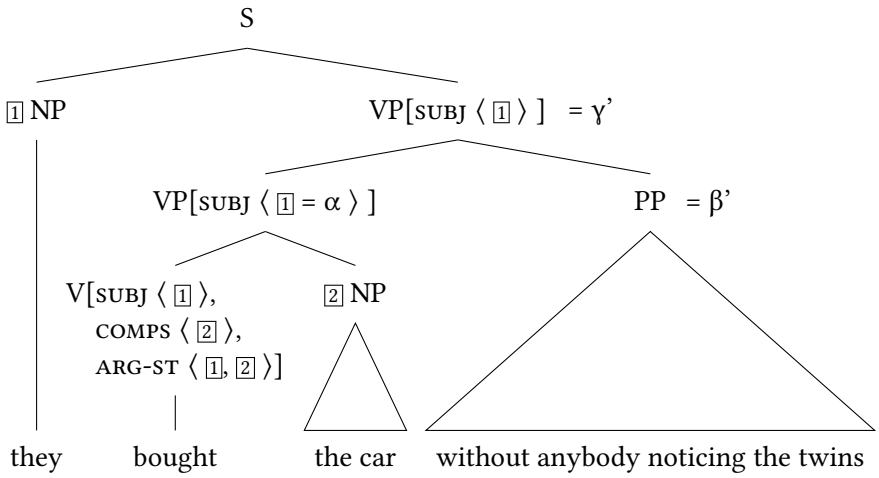

Figure 8: Example tree for explaining vc-command: the subject vc-commands the adjunct because it is in the valence list of the upper-most VP and this VP dominates the adjunct PP

there is a problem, whether one names it in the definition or not. It seems to be necessary to conceptualize binding conditions as something external to the core theory of HPSG: a filter that is applied on top of everything else as is common in more implementation-oriented approaches to HPSG and in the generate and test model of GB.

There is a further difference between Hukari & Levine's and Walker's definition: the former applies to Specifier-Head structures, in which the singleton element of the SPR list is saturated. We will return to this in Section ??. Note also that the definition of Hukari & Levine includes the sibling VP among the items commanded by the subject, while Walker's definition includes elements dominated by this VP only.[18] This difference will also matter in Section ??.

Hukari & Levine's examples involve a subject-object asymmetry. Interestingly, a similar subject-object asymmetry seems to exist in German, as Grewendorf (1985: 148) pointed out. The following example is based on his example:

(41) a. In Marias$_i$ Wohnung erwartete sie$_i$ ein Blumenstrauß.
in Maria's flat waits her.ACC a.NOM bouquet
'A bouquet waits for Maria in her flat.'

[18] The situation is similar to the different versions of c-command in MGG. See footnote ??.

b. * In Marias$_i$ Wohnung erwartete sie$_i$ einen Blumenstrauß.
in Maria's flat waits she.NOM a.ACC bouquet
Intended: 'Maria waits for a bouquet in her flat.'

While the fronted adjunct can bind the object in (41a), binding the subject in (41b) is ruled out. Walker's proposals for English would not help in such examples, since all arguments of finite verbs are represented in one valence list in grammars of German. Hence the highest domain in which vc-command is defined (taking Hukari & Levine's definition) is the full clause since COMPS would be empty at this level. There is the additional problem that the adjunct is fronted in a non-local dependency (German is a V2 language) and that the arguments are scrambled in (41a). There is no VP node in the analysis of (41a) that is commonly assumed in HPSG grammars of German and it is unclear how a reconstruction of the fronted adjunct into a certain position could help explaining the differences in (41).

4.3 Conclusion

Concluding this section, it seems that a totally non-configurational Binding Theory seems to be impossible because of adjuncts and the combination of configurational and non-configurational parts seems appropriate. The subject of the embedded verb should not be included among the local domain of VP embedding verbs.

Section ?? discusses an alternative approach that collects indices in lists. This can be done in a way that can be used to get the adjunct bindings right.

5 Exempt anaphors

The statement of Principle A has interesting consequences: if an anaphor is not locally o-commanded, Principle A does not say anything about requirements for binding. This means that anaphors that are initial in an ARG-ST list may be bound outside of their local environment. The following example by Pollard & Sag (1994: 270) shows that a reflexive can even be bound to an antecedence outside of the sentence:

(42) John$_i$ was going to get even with Mary. That picture of himself$_i$ in the paper would really annoy her, as would the other stunts he had planned.[19]

[19] Pollard & Sag (1994: 270).

A further example are NPs within adjunct PPs. Since there is nothing in the PP *around himself* that is less oblique than the reflexive, the principles governing the distribution of reflexives do not apply and hence both a pronoun and an anaphor is possible:

(43) a. John$_i$ wrapped a blanket around him$_i$.
b. John$_i$ wrapped a blanket around himself$_i$.

Which of the pronouns is used is said to depend on the *point of view* of the speaker (Kuroda 1973, for further discussion and a list of references see Pollard & Sag 1994: 270).

The exemptness of anaphors seems to cause a problem since the Binding Theory does not rule out sentencens like (44):

(44) * Himself sleeps.

This is not a real problem for languages like English, since such sentences are ruled out because *sleeps* requires an NP in the nominative and *himself* is accusative (Brame 1977: 388; Pollard & Sag 1994: 262). However, as Müller (1999b: Section 20.4.6) pointed out, German does have subjectless verbs like *dürsten* 'be thirsty' and *grauen* 'to dread' and here the problem is real:

(45) a. Den Mann friert.
the.ACC man cold.is
'The man is cold.'
b. * Einander friert.[20]
eachother.ACC cold.is
c. Den Mann dürstet.
the.ACC man thirsts
'The man is thirsty.'
d. * Sich dürstet.
SELF.ACC thirst

Note that subjectless verbs usually can be used with an expletive subject:

(46) a. weil es den Mann friert
because EXPL the.ACC man cold.is
b. weil es den Mann dürstet
because EXPL the.ACC man thirsts
'because the man is thirsty'

[20] Fanselow (1986: 349).

This does not help to explain these examples away since expletives are non-referential and hence they do not o-command any other item.

This line of thought leads to English examples that are problematic: the analysis of extraposition with expletive *it* results in a similar ARG-ST list:

(47) a. It bothers me that Sandy snores.
b. * It bothers myself that Sandy snores.

According to Pollard & Sag (1994: 149) the *it* in (47) is non-referential. Hence there is nothing that o-commands the accusative object and hence anaphors would be exempt in the object position and sentences like (47b) are predicted to be grammatical.

6 Nominal heads as binders

The definition of o-command has an interesting consequence: it does not say anything about possible binding relations between heads and their dependents. What is regulated is the binding relations between co-arguments and referential objects dominated by a more oblique coargument. As Müller (1999b: 419) pointed out, bindings like the one in (48) are not ruled out by the Binding Theory of Pollard & Sag (1994: Chapter 6):

(48) his_{*i} father_i

The possessive pronoun is selected via SPR and hence a dependent of *father* (Müller 2020; Machicao y Priemer & Müller 2020), but the noun does not appear in any ARG-ST list (assuming an NP analysis). The consequence is that Principle B and C do not apply and the o-command-based Binding Theory just does not have anything to say about (48). This problem can be fixed by assuming Hukari & Levine's (1995) version of Principle C together with their definition of vc-command in (??). This would also cover cases like (49):

(49) his_{*i} father of John_i

What is not accounted for so far is Fanselow's (1986: 344) examples in (51):

(50) a. * die Freunde$_i$ voneinander$_i$
the friends of.each.other
b. der Besitzer$_i$ seines$_{*i}$ Botes
the owner of.his boat

These examples would be covered by an *i*-within-*i*-Condition as suggested by Chomsky (1981: 212). Chomsky's condition basically rules out configurations like the one in (51):

(51) (... x_i ...)$_i$

Pollard & Sag (1994: 244) discuss the *i*-within-*i*-Condition in their discussion of GB's Binding Theory but do not assume anything like this in their papers. Nor was anything of this kind adopted anywhere else in th discussion of binding. Having such a constraint could be a good solution, but as Fanselow (1986: 343) working in GB pointed out, such a condition would also rule out cases like his examples in (52):

(52) a. die sich$_i$ treue Frau$_i$
the SELF faithful woman
'the woman who is faithful to herself'

b. die einander$_i$ verachtenden Männer$_i$
the each.other despising men
'the men who despise each other'

German allows for complex prenominal adjectival phrases. The subject of the respective adjectives or adjectival participles are coindexed with the noun that is modified. Since the reflexive and reciprocal in (52) are coindexed with the non-expressed subject and since this subject is coindexed with the modified noun (Müller 2002: Section 3.2.7), a general *i*-within-*i*-Condition cannot be formulated for HPSG grammars of German. The problem also applies to English, although English does not have complex prenominal adjectival modifiers. Relative clauses basically produce a similar configuration:

(53) the woman$_i$ seeing herself$_i$ in the mirror

The non-expressed subject in (53) is the antecedent for *herself* and since this element is coindexed with the antecedent noun of the relative clause, we have a parallel situation.

Chomsky (1981: 229, Fn. 63) notes that his formulation of the *i*-within-*i* rules out relative clauses and suggests a revision. However, the revised version would not rule out the examples above either, so it does not seem to be of much help.

In a version of the Binding Theory that is based on command relations in tree configurations, some special constraint seems to be needed that rules out binding by and to the head of nominal constructions unless this binding is established

by adnominal modifiers directly. Section ?? discusses a novel approach to binding that accounts for i-within-i problems by explicitly collecting indices that are possible antecedents and excluding the unwanted indices in this collection.

7 Locality

Müller (1999b: Section 20.4.7) pointed out that examples like (54) involving anaphors within coordinations are problematic for the HPSG Binding Theory:

(54) Wir beschreiben ihm$_i$ [sich$_i$ und seine Familie].
we describe him SELF and his family
'We describe him and his family to him.'

Since *sich* is not local to *ihm* and since reflexives are not excempt in German (Kiss 2012: 158–159), *ihn* would be expected as the only option for a pronominal element within the coordination.

Fanselow (1987: 112) discussed such examples in the context of a GB-style Binding Theory. See also Müller (1999b: 420) for attested examples. Such sentences pose a challenge for the way locality is defined as part of the definition of local o-command. Local o-command requires that the commander and the commanded phrase are members of the same ARG-ST list (??), but the result of coordinating two NPs is usually a complex NP with a plural index:

(55) Der Mann und die Frau kennen / * kennt das Kind.
the man and the woman know knows the child
'The man and the woman know the child.'

The NP *der Mann und die Frau* 'the man and the woman' is an argument of *kennen* 'to know'. The index of *der Mann und die Frau* 'the man and the woman' is local with respect to *das Kind* 'the child'. The indices of *der Mann* 'the man' and *die Frau* 'the woman' are embedded in the complex NP.

For the same reason *sich* is not local to *ihm* in (54). This means that the anaphor is not locally o-commanded in any of the sentences and hence Binding Theory does not say anything about the binding of the reflexive in these sentences: the anaphors are exempt.

For the same reason, *ihn* 'him' is not local to *er* 'he' in (56b) and hence the binding of *ihn* 'him' to *er* 'he', which should be excluded by Principle B, is not ruled out.

(56) a. Er$_i$ sorgt nur für [sich$_i$ und seine Familie].
he cares only for SELF and his family
'He cares for himself and his family only.'
b. Er$_i$ sorgt nur für [ihn$_{*i}$ und seine Familie].
he cares only for him and his family

If one assumed transformational theories of coordination deriving (56) from (57) (see for example Wexler & Culicover 1980: 303 and Kayne 1994: 61, 67 for proposals to derive verb coordination from VP coordination plus deletion), the problem would be solved, but as has been pointed out frequently in the literature such transformation-based theories of coordinations have many problems (Bartsch & Vennemann 1972: 102; Jackendoff 1977: 192–193; Dowty 1979: 143; den Besten 1983: 104–105; Klein 1985; Eisenberg 1994; Borsley 2005: 471) and nobody ever assumed something parallel in HPSG (see Abeillé & Chaves (2021), Chapter ?? of this volume on coordination in HPSG).

(57) Er$_i$ sorgt nur für sich und er$_i$ sorgt nur für seine Familie.
he cares only for SELF and he cares only for his family

Reinhart & Reuland (1993) develop a Binding Theory that works at the level of syntactic or semantic predicates. Discussing the examples in (58) they argue that the semantic representation is (59) and hence their semantic restrictions on reflexive predicates apply.

(58) a. The queen invited both Max and herself to our party.
b. * The queen$_1$ invited both Max and her$_1$ to our party.

(59) the queen (λ x (x invited Max & x invited x))

Such an approach solves the problem for coordinations with *both … and …* having a distributive reading. Reinhart & Reuland (1993: 677) explicitly discuss coordinations with a collective reading. Since we have a collective reading in examples like (??), examples like (??) continue to pose a problem. There are however ways to cope with such data: one is to assume a construction-based account to binding domains. The details of an account that makes this possible will be discussed in Section ??.

The previous two sections discussed problems for the configuration-based Binding Theories. The two following sections deal with the role of the ARG-ST list in binding. The following section discusses Austronesian languages arguing that the order of the elements in the ARG-ST list should not reflect the grammatical functions of the ARG-ST elements. Section ?? deals with data from Russian

and argues for a more complex representation within ARG-ST involving empty elements like PRO (on the ARG-ST list). This all leads to a novel approach to be discussed in Section ?? that assumes special lists for indices playing a role in binding.

8 Disentangeling ARG-ST and grammatical functions

So far we have discussed binding for English with some occasional reference to Mandarin Chinese, Portuguese and German. The question is whether Binding Theory is universal, that is, whether it is a set of constraints holding for all languages or whether language specific solutions are necessary, maybe involving a general machinery for establishing such solutions. In this section, we discuss approaches suggested for Austronesian languages.

Manning & Sag (1998) discuss data from Toba Batak, a Western Austronesian language. They assume that the ARG-ST elements are in the order actor and undergoer, but since Toba Batak has two ways to realize arguments, the so-called *active voice* and the *objective voice* either of the arguments can be the subject.

(60) a. Mang-ida si Ria si Torus
AV-see PM Ria PM Torus
'Torus sees/saw Ria.'

b. Di-ida si Torus si Ria
OV-see PM Torus PM Ria
'Torus sees/saw Ria.'

Manning & Sag argue that the verb and the adjacent NP form a VP which is combined with the final NP to yield a full clause. They furthermore argue that neither sentence in (60) is a passive or anti-passive variant of the other. Instead they suggest that the two variants are simply due to different mappings from argument structure (ARG-ST) to surface valence (SUBJ and COMPS). They provide the following lexical items:

(61) a. *mang-ida* 'AV-see':

$$\begin{bmatrix} \textsc{phon} & \langle\ \textit{mang-ida}\ \rangle \\ \textsc{subj} & \langle\ \boxed{1}\ \rangle \\ \textsc{comps} & \langle\ \boxed{2}\ \rangle \\ \textsc{arg-st} & \langle\ \boxed{1}\ \mathrm{NP}_i, \boxed{2}\ \mathrm{NP}_j\ \rangle \\ \textsc{cont} & \begin{bmatrix} \textit{seeing} & \\ \textsc{actor} & i \\ \textsc{undergoer} & j \end{bmatrix} \end{bmatrix}$$

b. *di-ida* 'OV-see':

$$\begin{bmatrix} \textsc{phon} & \langle\ \textit{di-ida}\ \rangle \\ \textsc{subj} & \langle\ \boxed{2}\ \rangle \\ \textsc{comps} & \langle\ \boxed{1}\ \rangle \\ \textsc{arg-st} & \langle\ \boxed{1}\ \mathrm{NP}_i, \boxed{2}\ \mathrm{NP}_j\ \rangle \\ \textsc{cont} & \begin{bmatrix} \textit{seeing} & \\ \textsc{actor} & i \\ \textsc{undergoer} & j \end{bmatrix} \end{bmatrix}$$

The analysis of (??) is given in Figure ??. Since the second argument, the logical object and undergoer is mapped to SUBJ in (61b), it is combined with the verb last.

But since binding is taken care of at the ARG-ST list and this list is not affected by voice differences, this account correctly predicts that the binding patterns do not change independent of the realization of arguments: as the following examples show, it is always the logical subject, the actor (the initial element on the ARG-ST list) that binds the non-initial one.

(62) a. [Mang-ida diri-na$_i$] si John$_i$.
AV-saw self-his PM John
'John saw himself.'

b. * [Mang-ida si John$_i$] diri-na$_{*i}$.
AV-saw PM John self-his
Intended: 'John saw himself.' with *himself* as the (logical) subject

(63) a. * [Di-ida diri-na$_i$] si John$_i$
OV-saw self-his PM John
Intended: 'John saw himself.' with *himself* as the (logical) subject

b. [Di-ida si John$_i$] diri-na$_i$
OV-saw PM John self-his
'John saw himself.'

Manning & Sag (1998: 121) point out that theories relying on tree configurations will have to assume rather complex tree structures for one of the patterns to establish the required c-command relations. This is unnecessary for ARG-ST-based binding theories.

Wechsler & Arka (1998) discuss similar data from Balinese and provide a parallel analysis. See also Wechsler (1999) for a comparison of GB analyses with

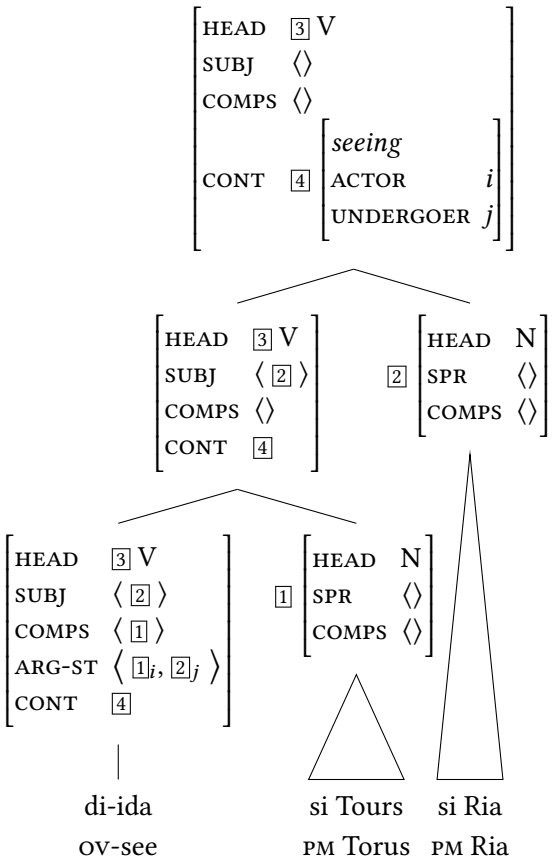

Figure 9: Analysis of Toba Batak example in objective voice according to Manning & Sag (1998: 120)

ARG-ST-based HPSG analyses.

The conclusion to be drawn from this section is that obliqueness should not be defined in terms of grammatical functions as was done in (??) above but rather with reference to a thematic hierarchy as suggested by Jackendoff (1972). This would not make a difference for languages like English, but for languages like Toba Batak and Balinese the arguments may be mapped to different grammatical functions depending on the voice the verb is realized in.

9 ARG-ST lists with internal structure

Manning & Sag (1998) discuss binding in passive clauses. They suggest that the passive is analyzed as a lexical rule demoting the subject argument and adding an optional PP. If this lexical rule involves the ARG-ST list, this means that the former object is the initial argument on the ARG-ST list and that reflexives must be bound by this element rather than by the logical subject of the passivized verb which is optionally expressed in the *by*-PP.

(64) $\begin{bmatrix} \textsc{arg-st} & \langle \boxed{1}_i, \boxed{2}, \ldots \rangle \\ \textsc{cont} & \boxed{3} \end{bmatrix} \mapsto \begin{bmatrix} \textsc{arg-st} & \langle \boxed{2}, \ldots \rangle \oplus \langle \text{PP}[by]_i \rangle \\ \textsc{cont} & \boxed{3} \end{bmatrix}$

However, Perlmutter (1984) argued that more complex representations are necessary to capture the fact that some languages allow binding to the logical subject of the passivized verb. He discusses examples from Russian. While usually the reflexive has to be bound by the subject as in (65a), the antecedent can be either the subject or the logical subject in passives like (65a):

(65) a. Boris$_i$ mne rasskazal anekdot o sebe$_i$.
Boris.NOM me.DAT told joke about SELF
'Boris told me a joke about himself.'

b. Eta kniga byla kuplena Borisom$_i$ dlja sebja$_i$.
this book.NOM was bought Boris.INSTR for SELF
'This book was bought by Boris for himself.'

In order to capture the binding facts, Manning & Sag (1998) suggest that passives of verbs like *kupitch* 'buy' have the following representation at least in Russian.

(66) *kuplena* 'bought':
$\begin{bmatrix} \textsc{arg-st} & \langle \text{NP}[nom]_j, \langle \text{NP}[instr]_i, \text{PRO}_j, \text{PP}_k \rangle \rangle \\ \textsc{cont} & \begin{bmatrix} buying & \\ \textsc{actor} & i \\ \textsc{undergoer} & j \\ \textsc{beneficiary} & k \end{bmatrix} \end{bmatrix}$

The ARG-ST list is not a simple list like the list for English but it is nested. The complete ARG-ST list of the lexeme *kupitch* 'buy' is contained in the ARG-ST list of the passive. The logical subject is realized in the instrumental and the logical object is stated as PRO$_j$ on the embedded ARG-ST but as full NP in the nominative

on the top-most ARG-ST list. This setup makes it possible to account for the fact that a long-distance reflexive (see p. **??**) like the reflexive in the PP may refer to one of the two subjects: the nominative NP in the upper ARG-ST list and the NP in the instrumental in the embedded list. The PRO element is kept as a reflex of the argument structure of the lexeme. Such PRO elements also play a role in binding phenomena in languages like Chi-Mwi:ni also discussed by Manning & Sag.

In order to facilitate distributing the elements of such nested ARG-ST lists to valence features like SUBJ and COMPS, Manning & Sag (1998: 124, 140) use a complex relational constraint that basically flattens the nested ARG-STs again and removes all occurrences of PRO. An alternative would be to keep the ARG-ST list for linking, case assignment, and scope and use additional lists related to the ARG-ST list for binding. Such lists can contain PRO indices and additional indices for complex coordinations (see Section **??**). We discuss an approach assuming additional lists in the following section.

10 Explicit constructions of lists with possible antecedents

The discussion of early HPSG approaches to binding revealed a number of problems. The proposals are based on tree configurations and on command relations. This is basically the conceptual inheritance of the GB Binding Theory, of course with a lot of improvements. The general problem seems to be that the command relations are defined in a uniform way not taking account of special configurations like coordinated structures and so on.

Now, there is a more recent approach to binding that looks technical at first, but it is the solution to the problems caused by an approach assuming that one command relation that is supposed to work for all structures in all languages. Branco (2002) suggested an approach that collects indices that are available for binding in certain binding domains. Since the way in which indices relevant for binding are collected can be specified with reference to specific constructions the problems mentioned so far can be circumvented.

Branco (2002) argues that sentences with wrong bindings of pronouns and/or reflexives are not syntactically ill-formed but semantically deviant. For the representation of his Binding Theory, he assumes Underspecified Discourse Representation Theory (UDRT, Reyle 1993; Frank & Reyle 1995) as the underlying formalism for semantics (see also Koenig & Richter 2021: Section **??**, Chapter **??** of this volume).

Similar to the notion assumed in Minimal Recursion Semantics (MRS, Cope-

stake, Flickinger, Pollard & Sag 2005) there is an attribute for distinguished labels that indicate the upper (L-MAX) and lower (L-MIN) bound for quantifier scope, there is a set of subordination condition for quantifier scope (the HCONS set in MRS), a list of semantic conditions (the RELS set in MRS). In addition, Branco suggests a feature ANAPH(ORA) for handling the Binding Theory constraints. Information about the anaphoric potential of nominals is represented here. There is a reference marker represented under R(EFERENE)-MARK(ER) and there is a list of reference markers under ANTEC(EDENTS). The list is set up in a way so that it contains the antecedent candidates of a nominal element. Furthermore, Branco adds special lists containing antecedents for special types of anaphora. The lists are named after the binding principles that were already discussed in previous sections: LIST-A contains all reference markers of elements that locally o-command a certain nominal expression *n* ordered with respect to their obliqueness, LIST-Z contains all o-commanders also including everything from LIST-A. The elements in LIST-Z may come from various embedded clauses and are also ordered with respect to their obliqueness. The list LIST-U contains all the reference markers in the discourse context including those not linguistically introduced. The list LIST-LU is an auxiliary list that will be explained below.

(67)
$$\begin{bmatrix} \text{LOC|CONT} & \begin{bmatrix} \textit{udrs} & \\ \text{LS} & \begin{bmatrix} \text{L-MAX} & \boxed{1} \\ \text{L-MIN} & \boxed{1} \end{bmatrix} \\ \text{SUBORD} & \{\ldots\} \\ \text{CONDS} & \{\ldots\} \\ \text{ANAPH} & \begin{bmatrix} \text{R-MARK} & \textit{refm} \\ \text{ANTEC} & \textit{list}(\textit{refm}) \end{bmatrix} \end{bmatrix} \\ \text{NONLOC|BIND} & \begin{bmatrix} \textit{bind} & \\ \text{LIST-A} & \textit{list}(\textit{refm}) \\ \text{LIST-Z} & \textit{list}(\textit{refm}) \\ \text{LIST-U} & \textit{list}(\textit{refm}) \\ \text{LIST-LU} & \textit{list}(\textit{refm}) \end{bmatrix} \end{bmatrix}$$

The lists containing possible antecedents for various nominal elements are represented under nonlocal as the value of a newly introduced feature BIND. These binding lists differ from other NONLOCAL features in that nothing is ever removed from them (on unbounded dependencies and nonlocal features in general see Borsley & Crysmann (2021), Chapter ?? of this volume). Before we provide the principles that determine the list values, we explain an example: Figure ?? shows

the relevant aspects of the analysis of (68):

(68) Every student thought that she saw herself.

The noun phrase *every student* introduces the reference marker (R-MARK) [3] for e-type anaphora (Evans 1980) and as value of VAR the value used for bound-variable anaphora interpretations (Reinhart 1983). This is [2] in the example. The pronouns *she* and *herself* introduce the reference markers [4] and [5] respectively. All these reference markers are added to the book keeping list LIST-LU of the respective lexical items: *she* has [4] in its LIST-LU and *herself* has [5] in this list. The noun phrase *every student* has both the variable [2] and the reference marker ([3]) in the LIST-LU. As can be seen by looking at the individual nodes in Figure **??**, the elements of LIST-LU in daughters are collected at the mother node. The element *ctx* is an empty element that stands for the non-linguistic context. It is combined with one or more sentences to form a text fragment (see also Lücking, Ginzburg & Cooper (2021), Chapter **??** of this volume for discourse models and HPSG). The CONDS list of the *ctx* element contains semantic relations that hold of the world and all reference markers contained in these relations are also added to the LIST-LU list. In the example this is just [1]. The example shows just one sentence that is combined with the empty head, but in principle there can be arbitrarily many sentences. The LIST-LU list contains all reference markers contained in all sentences and the non-linguistic context.

The top node of Figure **??** is licensed by a schema that also identifies the LIST-U value with the LIST-LU value. The LIST-U value is shared between mothers and their daughters and since LIST-LU is a collection of all referential markers in the tree and this collection is shared with LIST-U at the top node, it is ensured that all nodes have an LIST-U value that contains all reference markers available in the whole discourse. In our example, all LIST-U values are ⟨ [1], [2], [3], [4], [5] ⟩.

LIST-A values are determined with respect to the argument structures of governing heads. So the LIST-A value of *thought* is ⟨ [2], [3] ⟩ and the one of *saw* is ⟨ [4], [5] ⟩. The LIST-A values of NP or PP arguments are identical to the ones of the head, hence *she* and *herself* have the same LIST-A value as *saw* and *every student* has the same LIST-A value as *thought*. Apart from this the LIST-A value is projected along the head path in non-nominal and non-prepositional projections. For further cases see Branco (2002: 77).

The value of LIST-Z is determined as follows (Branco 2002: 77): for all sentences combined with the context element, the LIST-Z value is identified with the LIST-A value. Therefore the LIST-Z value of *every student thought that she saw herself* is ⟨ [2], [3] ⟩: the LIST-A value is projected from *thought* and then identified with the LIST-Z value. In sentential daughters that are not at the top-level, the LIST-Z value

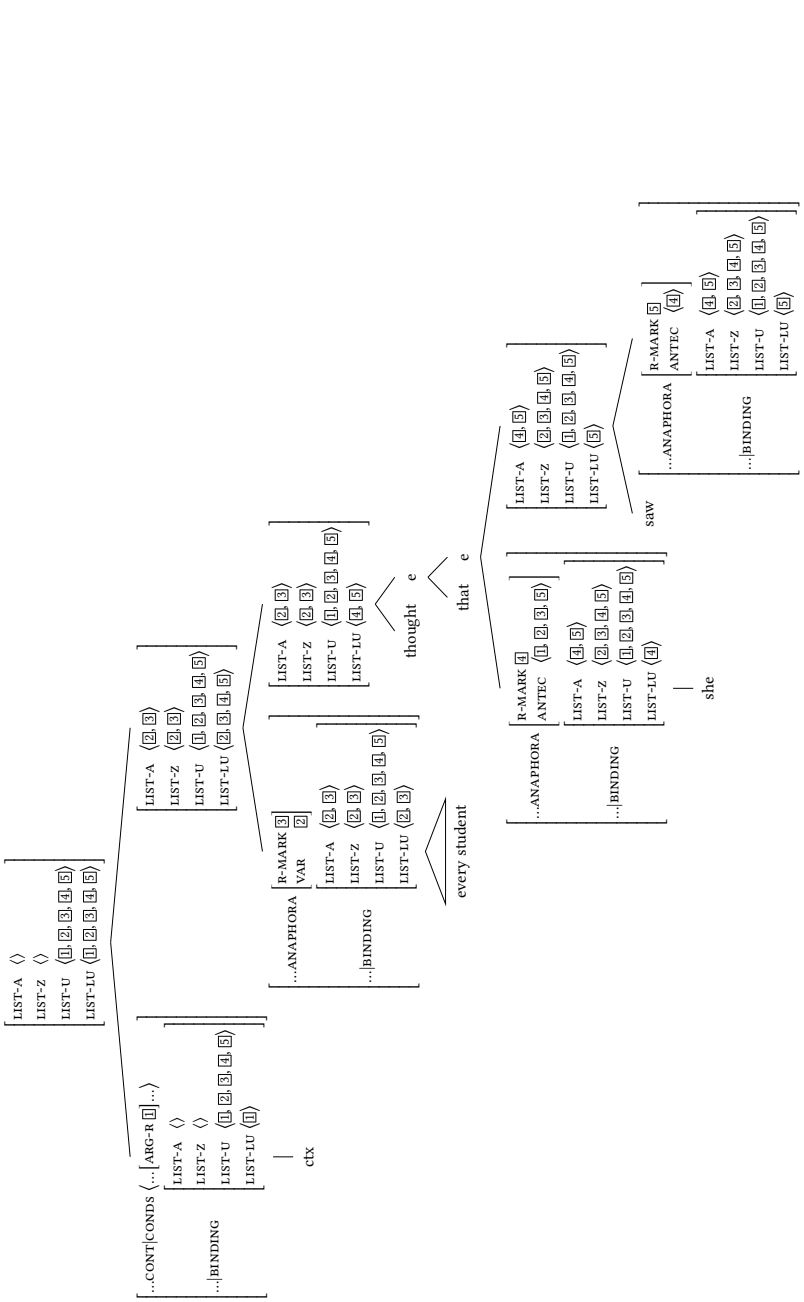

Figure 10: Partial grammatical representation of *Every student thought that she saw herself.*

is the concatenation of the LIST-Z value of the mother and the LIST-A value of the sentential daughter. In other non-filler daughters of a sign, the LIST-Z value is structure shared with the LIST-Z value of the sign. For example, *she* and *saw* and *herself* have the same LIST-Z value, namely ⟨ 2, 3, 4, 5 ⟩.

Branco (2002: 78) provides the following lexical item for a pronoun:

(69) Parts of the SYNSEM value for *she*:

$$\begin{bmatrix} \text{LOC}|\text{CONT} & \begin{bmatrix} \text{LS} & \begin{bmatrix} \text{L-MAX} & \boxed{1} \\ \text{L-MIN} & \boxed{1} \end{bmatrix} \\ \text{SUBORD} & \{\} \\ \text{CONDS} & \left\{ \begin{bmatrix} \text{LABEL} & \boxed{1} \\ \text{DREF} & \boxed{2} \end{bmatrix} \right\} \\ \text{ANAPH} & \begin{bmatrix} \text{R-MARK} & \boxed{2} \\ \text{ANTEC} & \texttt{principleB}\left(\boxed{4},\boxed{3},\boxed{2}\right) \end{bmatrix} \end{bmatrix} \\ \text{NONLOC}|\text{BIND} & \begin{bmatrix} \text{LIST-A} & \boxed{3} \\ \text{LIST-Z} & \mathit{list}(\mathit{refm}) \\ \text{LIST-U} & \boxed{4} \\ \text{LIST-LU} & \langle \boxed{2} \rangle \end{bmatrix} \end{bmatrix}$$

The interesting thing about the analysis is that all information that is needed to determine possible binders of the pronoun are available in the lexical item of the pronoun. The relational constraint `principleB` takes as input the LIST-A list 3, the LIST-U list 4 and the reference marker of the pronoun under consideration (2). The result of the application of `principleB` is the list of reference markers that does not contain elements locally o-commanding the pronoun, since all o-commanders of the reference marker 2, which are contained in the LIST-A are removed from LIST-U (the list of all reference markers in the complete discourse). In the case of *she* in our example, `principleB` returns the complete discourse ⟨ 1, 2, 3, 4, 5 ⟩ minus all reference markers of elements less oblique than 4, which is the empty list, minus 4 since the pronoun is not a possible antecedent of itself. So, the list of possible antecedents of *she* is ⟨ 1, 2, 3, 5 ⟩. This list contains 5 as a possible binder, which is of course unwanted. According to Branco (2002: 84), *herself* as a binder of *she* is ruled out, since *she* binds *herself*.

The SYNSEM value for *herself* is shown in (70):

(70) Parts of the SYNSEM value for *herself*:

$$\begin{bmatrix} \text{LOC|CONT} & \begin{bmatrix} \text{LS} & \begin{bmatrix} \text{L-MAX } \boxed{1} \\ \text{L-MIN } \boxed{1} \end{bmatrix} \\ \text{SUBORD} & \{\} \\ \text{CONDS} & \left\{ \begin{bmatrix} \text{LABEL } \boxed{1} \\ \text{DREF } \boxed{2} \end{bmatrix} \right\} \\ \text{ANAPH} & \begin{bmatrix} \text{R-MARK } \boxed{2} \\ \text{ANTEC } \texttt{principleA}(\boxed{3},\boxed{2}) \end{bmatrix} \end{bmatrix} \\ \text{NONLOC|BIND} & \begin{bmatrix} \text{LIST-A } \boxed{3} \\ \text{LIST-Z } \mathit{list}(\mathit{refm}) \\ \text{LIST-U } \mathit{list}(\mathit{refm}) \\ \text{LIST-LU } \langle \boxed{2} \rangle \end{bmatrix} \end{bmatrix}$$

LIST-A contains the reference markers of locally o-commanding phrases (3). Together with the reference marker of *herself* (2), 3 is the input to the relational constraint `principleA`. This constraint returns a list containing all possible binders for 2, that is, all elements of 3 that are less oblique than 2. If there is no such element, the returned list is the empty list and the anaphor is exempt (see Section ??).

The example discussed here involved a personal pronoun and a reflexive. The antecedents were determined by the relational constraints `principleB` and `principleA`. Further relational constraints are assumed for long-distance reflexives (`principleZ`) and normal referential NPs (`principleC`). `principleC` is part of the specification of the specifier used in non-lexical anaphoric nominals (Branco 2002: 79).

The setting up of the LIST-A and LIST-U list is flexible enough to take care of problems that are unsolvable in the standard HPSG approach (and in GB approaches). For example, the LIST-U list of a noun phrase can be set up in such a way that the reference marker of the whole NP, which is introduced by the specifier is not contained in the LIST-U list of the $\overline{\text{N}}$ that is combined with it. As pointed out by Branco (2002: 76), this solves *i-within-i* puzzles, which were discussed in Section ??.

Note also that this flexibility in determining the lists of possible local antecedents on a construction specific basis makes it possible for the first time to account for puzzling data like the coordination data discussed in Section ??. If the coordination analysis standardly assumed in HPSG (see Abeillé & Chaves (2021), Chapter ?? of this volume) is on the right track, a special rule for licensing coor-

dination is needed and this rule can also incorporate the proper specification of binding domains with respect to coordination.

Summing up, it can be said that the lexical, list-based solution discussed in this last section provides flexibility in defining binding domains and can cope with the *i*-within-*i* problem and problems of locality.

11 Conclusion

We discussed several approaches to Binding Theory in HPSG. It was shown that the valence-based approach referring to the ARG-ST list of lexical items has advantages over proposals exclusively referring to tree configurations. Since tree configurations play a minor role HPSG's Binding Theory, binding data does not force syntacticians to assume structures branching in a certain way. This sets HPSG apart from theories like Government & Binding and Minimalism, in which empty nodes are assumed for sentences with ditransitive verbs in order to account for binding facts.

A further highlight was the treatment of so-called exempt anaphors, that is, anaphors that are not commanded by a possible antecedent. Pollard & Sag (1992) argued that these anaphors should not be regarded as constrained by the Binding Theory and hence that binding to antecedents outside of the clause or the projection are possible.

Finally, we discussed a lexical approach to binding making all the relevant binding information available locally within lexical items of pronouns. This approach is flexible enough to deal with problematic aspects like the *i*-within-*i* situations and locality problems in coordinated structures.

Abbreviations

AV Agentive Voice
OV Objective Voice
PM pivot marker

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Part III

Other levels of description

Chapter 21

Morphology

Berthold Crysmann
CNRS, Laboratoire de linguistique formelle, U Paris

This chapter provides an overview of work on morphology within HPSG. Following a brief discussion how morphology relates to the issue of lexical redundancy, and in particular horizontal redundancy, I map out the historical transition from meta-level lexical rules of derivational morphology and grammatical function change towards theories that are more tighly integrated with the hierarchical lexicon (Riehemann 1998; Koenig 1999). After a discussion of fundamental issues of inflectional morphology and the kind of models these favour, the chapter summarises previous HPSG approaches to the issue and finally provides an introduction to Information-based Morphology (Crysmann & Bonami 2016), a realisational model of morphology that systematically exploits HPSG-style underspecification in terms of multiple inheritance hierarchies.

1 Introduction

Lexicalist approaches to grammar, such as HPSG, typically combine a fairly general syntactic component with a rich and articulate lexicon. While this makes for a highly principled syntactic component — e.g. the grammar fragment of English presented in Pollard & Sag (1994) contains only a handful of principles together with six rather general phrase structure schemata —, this decision places quite a burden on the lexicon, an issue known as lexical redundancy.

Lexical redundancy comes in essentially two varieties: vertical redundancy and horizontal redundancy. Vertical redundancy arises because many lexical entries share a great number of syntactic and semantic properties: e.g. in English (and many other languages) there is a huge class of strictly transitive verbs which display the same valency specifications, the same semantic roles, and the same

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linking patterns. From its outset, HPSG successfully eliminates vertical redundancy by means of multiple inheritance networks over typed feature structures (Flickinger et al. 1985).

The problem of horizontal redundancy is associated with systematic alternations in the lexicon: these include argument-structure alternations, such as resultatives or the causative-inchoative alternation, as well as classical instances of grammatical function change, such as passives, applicatives or causatives. The crucial difference with respect to vertical redundancy is that we are not confronted with what is essentially a classificational problem — assigning lexical entries to a more general class and inheriting its properties —, but rather with a relation between lexical entries. Morphological processes, both in word formation and inflection, crucially involve this latter type of redundancy: for example, in the case of deverbal adjectives in *-able*, we find a substantial number of derivations that show systematic changes in form, paired with equally systematic changes in grammatical category, meaning, and valency (Riehemann 1998). In inflection, change in morphosyntactic properties, e.g. case or agreement marking, is often signalled by a change in shape, which means the generalisation to be captured is about the contrast of form and morphosyntactic properties between fully inflected words.

Following Bresnan (1982b), the classical way to attack the issue of horizontal redundancy in HPSG is by means of lexical rules (Flickinger 1987). Early HPSG embraced Bresnan's original conception of lexical rules as mappings between lexical items. To a considerable extent[1], work on morphology and, in particular, derivational morphology has led to a reconceptualisation of lexical rules within HPSG: now, they are understood as partial descriptions of lexical items that are fully integrated into the hierarchical lexicon (Meurers 1995; Copestake 2002; Koenig 1999). As such, they are amenable to the same underspecification techniques that are used to generalise across classes of basic lexical items.

The chapter is structured as follows: in Section ??, I shall present the main developments towards an inheritance-based view of derivational morphology within HPSG and provide pointers to concrete work within HPSG and beyond that has grown out of these efforts.

In Section ??, I shall discuss inflectional morphology, starting with an overview of the classical challenges (Section ??) and assess how the different types of inflectional theories — Item-and-Arrangement (IA), Item-and-Process (IP), and Word-and-Paradigm (WP) — fare with respect to these basic challenges (Section ??).

[1] See also the work by Meurers (1995; 2001), providing a formal description-level formalisation of lexical rules, as standardly used in HPSG.