An Alternative to the HPSG Raising Principle on the Description-Level

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Abstract

I reconsider the HPSG RAISING PRINCIPLE which is introduced in Pollard and Sag (1994) to constrain the way in which lexical entries describe the SUBCAT lists of the words they license. On the basis of whether a complement is assigned a semantic role in a lexical entry or not, this entry may not or must describe this complement as structure-shared with the unrealised subject of some other (non-subject) complement. The formal status of this principle is still unclear, as it is formulated as a 'meta principle' that does not talk about linguistic objects directly but rather about the lexical entries that license them. I show that, although its meaning cannot be expressed faithfully by the usual kind of constraints employed in HPSG, the RAISING PRINCIPLE can nevertheless be replaced by two such constraints which make largely the same predictions. Most importantly, these constraints interact with the output values of description-level lexical rules in the style of Meurers (2001) in a way that makes predictions available that Pollard and Sag (1994) intended the RAISING PRINCIPLE to make but that it cannot possibly make if description-level lexical rules are employed.

1 Introduction

In chapter 3 of Pollard and Sag (1994) the RAISING PRINCIPLE (RP) is introduced. This principle's initial motivation was to enforce under certain circumstances what I shall call the *raising configuration* on the SUBCAT lists of words:[1] If a subject is raised, it is identical to the *synsem* object belonging to the subject or object it is raised to. This is illustrated by the SUBCAT lists in (1).

(1) a. $\left\langle \boxed{1}, \text{VP}\left[\text{SUBCAT } \langle \boxed{1} \rangle\right] \right\rangle$

b. $\left\langle \text{NP}, \boxed{1}, \text{VP}\left[\text{SUBCAT } \langle \boxed{1} \rangle\right] \right\rangle$

The list described in (1a) corresponds to a subject-to-object raising verb like *seem*. The raising configuration holds on the list since the subject (i.e. the first element of the list) is token-identical to the subject of the unsaturated VP. Similarly, the raising configuration holds on the list described in (1b). This list might be that of a subject-to-object raising verb like *believe* or *expect*.

1.1 Description-Level and Meta-Level

In Pollard and Sag (1994), linguistic regularities were expressed on two different levels, which I shall call (following Meurers (2001)) the description-level and the

[†]I thank Frank Richter, Janina Radó, Manfred Sailer, Gerald Penn and Ivan Sag for valuable discussions and advice; I thank the three anonymous reviewers of an earlier draft of this paper for helpful comments.

[1]In the following I shall sometimes be talking about raising verbs instead of raising words, usually because certain properties of verbs are an issue. This should not distract from the fact that the RP as well as the principles introduced in this paper talk about words in general.

meta-level. The descriptions that are formulated on the description-level talk about linguistic objects directly and constrain them to certain shapes. On the meta-level, lexical rules are formulated that derive new lexical entries (which are descriptions of words) from existing ones, thus allowing for what has been called 'horizontal generalisations' in the lexicon. Apart from the lexical rules, constraints on the shape of not linguistic objects but instead the descriptions constraining them can be imagined, and the RAISING PRINCIPLE was intended as just this kind of meta-level constraint.

While a precise formal explication of the meaning of principles formulated on the description-level has been provided in the form of (R)SRL,[2] no such formal rendering has so far been given for meta-level rules and principles. Hence no precise account of the RPs meaning exists so far, and the details of its effects may thus always be subject to some amount of speculation. Furthermore, since the principle was intended to constrain not only basic lexical entries but likewise those generated as the outputs of lexical rules, it is incompatible with a description-level approach to lexical rules in the style of Meurers (2001) for principled reasons, since in this approach *word* objects are related to other *word* objects, while the originally envisioned meta-level formalisation of lexical rules should have related lexical entries to lexical entries. If use is made of a description-level formalisation of lexical rules, the RAISING PRINCIPLE will no more be able to constrain the output values of the rules, since these will be in a domain different from the one the principle talks about (linguistic objects vs. lexical entries).

Since neither a satisfactory formulation of meta-level lexical rules nor of the RP have yet been given, I consider the meta-level approach a dead end for the time being. It follows that, for the purpose of full formalisation, description-level lexical rules are called for. It is then an obvious question whether some replacement of the RP in terms of descriptions can be given as well.[3] To my knowledge, no such alternatives have been attempted to give, probably because the RP as it stands talks about the way words are described by lexical entries, which clearly is something that cannot be done in the same manner by a description that is formulated on the same level as the lexical entries themselves. From this it follows that the effects of the alternative that will be offered here cannot be quite the same as those of the RP (under any interpretation it might possibly be given).

1.2 The issue

In this paper, I offer a replacement for the RP formulated on the description-level. The replacement is intended to have at least the effects that the RP was positively intended to have. In section 2, I briefly review the idea of the original RP and take a look at the features of this principle that make it so problematic to express on the description level. In section 3, taking my departure from the theory of

[2] cf. Richter (2004).

[3] Descriptions are considered expressions of (R)SRL or the AVM notation for (R)SRL, as defined in Richter (2004). I consider nothing else a true description.

English presented in the first eight chapters of Pollard and Sag (1994), excluding the CONTROL THEORY, I offer two new principles as an alternative to the RP, namely the ARGUMENT CONSISTENCY PRINCIPLE (ACP) and the COHERENCE OF VALENCE PRINCIPLE. In section 4 I argue that, if description-level lexical rules are employed, these two principles achieve what the RP was intended to achieve with respect to predicting the shapes of the output values of lexical rules. I show that the argument about the Subject Extraction Lexical Rule (SELR) output for the null relativiser that Pollard and Sag (1994, p. 219, fn. 4.) make, as well as the one about the impossibility of Null Complement Anaphora with raising verbs and raising adjectives, in contrast to its possibility with equi verbs and adjectives (cf Pollard and Sag (1994, p. 140-142), can be reconstructed using the new principles. Apart from this one, hardly any attempts at precise arguments employing the RP are known to me, which is probably due to its dubious formal status.[4] By giving a formalised description-level alternative to the RP while preserving the effects intended by Pollard and Sag (1994), I hope to make a more precise discussion of the meaning, effects and necessity of constraints ensuring the raising configuration possible.

2 The RAISING PRINCIPLE

In this section I shall take a brief look at the RP of Pollard and Sag (1994).

(2) (META-LEVEL) RAISING PRINCIPLE *Appendix Version*

> Let E be a lexical entry in which the (description of the) SUBCAT list L contains (a description corresponding to) a member X (of L) that is not explicitly described in E as an expletive. Then in (the description of) the CONTENT value, X is (described as) assigned no semantic role if and only if L (is described as if it) contains a nonsubject whose own SUBCAT value is <X>.

The crucial aspect of this formulation is the reference that is made to the way things are described by lexical entries, in particular the phrases *not explicitly described in E as an expletive* and *(described as) assigned no semantic role*. I consider each of these in turn.

- *not explicitly described in E as an expletive*

[4] A further is about the output values of a lexical rule accounting for prepositional passives in Tseng (2007). It is interesting to note that Tseng (2007), unlike Pollard and Sag (1994), does not assume that the RP can be used to predict the shape of output values of lexical rules. For Tseng, the rules themselves have to be formulated so as to comply with the principle.

If a member of a SUBCAT list of a *word* object *w* is not explicitly described as expletive in the lexical entry that licenses *w* (and, of course, if it is neither explicitly described as referential), then, in *w*, this member of the list might actually be expletive and just as well might not. All that is required is that the relevant complements of *word* objects licensed by the entry need not necessarily be expletive, while it is still possible for them to actually be expletive. This fact is made use of in the RP to account for the fact that (for example) raising verbs behave identically in cases where the verbal complement's subject is expletive and in cases where it is not.

- *(described as) assigned no semantic role*

  I distinguish between *role assignment* and *role filling*. *Role assignment* takes place in the domain of lexical entries (which the RP constrains). A *synsem* object is assigned a semantic role in a *word* object's CONTENT value if a token identity of (part of) the semantics of the *synsem* object (usually a member of the *word*'s SUBCAT list) and a semantic object filling a role in the *word*'s CONTENT value is specified in the entry that licenses the *word*.[5] *Role filling* denotes the case where (part of) the semantics of a *synsem* object actually is the value of some role attribute (like RUNNER, KNOWER, SOA-ARG etc.) evaluated on a *psoa* and similar cases (which are explained in detail below). A *synsem* object may fill a role without being assigned it. This is so because the token identity required for role filling might neither be ruled out by the word's lexical entry nor enforced by it. In this case role filling in a word licensed by the entry is possible, but not necessary. In (3), e.g., the subject fills the roles DISMEMBERER and DISMEMBEREE, but is only assigned the role DISMEMBEREE.

  (3) James dismembered himself

  The notion of role filling can and will be explicated precisely on the description level, while role assignment can not.

Any lexical entry that does not explicitly describe some member of the SUBCAT lists of the *word*s it describes as expletive has to assign this SUBCAT list member a semantic role just in case it descibes it also as the subject of some unsaturated complement on the same list. So in any given *word* object *w* any complement that is not assigned a role in the CONTENT value of *w* by the lexical entry that licenses *w* must be the subject of some unsaturated complement of *w*, provided the complement is not explicitly described as expletive in the entry that licenses *w*.

[5]Note that my explication of the meaning of role assignment does not seem to fully agree with the meaning intended in Pollard and Sag (1994). Given my explication, the phrase *(described as) assigned no semantic role* should be replaced by *assigned a semantic role by (or in) E*. But this shift in meaning does no harm here and it is convenient to condense the relevant distinction in two distinct expressions.

Since this structure sharing is not enforced by directly constraining the linguistic objects at issue, but indirectly by requirig the lexical entries to ensure it, it will hold no matter whether the actually shared *synsem* in some *word* the entry licenses is referential or expletive.

Assume (4) to be a partial lexical entry for the verb *seem*.

(4)
$$\left[\begin{array}{l} \textit{word} \\ \textsc{synsem}|\textsc{local} \left[\begin{array}{ll} \textsc{category}|\textsc{subcat} & \left\langle \boxed{1}, \textsc{vp}\left[\textsc{inf}, \textsc{subcat}\left\langle \boxed{1} \right\rangle\right] : \boxed{2} \right\rangle \\ \textsc{content} & \left[\begin{array}{l} \textit{seem} \\ \textsc{soa-arg}\ \boxed{2} \end{array}\right] \end{array}\right] \end{array}\right]$$

The principle then accounts for the following data.

(5) a. It is great to like her
b. He seems to like her
c. It seems to be great to like her
d. There seems to be good reason to like her
e. *There seems to be great to like her

(5a) is licensed since the lexical entry for the relevant form of *be* explicitly requires its subject to be expletive *it*. So the RP does not impose any further constraints on the entry. In constrast to that, the entry of *seem* does not impose any constraints on its subject. As a consequence of that, there are concrete instances of *seem* (i.e. *word* objects) that do have a referential subject (as in (5b)) and others that have an expletive subject (as in (5c), (5d)). Since the subject of *seem* is not assigned any semantic role in the lexical entry, the lexical entry is constrained by the RP to describe it as identical to that of the word's VP complement (i.e. the co-tagging in (4) which is done using the tag $\boxed{1}$ is actually enforced by the principle). This identity must then obtain in all *word* objects the entry licenses, no matter whether the subject is expletive as in (5c), (5d) or referential as in (5b). So the desired effect is achieved and the subject of *seem* also is the subject of the embedded VP. Obviously, (5e) will be ruled ungrammatical since *be great to like her* requires expletive *it* as its subject.

Although most of these considerations seem to be quite clear intuitively, neither the meaning of the RP nor that of meta-level lexical rules has been pinned down formally so far. So in the remainder of this paper I shall investigate whether and at what cost the effects the principle was intended to have in Pollard and Sag (1994) can be achieved by constraints formulated on the description-level.

3 The Description-Level Approach

3.1 Auxilliary Relations

Before introducing and discussing the description-level replacement for the RP that I shall offer, I need to introduce two auxillary relations: `raised-on` and `role-filler`.

3.1.1 Raised-on

The relation `raised-on` is a relation between *synsem* objects and (intuitively, SUBCAT) lists. It obtains between a *synsem* and a *list* object if the *synsem* object is a member of the list and also is the single element of some non-initial (i.e. non-subject) *synsem* element of that list. If for some list there exists a *synsem* object that is raised on the list, I also say that the raising configuration obtains on the list. Formally, the relation is defined as follows;

(6) $\forall s \forall l$
$(\texttt{raised-on}(s, l) \leftrightarrow$

$\exists \boxed{1} \exists \boxed{2}$
$(^{l}[\textsc{rest}\ \boxed{1}] \wedge$
$\texttt{member}(s,\ l) \wedge$
$\texttt{member}(\boxed{2}[\textsc{local}|\textsc{category}|\textsc{subcat}\ \langle s \rangle], \boxed{1})))$

3.1.2 Role-filler

To define the `role-filler` relation, I first need to introduce a new attribute called LEXICAL-SEMANTIC-CONTRIBUTION (LSC). LSC is appropriate to the sort *content* and takes as its value either an object of sort *psoa* or of sort *none*. If present, the psoa which is its value will always be the 'characteristic' psoa of the word, the one that the word adds to the overall meaning of its phrase. For example, in the case of an adjective like *blue*, it will be the *blue*-psoa introduced by the word.[6] The attribute is needed for the treatment of semantically vacuous words, as will become clear later.

The relation `role-filler`, a relation between *synsem* objects, covers three distinct ways in which the CONTENT value of one such object can fill a role in that of the other. These are:

(i) The CONTENT values of both objects are identical.

[6] I assume that the LSC values of head-daughter and mother are always identical. The formulation of a principle to enforce this is of course trivial. The attribute might be independently motivated, cf. e.g. De Kuthy (2000, p. 101).

This covers the base form complement of infinitival *to*, which simply identifies its own CONTENT value with that of its base form complement. It also covers case marking prepositions, which do the same. If identity of CONTENT values were not regarded as an instance of role filling, the base form complement of *to* and the prepositional objects of case marking prepositions would be required to be raised.[7]

(ii) The CONTENT value of the first argument is a *psoa* that is also an element of the CONTENT|RESTR list of the second.

This covers the clausal complement of the null relativiser, the CONTENT value of which appears on the relativisers RESTR list and must not be required to be raised.

(iii) The CONTENT or CONTENT|INDEX value of the first argument is the value of some attribute $\rho \in \mathcal{R}$ evaluated on the LOCAL|CONTENT|LSC|-NUCLEUS value of the second argument, where $\mathcal{R}$ is the set of those and only those attributes that denote functions on *psoas* corresponding to semantic roles (the obvious case).

The formal definition of the relation is given in (7)

(7) $\forall x \forall y$
$(\texttt{role-filler}(x, y) \leftrightarrow$

$\exists \boxed{1}$
$((^{x}\left[\textsc{local|content}\ \begin{bmatrix}\textit{nom-obj}\\ \textsc{index}\ \boxed{1}\end{bmatrix}\right] \vee (\neg \boxed{1}[\textit{nom-obj}] \wedge {}^{x}[\textsc{local|content}\ \boxed{1}])) \wedge$
$({}^{y}[\textsc{local|content}\ \boxed{1}] \vee$
$\exists \boxed{2}({}^{y}[\textsc{local|content|restr}\ \boxed{2}] \wedge \texttt{member}(\boxed{1}[\textit{psoa}], \boxed{2})) \vee$
$\bigvee_{\rho \in \mathcal{R}} {}^{y}[\textsc{local|content|lsc|nucleus}|\rho\ \boxed{1}]))$

3.2 The Principles

In this section I shall investigate the possibilities of gaining the effects that the RP was supposed to have while using only constraints that can be formulated on the description level. I shall start by considering why two naive 'translations' of the meta-principle to the description-level will not work. While one of these appears to be truly inadequate, the other will be kept, but a second principle will be added to it.

The problem that has to be faced when trying to construe an alternative to the RP on the description-level is that description-level constraints can never make ref-

[7] A similar notion on the metalevel is implicitly employed in Pollard and Sag (1994). There, too, (at least) the three cases covered here will have to be considered as instances of *role assignment*.

erence to the way things are described in lexical entries. Hence no formulation corresponding to the phrase *not explicitly described in E as an expletive* as employed in the RP will be available if an alternative to the principle is to be formulated on the description level. This leads to the question how the fact is to be accounted for that raising verbs show identical behaviour in cases where the subject to be raised is expletive and in cases where it is not; that is, why expletive raising is generally possible.

The RP achieves this by constraining lexical entries to specify certain token identities, but descriptions can only constrain linguistic objects to have certain shapes, where in any (by definition totally well-typed and sort-resolved) *word* object, a given complement of the *word* is either expletive or is not. So, if one simply tried to reformulate the principle as closely as possible as a constraint on *word*-objects, the condition *not explicitly described in E as an expletive* could only be (i) dropped or (ii) taken over as *not an expletive*. (The condition *not assigned a semantic role by E* will be translated as *not filling a semantic role*. This treatment will lead to problems discussed in section 3.4.)

(i) Is not an option. It would result in a principle somewhat like (8).

(8) For every *word* object, every *synsem* object on the *word*'s SUBCAT list is raised on that list if it does not fill a role in the *word*'s CONTENT value.[8]

This is of course no viable solution. Since no expletive ever fills a role it would amount to requiring every expletive to be raised. So expletives on the SUBCAT lists of words that are lexically specified to select for expletives would also be required to be raised, which clearly is not a welcome effect. Lexically specified selection is where selection for expletives originates, and it is not hard to see that introducing such a principle would in effect require every sentence containing an expletive to be infinite.

(ii) Would result in something like the principle (9).

(9) The ARGUMENT CONSISTENCY PRINCIPLE (*informal version*)

For every *word* object, every *synsem* object on the *word*'s SUBCAT list that is neither expletive nor does fill a role in the *word*'s CONTENT value is raised on that list.

[8] In the following principles, the *if and only if* formulation present in the RP will be replaced by a unidirectional implication. In the RP, the condition assures that complements can only be described as raised if they are not assigned a role. That means that the lexical entry of a subject or object control verb may not specify this verb's subject or object, respectively, to be identical to that of the VP complement because it assigns it a role. Yet in a given concrete instance of the word, this identity may hold. cf. Pollard and Sag (1994, p. 140, fn. 40), Przepiórkoswki and Rosen (2004). If the biconditional were retained in the description-level analysis, this would exclude this identity in all instances of the word, which is a completely undesired effect.

This principle ensures that the semantics of every non-expletive argument that happens to be on a *word*'s SUBCAT list must either be used in the semantics of this *word* directly or raised from some other complement of the *word*. Following a suggestion by Frank Richter and Janina Radó, I shall henceforth call it the ARGUMENT CONSISTENCY PRINCIPLE (ACP).

This principle alone will not have the desired effect. This is so because, in some sense, nothing is said by it about expletive complements. While referential complements that do not fill roles are required to be raised, expletives are not. This leads to the licensing of such sentences as in (10).

(10) a. *There seems to like her
b. *There seems to be obvious that you like her

(10a) could mean, e.g., *you seem to like her*. Since expletive subjects would not be required to be raised, the VP's subject could correspond to *you* while *seem* could have some expletive (*there*, in this case) as its subject. (10b) is similar; in this case both subjects are expletive, but the expletives are different although they should be the same.

In essence, the question seems to be how to distinguish complements that are lexically specified to be expletive from those that are not. On the meta-level, this can be done by simply looking at the lexical entries. On the description level, it can not.

The analysis offered here attacks the problem from a different angle. Assume that the RP is dropped and the ACP is incorporated into the theory and consider the sentences in (10). Both of them have in common that the subject of the embedded VP is in some way 'lost': it does not get realised by direct combination with the VP according to the head-subject-schema, but neither is it realised anywhere else. Realisation of the subject 'somewhere else' is just what would have happened had the subject been raised. In the sentences in (10), it would have been realised as the subject of the raising verb. In cases with subject-to-object raising as the object.

If the ACP were accompanied by some principle that prevented subjects of embedded VPs to be lost in the manner displayed in (10), and if this principle further required every expletive subject of such a VP to be raised, the problem with the sentences in (10) would be solved. These considerations lead to the formulation of the following principle, which I call the COHERENCE OF VALENCE PRINCIPLE (CVP).[9]

[9]It was pointed out to me by Manfred Sailer (personal communication) that the CVP as stated in this paper may be in conflict with analyses of so-called 'arbitrary' PRO as in (1).

(1) It is easy to like her

In (1), the unrealised subject of the infinitival VP is not realised in any of the ways the CVP requires such subjects to be realised in. However, the question whether this is a fatal problem cannot be answered without any detailed analysis of conditions under which 'arbitrary' PRO can occur. This paper is not the right place to give such an analysis.

(11) THE COHERENCE OF VALENCE PRINCIPLE (*preliminary informal version*)

For every *word* object whose SUBCAT list contains a non-subject complement whose SUBCAT list has the form <X>, one of the following must be the case:

- The LOCAL value of X is a member of the *word*'s SLASH set
- The LOCAL|CONTENT|INDEX value of X is identical to that of another member of the *word's* SUBCAT list
- X is raised on the SUBCAT list of the *word*, which is always the case for expletives

The first of the three bullets is needed to license the output values of the SUBJECT EXTRACTION LEXICAL RULE. The second covers the case of equi verbs, where the unrealised subject of the embedded VP only needs to share its index with that of its controller. The third allows for the realisation of the VP's subject via raising and enforces raising if the subject is expletive.

It is easily seen that by the CVP, the examples in (10) are ruled ungrammatical. In the case of (10a), the embedded VP's subject will be required to share at least its index with some element of the matrix verb's SUBCAT list. Only the matrix verb's subject is available for sharing the index with. But if its index is shared with that of the VP's subject it will neither be expletive nor fill a role and hence be required by (9) to be raised, which is the desired result. In the case of (10b), raising is enforced directly by the CVP, since the subject of the embedded VP is expletive.

3.3 Subject-to-Object Raising

Subject-to-object raising verbs give rise to a further problem. Consider (12).

(12) a. *John believes there to like her
b. John believes himself to like her

The analysis presented so far licenses (12a) with the semantics of (12b). To see this, assume that the subject of the VP *to like Kim* in (12a) has the same index as the *synsem* object corresponding to *John*. Then the sentence complies to the CVP: the unrealised subject of the VP has been realised as required by the CVP by virtue of having the same index as the subject of the matrix verb. Nothing requires the expletive to be raised, since nothing requires its index to be referential, which the CVP does for the subject of (10a), thus ruling this sentence ungrammatical. In (10a), only the subject is available for sharing its index with that of the unrealised subject in accordance with the CVP. In (12a) the index should be required to be shared with the accusative object of the matrix verb. But by the current formulation

For similar reasons, *tough* constructions might be problematic, too.

of the CVP, it may share it with the matrix verb's subject just as well. If this is the case, nothing prevents expletive *there* from occuring as the accusative object, which, as an expletive, is not required to be raised by (9).

It appears possible to solve this problem by requiring unrealised VP subjects to be realised as the most oblique complement of the word selecting for the VP that is still less oblique than the VP itself.[10] In the case of *seem*, this would be the subject, in the case of *believe*, the accusative object. This leads to the revised version of the CVP shown in (13).

(13) THE COHERENCE OF VALENCE PRINCIPLE (*final informal version*)

For every *word* object whose SUBCAT list contains a non-subject complement Y whose SUBCAT list has the form <X>, one of the following must be the case:

- The LOCAL value of X is a member of the *word*'s SLASH set
- The most oblique member of the described *word* object's SUBCAT list that is still less oblique than Y (call it Z) is such that
  - The LOCAL|CONTENT|INDEX value of X is identical to that of Z or
  - X is identical to Z, which is always the case if X is an expletive

3.4 Subject-to-Object Raising and Reflexives

It has already been remarked above that not only the phrase *not explicitly ... as an expletive* but also the notion of *role assignment* cannot be faithfully expressed on the description level. This leads to undesired consequences in the case of subject-to-object raising verbs with reflexive accusative objects: (14a) is possible with the SUBCAT list (14b), where $\boxed{1} \neq \boxed{2}$. That is, the reflexive is not required to be raised as it should.

(14) a. John believes himself to like her

b. $\left\langle \text{NP}_i, \boxed{1}_i\text{:}\textit{reflexive}, \text{VP}\left[\text{SUBCAT } \langle \boxed{2} \rangle\right] \right\rangle$

This is the case because the indices of subject and accusative object are (and must be, by PRINCIPLE I of the BINDING THEORY) identical. So, since the subject fills the role BELIEVER, the object also fills this role. It is not possible to distinguish on the description-level between role filling by lexical assignment and externally enforced role filling, in this case role filling enforced by the BINDING THEORY. To force reflexives like the one in (14a) to be raised, it is inevitable to be able to tell which member of a SUBCAT list it is that fills a certain role; that means it must be impossible for distinct SUBCAT list members to fill the same role.

[10] If the *to*-phrase in sentences like *he seems to me to like her* is to be analysed as a complement of *seem*, this would probably be inconsistent with the present suggestion. I however doubt that an analysis of the *to*-phrase as an complement is mandatory.

To achieve this, I introduce a sort of 'intermediary index' which must be unique for every member of a SUBCAT list. The attribute INDEX, evaluated on an intermediary index, will yield a 'standard' index. It must then be these standard indices that the BINDING THEORY and most other principles talk about, while intermediary indices are only relevant for more exotically flavoured purposes.

To make this proposal precise, I introduce the sort (species) *intind* (for *intermediary index*) as a direct subsort of *object* in the way shown in (15).

(15) *intind*
INDEX *index*

The only attribute appropriate to *intind* is INDEX, and to evaluate it on an object of this sort yields an object of sort *index*. Evaluating INDEX[11] on an object of sort *nom-obj* will now yield an object of sort *intind*. The attributes that represent roles on *psoa*s must now likewise yield objects of sort *intind* when evaluated on such an object.

The benefit of *intind*s is that, while objects of sort *index* can be required to be indentical for different members of the same SUBCAT list by virtue of the (appropriately reformulated) BINDING THEORY, their *intind*s do not have to be indentical. To say more, they may not even be identical, which is enforced by the following constraint.

(16) UNIQUENESS CONDITION on intemediary indices

$$[\textit{category}] \rightarrow$$

$$[\textsc{subcat}\ \boxed{1}] \wedge$$
$$\forall x \forall y$$
$$(\texttt{member}(x,\boxed{1}) \wedge \texttt{member}(y,\boxed{1}) \rightarrow$$
$$(x\textsc{local}|\textsc{content}|\textsc{index} = y\textsc{local}|\textsc{content}|\textsc{index} \rightarrow x = y))$$

The constraint states that for any two members of a SUBCAT list, having the same LOCAL|CONTENT|INDEX value means to be identical.[12]

Since role attributes evaluated on *psoa*s yield *intind*, it is now the case that no two distinct *synsem* objects on the SUBCAT list of any *word* can ever fill the same role in the CONTENT value of this *word*. So in the case of (14), although the 'standard' indices of subject and accusative object, which are embedded in the *intind*s under the attribute INDEX, are identical, the *intinds* are not. Hence the subject fills the role BELIEVER, but the reflexive object does not and will be required to be raised.

[11] Which could now be renamed INTIND, but it need not.

[12] Note that still the same *synsem* object could occur twice on the same list. If necessary, this possibility might be ruled out by a further constraint, requiring that any *synsem* object occur at most once on any SUBCAT list.

3.5 Formal Statement of the Principles

The ARGUMENT CONSISTENCY PRINCIPLE as well as the COHERENCE OF VALENCE PRINCIPLE can be stated formally in (the AVM notation for) RSRL. To do this is the sole purpose of this section.

(17) The ARGUMENT CONSISTENCY PRINCIPLE (*formal version*)

$$
\begin{array}{l}
[\textit{word}] \rightarrow \\
\\
\left(\left[\textsc{synsem}\ \boxed{1}\left[\textsc{local|category|subcat}\ \boxed{2}\right]\right] \wedge \right. \\
\\
\forall x \\
(\texttt{member}(x, \boxed{2}) \rightarrow \\
((\neg\texttt{role-filler}(x, \boxed{1}) \ \wedge \neg^{x}[\textsc{local|content|index|index}\ \textit{expletive}] \rightarrow \\
\texttt{raised-on}(x, \boxed{2})))))
\end{array}
$$

The principle says that for every object on a *word* object's SUBCAT list, if it does not fill a role and is not expletive, then it is raised on the SUBCAT list.

(18) The COHERENCE OF VALENCE PRINCIPLE (formal version)

$$
\begin{array}{l}
[\textit{word}] \rightarrow \\
\\
\left(\left[\textsc{synsem}\ \left[\begin{array}{ll}\textsc{local|category|subcat} & \boxed{1}\left[\textsc{rest}\ \boxed{2}\right] \\ \textsc{nonloc|slash} & \boxed{3}\end{array}\right]\right] \wedge \right. \\
\\
\forall x \forall y \\
(\texttt{member}(^{y}\left[\textsc{local|category|subcat}\ \left\langle ^{x}\left[\textsc{local}\ \boxed{4}\right]\right\rangle\right], \boxed{2}) \ \rightarrow \\
\\
\texttt{member}(\boxed{4}, \boxed{3}) \vee \\
\exists\boxed{6} \\
(\texttt{to-the-left}(\boxed{6}, y, \boxed{1}) \ \wedge \\
\forall z(\texttt{to-the-left}(z, y, \boxed{1}) \ \wedge z \neq \boxed{6} \rightarrow \texttt{to-the-right}(\boxed{6}, z, \boxed{1})) \wedge \\
(x = \boxed{6} \vee \\
(^{x}[\textsc{local|content|index|index}\ \boxed{5}] \wedge \boxed{6}[\textsc{local|content|index|index}\ \boxed{5}])) \wedge \\
(^{x}[\textsc{local|content|index|index}\ \textit{expletive}] \rightarrow x = \boxed{6}))))
\end{array}
$$

The relation `to-the-right`, defined in Richter (2004, ch. 4.2), holds of its argument triple if the last argument is a list and the first argument occurs to the right of the second argument on that list. The relation `to-the-left` is defined with respect to the relation `to-the-right`.

(19) The relation `to-the-left`

$$\forall x \forall y \forall z \\ (\texttt{to-the-left}(x, y, z) \leftrightarrow \neg\texttt{to-the-right}(x, y, z) \wedge x \neq y)$$

An object x is to the left of an object y on a list z iff x is not to the right of and not identical with y.

The principle requires that for any *word* object whose SUBCAT list contains an unsaturated complement, this complement's subject's LOCAL value must either be in the described *word*'s SLASH set, or there is some element on the described *word*'s SUBCAT list that is the most oblique complement of the word that is still less oblique than the unsaturated complement.[13] With this object, then, the unsaturated complement's subject is either identical or index-shared.

4 Interaction with Description-Level Lexical Rules

The RP was not only used in Pollard and Sag (1994) to constrain the content of basic lexical entries, but likewise to constrain the content of output values of lexical rules. This made sense intuitively, since lexical rules were conceived of as rules generating new lexical entries from existing ones. With the RP understood as constraining all lexical entries, the output values of lexical rules had to be constrained as well.

Since no satisfactory formalisation of the meta-level rules employed in Pollard and Sag (1994) has yet been established, the description-level formalisation given by Meurers (2001) seems the only possibility so far to have a formal account of lexical rules at all. But if description-level lexical rules are employed, lexical rules are understood as descriptions of *lex-rule* objects. An application of a rule can be understood as an object licensed by the rule. Input to and output of an application of a rule are represented as components of the corresponding *lex-rule* object, that is, as *word* objects that can be reached from the *lex-rule* object via the attributes IN and OUT, respectively. It is a crucial aspect of this formalisation that no new lexical entries for the rules' outputs are generated at all. Hence the RP, even if it were precisely formalised, could never constrain the outputs of these rules.

From this it follows that, even if the RP as a meta-level statement were to be retained and a satisfactory formalisation of it were given, then either lexical rule outputs could no more be constrained by it or finding a satisfactory formalisation of meta-level lexical rules would again be an issue. In this section, I assume that description-level lexical rules are used and investigate how much of the predictions made about the output values of lexical rules using the RP in Pollard and Sag (1994) can be reconstructed employing these rules and the principles introduced above. Only two such arguments about output values of lexical rules are know to me, both stemming from Pollard and Sag (1994). I consider both of them in turn.

4.1 The Null Relativiser

The most explicitly formulated and also most interesting argument known to me in which the RP is employed in to reason about output values of a lexical rule

[13] Recall that the order on SUBCAT lists reflects the obliqueness hierarchy.

concerns the SUBJECT EXTRACTION LEXICAL RULE (SELR) output for the null relativiser. In this section, I briefly summarise the central aspects of the relativiser and the lexical rule and review this argument. I then show that the structure sharing that the RP should have guaranteed in the objects licensed by the rule's output for the relativiser is also enforced by the new principles in the output values of a corresponding description-level rule. Thus the effects the RP was intended to have are preserved.

A null relativiser is employed in the treatment of relative clauses suggested in Pollard and Sag (1994). Given this phonetically empty word, the relative clause (20a) will have the structure shown in (20), with the relativiser represented as **e**.

(20) a. <man> to whom you gave your pocket
b. <man> [to whom [**e** [you gave your pocket]]].

The lexical entry for **e** requires the LOCAL value of the relative phrase to be a member of the SLASH set of the clause which the relativiser takes as its complement. The relativiser binds this SLASH set member. Furthermore it requires the relativiser to select for a subject[14] with just the LOCAL value of the relative phrase. Together with the identification of the index which is described by the entry as the single member of the subject's INHER|REL set with the relativiser's CONTENT|INDEX value and the INDEX of the modified N', (20a) is licensed with the syntax indicated in (20b) and appropriate semantics.

It is for the analysis of sentences like (21a) that the SUBJECT EXTRACTION LEXICAL RULE (SELR) comes into play. The desired analysis of this sentence is shown in (21).

(21) a. <man> who gave his pocket to you
b. <man> [who [**e** [gave his pocket to you]]]

Without the SELR, an analysis as indicated in (21b) would be blocked by the TRACE PRINCIPLE for English, which forbids the extraction of subjects to rule sentences like (22) ungrammatical.

(22) *Who did Bob tell you that will visit us?

Yet the extraction of subjects seems possible in cases like (24), where the subject of the embedded clause *who will visit us* is fronted.

(23) Who did Bob tell you will visit us?

Pollard and Sag (1994) account for these sentences by introducing the SELR as shown in (24).

[14]Recall that in the theory presupposed here, *subject of x* simply means *initial member of the SUBCAT list of x.*

(24) $\left[\text{SS|LOC|CAT|SUBCAT}\ \left\langle \text{Y, ... , S}\left[\textit{unmarked}\right], \ldots \right\rangle\right] \mapsto$

$$\left[\text{SS}\ \left[\begin{array}{l}\text{LOC|CAT|SUBCAT}\quad \left\langle \text{Y, ... , VP}\left[\text{SS}\ \left[\begin{array}{l}\text{LOC|CAT|SC}\quad \left\langle\left[\text{LOC}\ \boxed{1}\right]\right\rangle \\ \text{NONLOC|INH|SL}\ \{\}\end{array}\right]\right], \ldots \right\rangle \\ \text{NONLOC|INHER|SLASH}\ \{\boxed{1}\}\end{array}\right]\right]$$

This lexical rule guarantees that for each word that subcategorises for an unmarked non-subject sentential complement there is another word, subcategorising for a VP instead of the sentence and having the LOCAL value of this VP's subject as the single member of its INHER|SLASH set.[15] (23) is then explained as resulting from an application of the SELR to *tell*. It is thus analysed as a HEAD-FILLER-CONSTRUCTION with *did Bob tell you will visit us* as the head and *Who* as the filler.

The SELR is employed to derive the null relativiser for (21) from that employed in (20), and here it is that the RP comes into play. Consider (25a).[16] This description of a *synsem* object fits the input schema of the SELR and so can serve as a part of its input (assuming for the moment meta-level lexical rules), yielding an output about as shown in (25b), if the effects of the RP are ignored.

(25) a.
$$\left[\begin{array}{l}\text{LC}\quad \left[\text{CAT}\ \left[\begin{array}{l}\text{HD}\quad \left[\begin{array}{l}\textit{rltvzr} \\ \text{MOD N'}\left[\text{NL|TO-BIND|REL}\ \{\boxed{1}\}\right]\text{:}\left[\begin{array}{l}\text{INDEX}\ \boxed{1} \\ \text{RESTR}\ \boxed{2}\end{array}\right]\end{array}\right] \\ \text{SC}\quad \left\langle \begin{array}{l}\left[\begin{array}{ll}\text{LC} & \boxed{3} \\ \text{NL|INHER|REL} & \boxed{1}\end{array}\right], \\ \text{S}\left[\text{INHER|SL}\ \{\boxed{3}\}, \textit{fin}, \textit{unmarked}\right]\text{:}\boxed{4}\end{array}\right\rangle \\ \text{CNT}\quad \left[\begin{array}{l}\textit{npro} \\ \text{INDEX}\ \boxed{1} \\ \text{RESTR}\ \{\boxed{4}\}\cup\boxed{2}\end{array}\right]\end{array}\right]\right] \\ \text{NL|T-B|SL}\ \{\boxed{3}\}\end{array}\right]$$

b.
$$\left[\begin{array}{l}\text{LC}\quad \left[\text{CAT}\ \left[\begin{array}{l}\text{HD}\quad \left[\begin{array}{l}\textit{rltvzr} \\ \text{MOD N'}\left[\text{NL|TO-BIND|REL}\ \{\boxed{1}\}\right]\text{:}\left[\begin{array}{l}\text{INDEX}\ \boxed{1} \\ \text{RESTR}\ \boxed{2}\end{array}\right]\end{array}\right] \\ \text{SC}\quad \left\langle \boxed{5}\left[\text{INHER|REL}\ \boxed{1}\right], \text{VP}\left[\begin{array}{ll}\text{SC} & \left\langle \boxed{6}\left[\text{LC}\ \boxed{7}\right]\right\rangle, \textit{fin} \\ \text{INHER|SLASH} & \{\}\end{array}\right]\text{:}\boxed{4}\right\rangle \\ \text{CNT}\quad \left[\begin{array}{l}\textit{npro} \\ \text{INDEX}\ \boxed{1} \\ \text{RESTR}\ \{\boxed{4}\}\cup\boxed{2}\end{array}\right]\end{array}\right]\right] \\ \text{NL}\ \left[\begin{array}{ll}\text{INHER|SL} & \{\boxed{7}\} \\ \text{T-B|SL} & \{\boxed{3}\}\end{array}\right]\end{array}\right]$$

[15] Note that this is the first case considered in the CVP.

[16] I need to abbreviate some of the attribute names to make the AVM fit the page. I also sometimes abbreviate paths by leaving attributes out where this should not lead to any confusion.

Pollard and Sag (1994) now argue that, to comply with the RP, (25b) in addition needs to specify that [5] = [6], which should also imply [3] = [7].

The argument runs as follows.

> To see this, consider the following facts: (1) the SELR input specifies structure sharing between the $\mathrm{TO-BIND|SLASH}$ value and the first complement's LOCAL value; (2) SELR specifies stucture sharing between the output's $\mathrm{INHER|SLASH}$ value and the LOCAL value of its VP complement's SUBCAT value; and (3) the Raising Principle requires that there be structure sharing between the LOCAL value of the VP complement's SUBCAT value and the LOCAL value of the first complement. (In identifying *synsem* objects, the Raising Principle of course identifies the LOCAL values within the *synsem* objects.)
>
> Pollard and Sag (1994, p. 219, fn. 4)

The central point is of course (3): because the subject is not assigned a role by the entry in (25a), it must be raised.[17] It can only be raised from the VP complement, so must be raised from there.[18] So, according to this argument, the subject of the null relativiser in (25b) and the subject of its VP complement must be the same. This does not and may not result from the SELR itself; the form of *tell* occuring in (23) must be licensed by the output of SELR. There, *Bob* is the subject of tell, but the extracted subject corresponds to *who*, So they clearly cannot be identical. Differently, in (21b), where the subject has been extracted from the verbal complement of the relativiser, identity of the relativiser's subject to that of the VP is crucial, as shown in (26).

(26) a. <man> *who$_i$ **e** _$_j$ gave his pocket to you
b. <man> who$_i$ **e** _$_i$ gave his pocket to you

Clearly, (26a) does not make any sense (given, of course, $i \neq j$), so (26b) must be enforced. This is done by the RP.

The ACP will have similar effects. If description-level lexical rules are employed, the descriptions in (25) must be seen as descriptions of the INPUT value

[17] Note that it is necessary to consider it as an instance of *role assignment* when the CONTENT value is described in a lexical entry as a member of the described *word* object's $\mathrm{CONTENT|RESTR}$ list. Otherwise the second complement of each relativiser would not be assigned a role and hence required to be described as raised by the RP. This fact is reflected in the second clause of the definition of *role filling*, given above.

[18] As was already noted in Pollard and Sag (1994, p. 216, fn. 3), this argument applies to the rule's input as well, but since the verbal complement there is a saturated sentence, the subject cannot be raised. So (25a) actually cannot license anything at all. The analysis presented here suffers from the same problem. I assume that some modification of the ACP along the lines indicated in Pollard and Sag (1994) is in order. This would amount to requiring any non-expletive non-role-filler to be either raised or 'SLASH raised', i.e. have its LOCAL value on the SLASH set of another member of the SUBCAT list it is on, rather than be on the complement's SUBCAT list itself.

and OUTPUT value of some *lex-rule* object. All co-taggings indicate structure sharing as in any other description.[19] Both described objects must of course obey all constraints on *word* objects. Since the relativiser does not contribute any semantics of its own, it has no characteristic *psoa*. So its CONTENT|LSC value is *none*. Hence none of its complements can be a role filler according to the last clause of the definition of *role filling*. The VP complement is a role filler according to the second clause of the definition, but the subject is not. So the last possibility for the relativiser's subject to fill a role would be identity of its CONTENT value to that of the relativiser, according to clause (i) of the definition. This is not possible either.[20]

4.2 Null Complement Anaphora

Null complement anaphora is a complement drop phenomenon; the *to*-infinitival complement of a raising verb can be dropped if it can be inferred from the context. But this is only possible with equi verbs, not with raising verbs.[21] The contrast is exemplified in (27).

(27) a. John tries to understand this article and Janet also tries
b. *John seems to understand this article and Janet also seems

Pollard and Sag (1994, p. 141) assume that NCA is "a lexical process that removes an infinitival complement [...] from the SUBCAT list of verbs or adjectives". They offer no detailed analysis and also remain silent about the exact nature of this lexical process, but it seems safe to assume that an analysis based on lexical rules was intended. Such a rule might look like the one given in (28).

(28) $$\left[\text{SS|LOC|CAT}\left[\begin{array}{ll}\text{HEAD} & \textit{verb} \vee \textit{adj} \\ \text{SUBCAT} & \boxed{1}\left\langle \text{NP}_{\boxed{2}_{ref}} | \textit{list} \right\rangle \oplus \left\langle \text{VP}\left[\text{SUBCAT}\ \left\langle \text{NP}_{\boxed{2}} \right\rangle, \textit{inf}\right] \right\rangle\end{array}\right]\right] \mapsto$$
$$\left[\text{SS|LOC|CAT|SUBCAT}\ \boxed{1}\right]$$

The rule takes as input a lexical entry describing verbs and adjectives subcategorising for an infinitival complement, this being the last element on their SUBCAT list, and returns a lexical entry where this element has been removed from the list. Considering the application of that rule to the lexical entry of *seem*, the relevant parts of which are given in (29a), the result would be the entry in (29b)

[19] In the meta-level approach they were usually ambiguous between identity of object and identity of description.

[20] If cases exist in which this identity can hold, these cases are pathological. Their existence could hence not be used to criticise the present theory but only to criticise itself.

[21] It should be noted that the arguments made here about NCA cannot be generalised so as to explain also the phenomenon of VP deletion as in *She can do it and Jack also can* or *She wants to go and Jack also wants to*, as noted by Pollard and Sag (1994, p. 142, fn. 43). I shall not further concern myself with this problem.

(29) a.
$$\left[\begin{array}{l}\textsc{ss|loc}\ \left[\begin{array}{ll}\textsc{cat} & \left[\begin{array}{ll}\textsc{head} & \textit{verb}\\ \textsc{subcat} & \left\langle \boxed{1}\textsc{np}[\textit{nom}],\ \textsc{vp}[\textsc{subcat}\ \boxed{1},\ \textit{inf}]{:}\boxed{2}\right\rangle\end{array}\right]\\ \textsc{cont} & \left[\begin{array}{l}\textit{seem}\\ \textsc{psoa-arg}\ \boxed{2}\end{array}\right]\end{array}\right]\end{array}\right]$$

b.
$$\left[\begin{array}{l}\textsc{ss|loc}\ \left[\begin{array}{ll}\textsc{cat} & \left[\begin{array}{ll}\textsc{head} & \textit{verb}\\ \textsc{subcat} & \left\langle \boxed{1}\textsc{np}[\textit{nom}]\right\rangle\end{array}\right]\\ \textsc{cont} & \left[\begin{array}{l}\textit{seem}\\ \textsc{psoa-arg}\ \boxed{2}\end{array}\right]\end{array}\right]\end{array}\right]$$

But (29b) clearly violates the raising principle: The subject is not assigned a semantic role in the content, so it should be raised, which it is not and cannot be. Thus the RP rules out (29b) as a possible lexical entry and therewith (27b). Furthermore, as desired, equi verbs can undergo NCA, the relevant lexical entries for the example *try* being shown in (30).

(30) a.
$$\left[\begin{array}{l}\textsc{ss|loc}\ \left[\begin{array}{ll}\textsc{cat} & \left[\begin{array}{ll}\textsc{head} & \textit{verb}\\ \textsc{subcat} & \left\langle \textsc{np}[\textit{nom}]_{\boxed{1}},\ \textsc{vp}\left[\textsc{subcat}\ \left\langle \textsc{np}_{\boxed{1}}\right\rangle,\ \textit{inf}\right]{:}\boxed{2}\right\rangle\end{array}\right]\\ \textsc{cont} & \left[\begin{array}{ll}\textit{try}\\ \textsc{tryer} & \boxed{1}\\ \textsc{psoa-arg} & \boxed{2}\end{array}\right]\end{array}\right]\end{array}\right]$$

b.
$$\left[\begin{array}{l}\textsc{ss|loc}\ \left[\begin{array}{ll}\textsc{cat} & \left[\begin{array}{ll}\textsc{head} & \textit{verb}\\ \textsc{subcat} & \left\langle \textsc{np}[\textit{nom}]_{\boxed{1}}\right\rangle\end{array}\right]\\ \textsc{cont} & \left[\begin{array}{ll}\textit{try}\\ \textsc{tryer} & \boxed{1}\\ \textsc{psoa-arg} & \boxed{2}\end{array}\right]\end{array}\right]\end{array}\right]$$

Here, in the resulting lexical entry, the subject is assigned a semantic role; its index appears as an argument of the *try*-relation in the TRYER slot. So the RP is not violated and (27a) will be licensed.

It is not hard to see that the ACP makes the same predictions. The input object can be a raising verb as much as an equi verb. In the case of a raising verb, not only the indices of the input's subject and that of the verbal complement would be identical, but rather the *synsem* objects as a whole would be structure shared. But so, trivially, would then be the index. The index of the subject is specified as referential.[22] Thus it is non-expletive and, in the case of raising verbs, also a non-role-filler. So, by the ACP, the *synsem* object that bears this index (here, the subject) would have to be on the SUBCAT list of some further element on the SUBCAT list of the output. Since there is no other such element on the rest of list $\boxed{1}$ (as it is tagged in the lexical rule), the output does not satisfy the raising principle

[22] If this were not the case, the rule would license sentences like *There/it seem(s)* for expletive *there*/*it*: Since the rule removes the VP complement, there would be nothing left that the CVP could require to be token-identical or index-shared with the subject, and since the subject is expletive, the ACP would not have to say anything either. So the sentence would be licensed.

and hence is not licensed. As desired, the output of the rule is licensed for equi verbs like *try*. In their CONTENT values, the subject's index fills a role, so the VP complement may be missing.

4.3 Conclusions

I have shown the informal meta-level RAISING PRINCIPLE of Pollard and Sag (1994) to be replaceable by a fully formalised description-level alternative while preserving the positively intended effects of the original RP. Having a precise account of the enforcement of the raising configuration and likewise the possibility to employ it when reasoning about the output values of description-level lexical rules might make more detailed discussions, analyses of generalisations about raising phenomena in the framework of HPSG possible.

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