

## Chapter 1

# Relative Clauses in HPSG

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Some over-full boxes  
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## 1 Introduction

The goal of this paper is to give an overview of HPSG analyses of relative clauses – that is, typically, sentential constructions that function as nominal modifiers (as in (1), for example). The basic organisation of the discussion is as follows. Section 2 introduces basic ideas and overviews the analytic techniques that have been used, focusing on one kind of relative clause. Section 3 looks at other kinds of relative clause in a variety of languages. Section 4 looks at other constructions that are in some way ‘untypical’ (e.g. clauses that resemble relative clauses, but which are not nominal modifiers, or which are not adjoined to the nominals they modify).

## 2 Basic Ideas and Approaches

This section introduces basic ideas and intuitions about relative clauses, viewed from an HPSG perspective (Section 2.1), then introduces the two main approaches that have been taken in HPSG: the lexical approach of Pollard & Sag (1994) which makes use of phonologically empty elements (Section 2.2), and the constructional approach of Sag (1997), which makes phonologically empty elements unnecessary (Section 2.3).

### 2.1 Basic Ideas and Intuitions

Relative Clauses are, prototypically, sentential constructions which modify a nominal. (1a) is an example of one kind of English relative clause, which we will call a ‘*wh*-relative’. In (1b) it is used as a modifier of the nominal *person* (the ‘antecedent’ of the relative clause).

- (1) a. to whom Kim spoke yesterday
- b. The person to whom Kim spoke yesterday claimed to know nothing.

Syntactically, this kind of relative clause consists of a preposed *wh*-phrase (*to whom*), i.e. a phrase containing a relative pronoun (*whom*), and a clause with a missing constituent – a gap (the complement of *speak*: *Kim spoke — yesterday*). This is often called the ‘relativised constituent’. The preposed *wh*-phrase is understood as filling the gap. Semantically, the interpretation of (1a) in (1b) is *intersective*: (1b) denotes the intersection of the set of people and the set of entities that Kim spoke to. Getting this interpretation involves combining the descriptive content of the nominal and the propositional content of the relative clause,

and equating the referential indices of the nominal and the relative pronoun, to produce something along the lines of ‘the set of  $x$  where  $x$  is a person and Kim spoke to  $x$ ’.

Not all relative clauses have these properties, but they provide a good starting point.

In broad terms, we can account for these properties as follows. As regards their function and distribution, relative clauses are subordinate clauses, which can be captured by assuming they have a HEAD feature like MC–, ‘MAIN-CLAUSE minus’. They are naturally assumed to be adjuncts: their distribution as post-nominal adjuncts can be dealt with by assuming that (like other adjuncts) they indicate the sort of head they can modify via a feature like MOD or SELECT (cf ChXXX on the treatment of adjuncts). That is, whereas normal clauses are specified as (2), relative clauses such as (1a) will be specified as in (3).

$$(2) \quad \left[ \text{SYNSEM} \mid \text{LOC} \mid \text{CAT} \mid \text{HEAD} \mid \text{MOD } \textit{none} \right]$$

$$(3) \quad \left[ \text{SYNSEM} \mid \text{LOC} \mid \text{CAT} \mid \text{HEAD} \mid \text{MOD} \left[ \text{LOC} \left[ \text{CAT} \left[ \text{HEAD } \textit{noun} \right] \right] \right] \right]$$

### 2.1.1 The Internal Structure of the Relative Clause

As regards internal structure, it is characteristic of *wh*-relatives that they contain a *wh*-phrase, which must be preposed – English does not allow examples like (4a) without a relative phrase, or (4b) where the relative phrase is *in situ*.

- (4) a. \*a person Kim spoke to her yesterday  
 b. \*a person Kim spoke to whom yesterday

Examples like (5) demonstrate that the dependency between the surface position of the preposed *wh*-phrase and its ‘understood’ position is unbounded. In fact, it appears to be a typical filler-gap dependency, which can be handled by standard SLASH percolation techniques (see ChXXX). That is, *wh*-relatives like (1a) are head-filler structures, where the *wh*-phrase is the filler.

- (5) the person to whom [ Sam said [ Kim intended [ to speak — yesterday]]]

In examples like (1a) the *wh*-phrase must contain a relative pronoun. Here we have another unbounded dependency, because the relative pronoun can be embedded arbitrarily deeply inside the *wh*-phrase. This dependency between a relative pronoun and the phrase that contains it is generally called ‘*wh*-percolation’, ‘relative percolation’ or, following Ross (1967), ‘pied-piping’:

- (6) a. the person [to [whose friends]] Kim spoke —
- b. the person [to [[whose children's] friends]] Kim spoke —
- c. the person [to [the children [of [whose friends]]]] Kim spoke —
- d. books [the height [of [the letters [on [the covers [of which ]]]]] the government regulates —

Notice that as well as being unbounded, 'relative percolation' resembles 'SLASH percolation' in that the 'bottom' of the percolation path (i.e. the actual relative pronoun, or the gap in a filler-gap a dependency) is typically not a head (e.g. *whom* is not the head of *to whom*). Moreover, though examples involving multiple independent relative pronouns are rather rare in English (i.e. there are few, if any, relative clauses parallel to interrogatives like *Who gave what to whom?*) they exist in other languages, so there is some motivation for assuming that relative percolation involves a set of some kind. This motivates the introduction of a REL feature which is subject to the same kind of formal mechanisms as SLASH.<sup>1</sup>

The idea is that a relative pronoun will register its presence by introducing a non-empty REL value, which will percolate upwards until it is discharged on the *wh*-phrase at the top of relative clause (equivalently: a relative clause introduces a non-empty REL value that will percolate downwards till it is realised as a relative pronoun). As with SLASH percolation, some method is needed for preventing a non-empty REL value from percolating higher than the *wh*-phrase where it is discharged. To see this, notice that while relative percolation from a relative pronoun to a containing PP is fine, it should not continue to higher VPs or Ss:<sup>2</sup>

- (7) a. the person [<sub>NP</sub> who] we want Kim to speak to —
- b. the person [<sub>PP</sub> to whom] we want Kim to speak —
- c. \*the person [<sub>VP</sub> speak to whom] we want Kim to —
- d. \*the person [<sub>VP</sub> to speak to whom] we want Kim —

---

<sup>1</sup> The assumption that pied-piping should be treated as involving an unbounded dependency, handled with a NON-LOCAL feature, has been challenged in Van Eynde (2004) (Van Eynde argues it should be treated as local dependency). Examples of languages which allow multiple relative pronouns include Hindi (e.g. Srivastav 1991) and Marathi (e.g. Dhongde & Wali 2009: Ch7). See Pollard & Sag (1994: 228ff) for HPSG analyses. In English, multiple relative pronouns occur in cases of co-ordination (e.g. *the person with whom or for whom you work*), but they are not independent (they relate to the same entity). Kayne (2017) gives some English examples that appear to involve multiple relative pronouns, but they are rather marginal.

<sup>2</sup> This is a simplification: English allows VPs like that in (7d) so long as they are function as subjects, so *person to speak to whom is a privilege* is allowed. German allows REL percolation to VP more freely than English, and analogue of (7d) is grammatical in German. see Hinrichs & Nakazawa (1999) and De Kuthy (1999) for discussion and HPSG analyses.

- e. \*the person [<sub>S</sub> Kim to speak to whom] we want —

Co-indexation of the antecedent nominal and the relative pronoun can be achieved simply if the REL value contains an index which is shared by both the antecedent and the relative pronoun. As regards the relative pronoun, at the ‘bottom’ of the REL dependency, this can be a matter of lexical stipulation: relative pronouns can be lexically specified as having a REL value that contains their INDEX value, roughly as in (8a), which we abbreviate to (8b). This index can then be percolated upwards via the REL value to the level of the *wh*-phrase. At the top, the index of the antecedent can be accessed via the MOD value of the relative clause: this is simply a matter of replacing (3) with (9), where  $\boxed{1}$  is the index that appears in the REL value of the *wh*-phrase.<sup>3</sup>

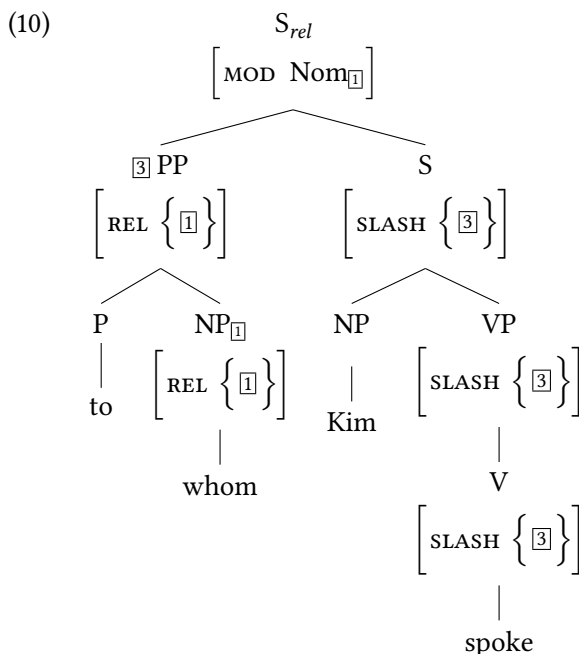
$$\begin{array}{ll}
 (8) & \text{a. } \left[ \begin{array}{c} \text{SYNSEM} \\ \text{LOC} \left[ \begin{array}{c} \text{CAT} \left[ \begin{array}{c} \text{HEAD} \text{ noun} \end{array} \right] \\ \text{CONT} \left[ \begin{array}{c} \text{INDEX } \boxed{1} \end{array} \right] \end{array} \right] \\ \text{REL} \left\{ \left[ \boxed{1} \right] \right\} \end{array} \right] \\
 & \text{b. } \begin{array}{c} \text{Nom}_{\boxed{1}} \\ \left[ \text{REL} \left\{ \left[ \boxed{1} \right] \right\} \right] \end{array} \\
 (9) & \left[ \text{SYNSEM} \mid \text{LOC} \mid \text{CAT} \mid \text{HEAD} \mid \text{MOD} \left[ \text{LOC} \left[ \begin{array}{c} \text{CAT} \left[ \begin{array}{c} \text{HEAD} \text{ noun} \end{array} \right] \\ \text{CONT} \left[ \begin{array}{c} \text{INDEX } \boxed{1} \end{array} \right] \end{array} \right] \right] \right] \right]
 \end{array}$$

Schematically, then, *wh*-relatives should have structures along the lines of (10).<sup>4</sup> The root structure here is a head-filler structure. Notice how SLASH inheritance percolates the relevant properties of the PP downwards so that it can satisfy the subcategorization requirements of the verb and can be interpreted

<sup>3</sup> We assume, for simplicity, that the value of REL is a set of indices. This is consistent with e.g. Pollard & Sag (1994) and Sag (1997), but not with Ginzburg & Sag (2001: 188), who assume it is a set of *parameters*, that is, indices with restrictions (a kind of *scope-object*), like the QUE attribute which is used for *wh*-percolation in interrogatives. It is not clear that anything important hangs on this.

<sup>4</sup> Here, and below, we will abbreviate attribute paths where no confusion arises, and use a number of other standard abbreviations, in particular, we write INDEX values as subscripts on nouns and NPs. We use Nom to indicate a noun with an empty COMPS list, i.e. one which has combined with its complements, if any. In X-bar terms this is an  $\bar{N}$ .

as a complement of the verb (equivalently: passes the gap caused by the missing complement of *speak* upwards so it can be filled by the PP). Similarly, REL inheritance passes the INDEX of the relative pronoun upwards so that it can be identified with the INDEX of the antecedent noun, via the MOD value of the highest S (equivalently: passes the index of the modified nominal downwards to the relative pronoun, so they are co-indexed).<sup>5</sup>



As regards the CONTENT, the effect of this will be to give the relative clause *to whom<sub>i</sub> Kim spoke* an interpretation along the lines of *Kim spoke to whom<sub>i</sub>*, where

<sup>5</sup> We have nothing to say here about the important but poorly understood restrictions on REL percolation (i.e. pied-piping in relative clauses), but it is worth noting that the restrictions are different from the restrictions on QUE percolation (i.e. pied-piping in interrogatives). For example, QUE-percolation is not possible from the complement of a noun, but REL percolation is fine, so *some pictures of whom* is not possible as the focus of a question, but is fine as the initial phrase of a relative clause:

- (i) \*I wonder [some pictures of whom] they were admiring.
- (ii) the children [some pictures of whom] they were admiring

REL and QUE also differ in other ways: e.g. as Sag (2010) emphasises, there are *wh*-words that can function as interrogative pronouns, but not as relative pronouns (i.e. which have non-empty QUE values, but empty REL values), and *vice versa*.

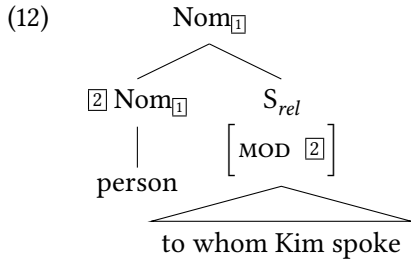


$i$  is the index of the nominal it modifies. In terms of standard HPSG semantics, this ‘internal’ content (i.e. the content associated with a verbal head with its complements and modifiers) is a *state-of-affairs* (*soa*), and can be represented as in (11a), abbreviated to (11b):

- (11) a. 
$$\left[ \begin{array}{c} soa \\ \text{NUC} \left[ \begin{array}{cc} speak\_to & \\ \text{SPEAKER} & Kim \\ \text{ADDRESSEE} & [1] \end{array} \right] \end{array} \right]$$
- b.  $speak\_to(Kim, [1])$

### 2.1.2 The Relative Clause and its Antecedent

Turning now to the way relative clauses combine with the nominals they modify: this will involve a head-adjunct structure, as in (12), where the nominal is the head and the relative clause is the adjunct.



The content we want for a modified nominal such as *person to whom Kim spoke*, as for an unmodified nominal such as *person*, is a ‘restricted index’, i.e. in HPSG terms a *scope-object* — an INDEX and a RESTRICTION set (a set of objects of type *fact*). For *person*, this is as in (13), abbreviated as in (14), for *person to whom Kim spoke* it is as in (15), abbreviated as in (16).<sup>6</sup>

<sup>6</sup> See Sag (2010: 221ff) for a more conventional predicate-logic based semantics for relative clauses. In Pollard & Sag (1994), *scope-objects* were called *nom-objects*, and restrictions were sets of ‘parameterized states of affairs’ (*psoas*), rather than *facts*. The difference reflects the more comprehensive semantics of Ginzburg & Sag (2001), which involves different kinds of *message* (e.g. *proposition*, *outcome*, and *question*, as well as *fact*). **For our purposes, this is just a minor change in feature geometry: facts contain Pollard & Sag style ‘state of affairs’ content as the value of the PROP | SOA path, as can be seen in (13).**

$$(13) \left[ \begin{array}{l} \text{scope-obj} \\ \text{INDEX } \boxed{1} \\ \\ \text{RESTR } \boxed{2} \left\{ \begin{array}{l} \left[ \begin{array}{l} \text{fact} \end{array} \right] \\ \text{PROP} \mid \text{SOA} \left[ \begin{array}{l} \text{soa} \\ \text{NUC} \left[ \begin{array}{l} \text{person} \\ \text{INSTANCE } \boxed{1} \end{array} \right] \end{array} \right] \end{array} \right\} \end{array} \right]$$

$$(14) \boxed{1} : \{ \text{person}(\boxed{1}) \}$$

$$(15) \left[ \begin{array}{l} \text{scope-obj} \\ \text{INDEX } \boxed{1} \\ \\ \text{RESTR } \boxed{2} \left\{ \begin{array}{l} \left[ \begin{array}{l} \text{fact} \\ \text{PROP} \mid \text{SOA} \left[ \begin{array}{l} \text{soa} \\ \text{NUC} \left[ \begin{array}{l} \text{person} \\ \text{INSTANCE } \boxed{1} \end{array} \right] \end{array} \right] \end{array} \right], \\ \left[ \begin{array}{l} \text{fact} \\ \text{PROP} \mid \text{SOA} \left[ \begin{array}{l} \text{soa} \\ \text{NUC} \left[ \begin{array}{l} \text{speak\_to} \\ \text{SPEAKER } \text{Kim} \\ \text{ADDRESSEE } \boxed{1} \end{array} \right] \end{array} \right] \end{array} \right] \end{array} \right\} \end{array} \right]$$

$$(16) \boxed{1} : \{ \text{person}(\boxed{1}), \text{speak\_to}(\text{Kim}, \boxed{1}) \}$$

To get the content of *person to whom Kim spoke* from the content of *person* is a matter of producing a *scope-object* whose index is the index of *person* (and the relative pronoun), and whose restrictions are the union of the restrictions of *person* with a set containing a *fact* corresponding to the *state-of-affairs* that is the content of the relative clause. Unioning the restrictions gives the intersective interpretation.

Conceptually, this is straightforward, but there is technical difficulty: (12) is a head-adjunct structure, and in such structures the content should come from the adjunct daughter, the relative clause. That is, for ‘external’ purposes (purposes of combination) relative clauses should have *scope-object* content, but as we have seen their ‘internal’ content is a *soa*. So some special apparatus will be required.<sup>7</sup>

<sup>7</sup> Though the details are HPSG specific, this is a general problem, regardless of semantic theory.

This should give the reader an idea of the general shape of an approach to relative clauses like (1a) using HPSG apparatus. In the following sections we will make this more precise by outlining the two main approaches that have been taken to the analysis of relative clauses in HPSG: the lexical approach of Pollard & Sag (1994) which makes use of phonologically empty elements, and the constructional approach of Sag (1997), which does not.

## 2.2 Pollard & Sag (1994)

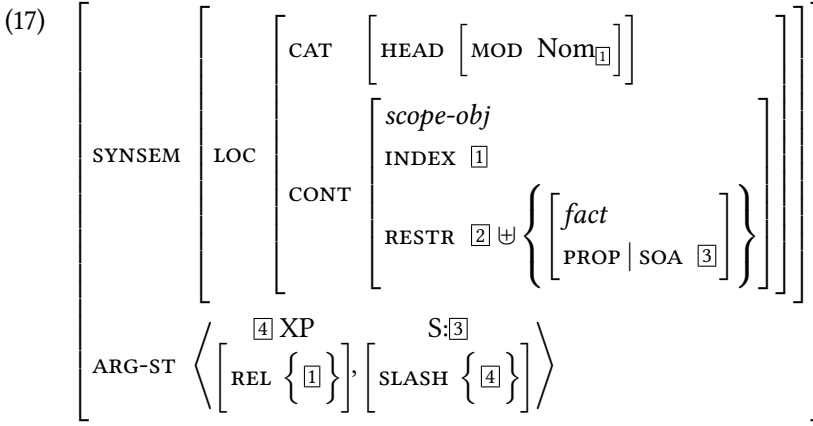
The idea that relative clauses have a lexical head is appealing for some kinds of relative clause in many languages (see below), but it is problematic for relative clauses like (1a) – there is just no obvious candidate to serve as the head. Building on an approach originally proposed by Borsley (1989), the analysis proposed in Pollard & Sag (1994), overcomes this by assuming that relative clauses involve a phonologically empty head, which we will call ‘R’ (‘relativizer’), which projects an ‘RP’ (that is, a relative clause).

R is lexically specified to be a nominal modifier (i.e. MOD *noun*) which takes two arguments. The first is an XP, the *wh*-phrase, with a REL value which contains the index of the modified nominal. The second is sentential, and constrained to have a SLASH value that includes the XP. With some simplifications and some minor modifications to fit the framework we assume here, this is along the lines of (17) (cf Pollard & Sag 1994: 216). Here  $\boxplus$  is intended to be the RESTR set of the modified nominal (this should be specified as part of the MOD value, but we have not done this, in the interests of readability).<sup>8</sup>

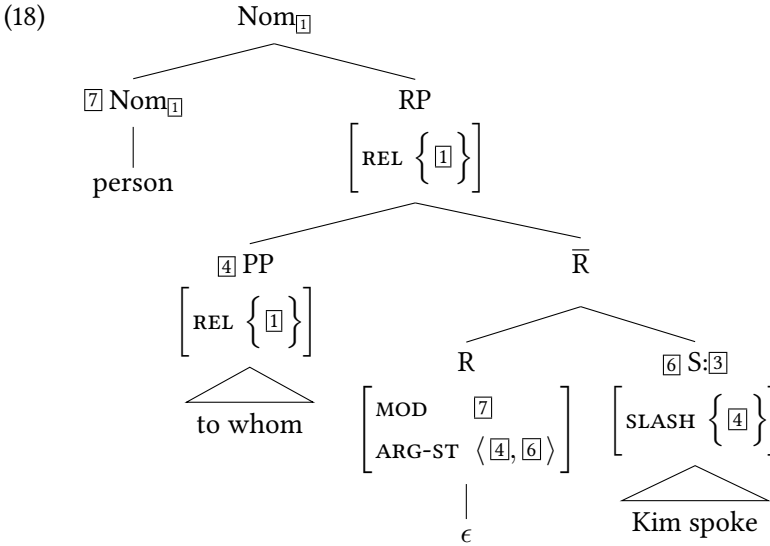
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For example, in a setting using standard logical types, relative clauses *qua* clauses (saturated predications) might be assigned type *t*, but in order to act as nominal modifiers this predicative semantics must be converted into ‘attributive’ (noun-modifying) semantics, i.e. logical type  $\langle et, et \rangle$ .

<sup>8</sup> The  $\boxplus$  symbol here signifies ‘disjoint union’. This is like normal set union, except that it is undefined for pairs of sets that share common elements. Here, it ensures that restrictions are distributed between the noun and the clause, so the restrictions associated with the noun do not include the restriction associated with the clause, and *vice versa*.



Standard schemas for combining heads with arguments will produce structures like the RP in (18), which (since MOD is a head feature) will inherit the MOD feature from R, and hence combine with a nominal like *person* in a head-adjunct phrase to produce (18).



This captures the properties described above, and resolves the issues mentioned.

The first argument of R is specified as  $\text{REL } \{ \boxed{1} \}$ . Thus, it must contain a relative pronoun. Moreover, (17) specifies that the first argument must correspond to a gap in the second argument. Hence cases like (4) where there is no *wh*-phrase, or where the *wh*-phrase is *in situ*, are excluded.

Since R, not the slashed S, is the head of RP, there is no problem of mismatch between the content of the S and the relative clause: R is lexically specified as

having *scope-obj* content incorporating the ‘internal’ content of its complement clause (tagged ③) in the appropriate way. This *scope-obj* content will be projected to RP by normal principles of semantic composition relating to heads, complements, and subjects, and RP will produce the right content by unioning the restrictions that come from the head nominal.

This leaves the question of how upwards percolation of the REL and SLASH values can be prevented. The same method is used for both. The idea is that for features like REL and SLASH (‘non-local’ features) the value on the mother is the union of the values on the daughters, less any indicated as being discharged (‘bound-off’) on the head daughter. Thus, R can be specified so as to discharge the SLASH value on its S sister (so that  $\bar{R}$  is SLASH { }), and we can ensure that the topmost Nom is REL { }, so long as its head Nom is specified as binding-off the REL value on RP. This specification can be imposed via the MOD value of R. See (Pollard & Sag 1994: 164) for details.

The approach can be extended to deal with other kinds of relative clause by positing alternative forms of empty relativizer (see Pollard & Sag (1994: Ch5), and below).

The great attraction of the approach is that apart from R, it requires no special apparatus of any kind. On the other hand, it requires the introduction of a novel part of speech (R), and the need to posit phonologically empty elements for which there is no independent evidence. Reservations about this lead Sag to develop the constructional approach presented in Sag (1997).<sup>9</sup>

### 2.3 Sag (1997)

The analysis of English relative clauses in Sag (1997) is constructional and completely dispenses with phonologically empty elements. It involves three main

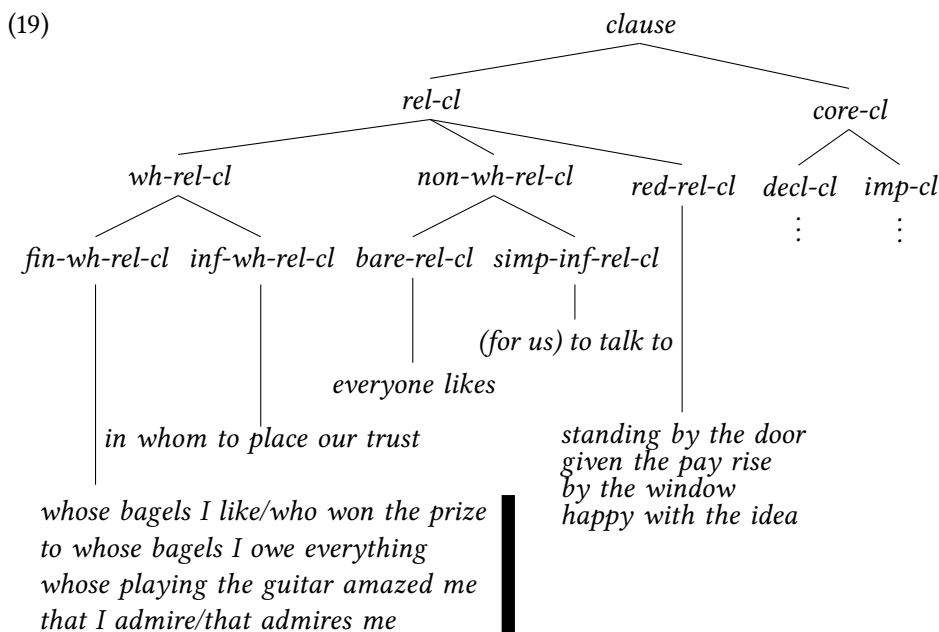
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<sup>9</sup> One detail we ignore here concerns the analysis of ‘subject’ relatives: relative clauses where the relative phrase is a grammatical subject inside the relative clause, as in the following:

- (i) person who spoke to Kim
- (ii) person who everyone thinks spoke to Kim

Pollard & Sag (1994) treat such examples specially: examples like (i) are treated as normal NP-VP clauses, examples like (ii) involve special apparatus (the ‘Subject Extraction Lexical Rule’ (SELR) which in essence permits a VP to replace an S in an ARG-ST in the presence of a gap, Pollard & Sag (1994: 174)). But this is not an essential part of the analysis of relative clauses: it is motivated by quite independent theoretical considerations (specifically, the assumption that gaps are associated only with non-initial members of ARG-ST lists — cf. the ‘trace-principle’ Pollard & Sag (1994: 172)). Hence we ignore it here.

constructions: one for combining relative clauses and nominals, and two for relative clauses themselves. One of these is the standard construction for head-filler phrases. The other involves a number of sub-constructions specific to relative clauses, which are treated as a subtype of *clause* (alongside e.g. *declaratives* and *imperatives*). These are outlined (with some simplifications and minor adjustments) in (19).<sup>10</sup>



The *rel-cl* clause type is associated with the constraints in (20), which simply states that relative clauses are nominal modifiers with *propositional* content, that they are subordinate clauses (MC −), and that they do not permit subject-aux inversion (INV −).<sup>11</sup>

<sup>10</sup> See Kim & Sells (2008: ch11) for an introductory overview of English relative clauses on similar lines to Sag (1997). One simplification we make here is that we follow more recent work (e.g. Sag (2010: 523)) and do not distinguish subject and non-subject finite relative clauses: Sag (1997) follows Pollard & Sag (1994) in treating them differently (cf. footnote 9; and see Sag (1997: 452ff)), but it is not clear whether Pollard & Sag's motivations carry over to the framework of Sag (1997).

<sup>11</sup> Giving relative clauses *propositional* content puts them on a par with other kinds of clause, and is not very different from Pollard & Sag's assumption that clauses have *soa* content (since *propositions* are simply semantic objects which contain a *soa*).

$$(20) \text{ rel-cl} \Rightarrow \left[ \begin{array}{c} \text{HEAD} \left[ \begin{array}{cc} \text{MC} & - \\ \text{INV} & - \\ \text{MOD} & \left[ \text{HEAD} \text{ noun} \right] \end{array} \right] \\ \text{CONT} \text{ proposition} \end{array} \right]$$

Relative clauses such as that in (1a) are what Sag calls *fin-wh-fill-rel-cl*, a sub-type of *wh-rel-cl*. This is associated with the constraints in (21). In words: *wh*-relatives are a subtype of relative clause, where the non-head daughter is required to have a REL value which contains the INDEX of the modified nominal.<sup>12</sup>

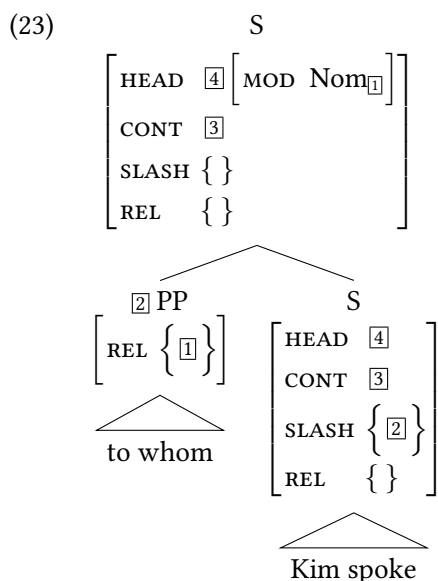
$$(21) \text{ wh-rel-cl} \Rightarrow \text{rel-cl} \& \left[ \begin{array}{c} \text{HEAD} \left[ \text{MOD Nom}_{\boxed{1}} \right] \\ \text{NON-HD-DTRS} \left\langle \left[ \text{REL} \left\{ \boxed{1} \right\} \right] \right\rangle \end{array} \right]$$

The framework assumed in Sag (1997) allows multiple inheritance of constraints from different dimensions (cf ChXXXX). As well as inheriting properties in the clausal dimension, expressions of type *fin-wh-fill-rel-cl* are also classified in the phrasal dimension as belonging to a sub-type of head-filler phrase (*hd-fill-ph*), thus inheriting constraints as in (22). In words: they are *verbal* – e.g. clausal – phrases where the SLASH value of the head daughter is the SLASH value of the mother plus the LOCAL value of the non-head daughter (equivalently, the SLASH value of the mother is the SLASH value of the head daughter less the local value of the non-head daughter). Head-filler phrases are a sub-type of another phrase type (*head-nexus-phrase*) which specifies identity of content between mother and head daughter.

<sup>12</sup> For simplicity and to avoid distractions, we have presented *wh*-relatives as Nom modifiers in (21). This is a conventional assumption, because standard methods of semantic composition ensure that the content of the relative clause is included in the restrictions of a quantificational determiner (as in *every person to whom Kim spoke*), but it is not Sag’s analysis. Instead he takes *wh*-relatives to be NP modifiers, which allows him to account for the facts about the ordering of *wh*-relatives and bare relatives, see Sag (1997: 464ff). Sag’s analysis requires a different approach to semantic composition, e.g. one using Minimal Recursion Semantics (MRS, Copestake et al. (2005)) or Lexical Resource Semantics (LRS, Richter & Sailer (2004)) – see, in particular Walker (2017), where such an approach is worked out in detail using LRS.

$$(22) \quad hd\text{-}fill\text{-}ph \Rightarrow \left[ \begin{array}{l} \text{SLASH} \quad [2] \\ \text{HD-DTR} \quad \left[ \begin{array}{l} \text{HEAD} \quad \textit{verbal} \\ \text{SLASH} \quad \{ [1] \} \uplus [2] \end{array} \right] \\ \text{NON-HD-DTRS} \quad \left\langle \left[ \text{LOCAL} \quad [1] \right] \right\rangle \end{array} \right]$$

Putting these together with a constraint that requires clauses to have empty REL values will license local trees like the following for a *finite-wh-relative-clause* like (1a) (simplifying, and disregarding most empty and irrelevant attributes).<sup>13</sup>



The REL specification on the non-head daughter (the PP) in (21) ensures the presence of a *wh*-phrase, and the fact that this is a head-filler phrase ensures that the *wh*-phrase cannot be *in situ* (cf. (4), above). REL inheritance will carry the index of the nominal that will be modified down into the PP, guaranteeing the presence of a relative pronoun co-indexed with the nominal that (23) will modify. Further upwards inheritance of this REL value is prevented by a requirement that all clauses (including relative clauses) have empty REL values. This same

<sup>13</sup> This assumption about REL values is one of many minor technical differences between Sag (1997) and Pollard & Sag (1994), where the non-empty REL value percolates to RP, and is discharged there. This means that for Pollard & Sag, but not for Sag (1997), a *wh*-relative clause is a REL marked clause.



requirement on the head S excludes the possibility of an additional relative expression lower down (cf. *\*(the person) to whom Kim spoke about whom*).<sup>14</sup> The SLASH specification on the S daughter in (23) will percolate LOCAL properties of the PP down into the S, so that the subcategorisation requirements of *speak* can be satisfied, and the right content produced for the lower S (and passed to the higher S, because this is a head-filler phrase).

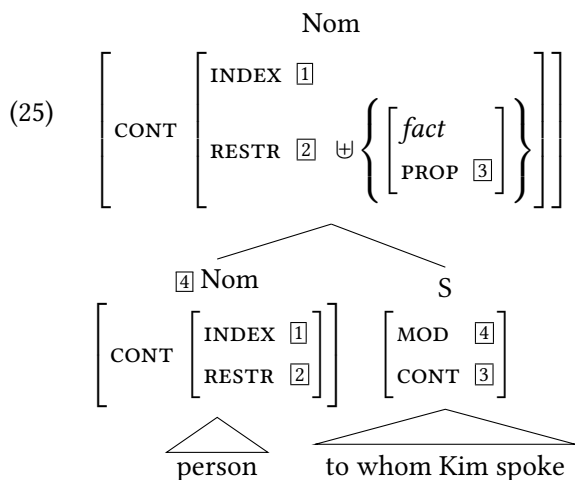
The task of combining a nominal and a relative clause (in particular, identifying indices and unioning restrictions) involves a further phrase type *head-relative-phrase*, as in (24). In words, this specifies a nominal construction (i.e. one whose head is a noun), whose CONTENT is the same as that of its head daughter, except that the content of the non-head-daughter (the relative clause) has been added to its restriction set. (Thus, it is this construction that takes care of the mismatch of between the ‘internal’, propositional, CONTENT of the relative clause itself, and its ‘external’ contribution of restrictions on the nominal it modifies). Since *head-relative-phrases* are a subtype of *head-adjunct-phrase*, which requires the MOD value of the non-head to be identical to the SYNSEM value of the head (see Sag (1997: 475)), this will give rise to structures like (25).<sup>15</sup>

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<sup>14</sup> Sag’s account of the propagation of REL values is a special case of the apparatus that is now standardly assumed for propagation of all ‘non-local’ features, SLASH, WH (i.e. QUE), and BACKGROUND (Ginzburg & Sag 2001: Ch5). ‘Upwards’ inheritance is handled by a constraint on *words* that says that (by default) the REL value of a word is the union of the REL values of its arguments. In the absence of a lexical head with arguments (e.g. in *of whom* and *of whose friends* if *of* is treated simply as a marker) the REL value on a phrase is that of its head daughter (the ‘Wh-Inheritance Principle’, WHIP), see Sag (1997: 449). Since these are only default principles, they can be overridden, e.g. by the requirement that clauses have empty REL values.

<sup>15</sup> This is not the normal semantics associated with head-adjunct phrases (where the content is simply the content of the adjunct daughter). This could be dealt with by introducing a separate sub-type of *head-adjunct-ph* which deals with content in this way: *head-adjunct-ph* itself would impose no constraints on content. Notice that we again follow Ginzburg & Sag (2001) in taking restrictions to be sets of *facts* (Sag assumes they are sets of *propositions*, nothing hangs on this).

$$(24) \text{ head-relative-phrase} \Rightarrow \left[ \begin{array}{l} \text{HEAD} \quad \textit{noun} \\ \text{CONT} \quad \left[ \begin{array}{l} \text{INDEX} \quad [2] \\ \text{RESTR} \quad [3] \uplus \left\{ \left[ \begin{array}{l} \textit{fact} \\ \text{PROP} \quad [4] \end{array} \right] \right\} \end{array} \right] \\ \text{HD-DTR} \quad \left[ \begin{array}{l} \text{INDEX} \quad [2] \\ \text{RESTR} \quad [3] \end{array} \right] \\ \text{NON-HD-DTR} \quad \left[ \text{CONT} \quad [4] \right] \end{array} \right]$$



From a purely formal point of view the *head-relative-phrase* construction is not strictly necessary. It would be possible to build its semantic effects into the *rel-cl* construction, so that (25) would be an entirely normal head-adjunct phrase where the content comes from the adjunct daughter. There are two arguments against this. One is that it would require the relative clause to have nominal (i.e. *scope-obj*) content, which is somewhat at odds with its status as a clause. The other is that it would push the semantic mismatch into the relative clause itself. That is, semantically, relative clauses like *to whom Kim spoke* would no longer be normal head-filler phrases where CONTENT is shared between head and mother.

### 3 Varieties of Relative Clause

In this section we will look at how the approaches introduced above have been extended to other kinds of relative clause. Section 3.1 looks at other kinds of relative clauses which involve a relative pronoun, notably ones which do not involve a finite verb. Section 3.3 and Section 3.2 look at relative clauses which do not involve relative pronouns. Section 3.2 looks at relative clauses which can be analysed as involving a complementiser, Section 3.3 looks at ‘bare’ relatives, which involve neither relative pronouns nor complementisers. Section 3.4 looks at non-restrictive or ‘supplemental’ relative clauses, which lack the intersective semantics associated with prototypical relative clauses.

One dimension of variation among relative clause construction which we will not address relates to whether, in the case of relative clauses that involve a filler-gap construction, the gap is genuinely absent phonologically and syntactically (as in the examples we have looked at so far), or whether it is realised as a full pronoun (a so-called ‘resumptive pronoun’) as in (26) from Alqurashi & Borsley (2012: 28), or the English example in (27) – the resumptive pronouns are indicated in bold.

- (26) wajadtu l-kitab-a [llaŕi tuhib-**hu** Hind-un ]  
 found.1.SG DEF-book-ACC that.M.SG like.3.F.SG-3.M.SG Hind-NOM  
 ‘I found the book that Hind likes.’ (Arabic)

- (27) This is the road which I don’t know where **it** goes.

The analysis of resumptive pronouns is discussed elsewhere in this volume (ChXXX) and while they are an important feature of relative clause constructions in many languages (see e.g. Vaillette (2001), Vaillette (2015), Taghvaipour (2005), Alotaibi & Borsley (2013)), the issues seem to be similar in all constructions involving unbounded dependencies, and not specific to relative clauses.

#### 3.1 *Wh*-Relatives

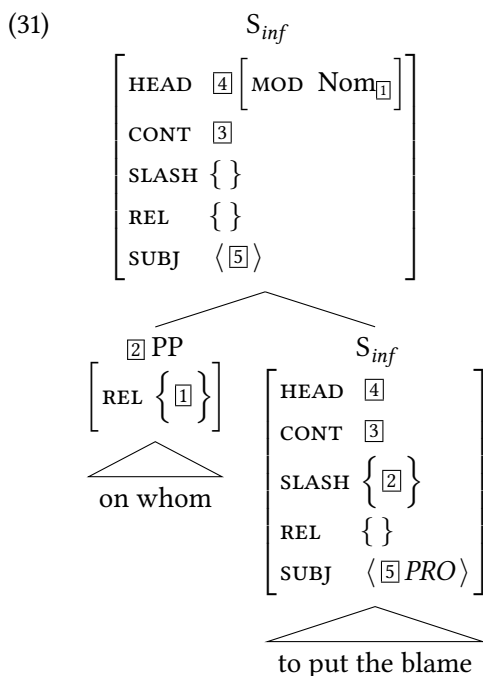
Finite *wh*-relatives in English have been discussed above (Section 2). English also allows *wh*-relatives which are headed by non-finite verbs, such as (28); (29) is a similar example from French.

- (28) a person [on whom to place the blame]  
 (29) un paon [dans les plumes duquel] mettre le courrier  
 a peacock in the feathers of-which to-place the mail  
 ‘a peacock in whose feathers to place the mail’ (French)

Non-finite relatives were not discussed Pollard & Sag (1994), but Sag (1997)'s constructional approach provides a straightforward account. It involves distinguishing two sub-types of *hd-filler-ph*: a finite subtype which has an empty SUBJ list, and a non-finite subtype whose SUBJ list is required contain just a *PRO* (that is, a pronominal that is not syntactically expressed as a syntactic daughter). This requirement reflects the fact that non-finite *wh*-relatives do not allow overt subjects:

(30) \*a person [on whom (for) Sam to place the blame]

The relative clause in (28) receives a structure like (31). Apart from the finite specification, this differs from the finite *wh*-relative in (23) above only in the presence of the unexpressed subject.<sup>16</sup>



The exclusion of overt subjects is not peculiar to non-finite relatives (it is shared by non-finite interrogatives, cf. *I wonder on whom (\*for Sam) to put the blame*),

<sup>16</sup> The use of  $S_{inf}$  in (31) is an approximation. First, S is standardly an abbreviation for something of type *verb* with empty SUBJ and COMPS values, and here there is a non-empty SUBJ. Second, Sag would have CP instead of S here, reflecting his analysis of *to* as a complementiser rather than an auxiliary verb, as is often assumed in HPSG analyses. S and CP are not very different (both *verb* and *comp* are subtypes of *verbal*), but Sag is careful to treat *to* as a *comp* and non-finite *wh*-relatives as CPs because this gives a principled basis for excluding overt subjects.

but non-finite *wh*-relatives are subject to the apparently idiosyncratic restriction that the *wh*-expression must be a PP:

- (32) a. \*a person who(m) to place the blame on (relative)  
 b. I wonder who(m) to place the blame on (interrogative)

The relevant constraints can be stated directly — roughly as in (33) (disregarding constraints that are inherited from elsewhere). In words these constraints say that a non-finite head-filler phrase must have an unexpressed subject, and a non-finite *wh*-relative clause is a non-finite-head-filler phrase whose non-head daughter is a PP.

- (33) a.  $inf-hd-fill-ph \Rightarrow \left[ \begin{array}{c} \text{HD-DTR} \\ \left[ \begin{array}{c} \text{HEAD} \left[ \begin{array}{c} \text{VFORM } non-fin \\ \text{SUBJ } \langle PRO \rangle \end{array} \right] \end{array} \right] \end{array} \right]$   
 b.  $inf-hd-fill-rel-cl \Rightarrow inf-hd-fill-ph \ \& \ \left[ \begin{array}{c} \text{NON-HD-DTRS } \langle PP \rangle \end{array} \right]$

### 3.2 ‘Complementizer’ Relatives

As well as *wh*-relatives, which involve relative pronouns, there are cases of relative clauses which appear to be headed by what is plausibly analysed as a complementiser. In this section we look first at Arabic, where a ‘complementiser’ analysis has been proposed, and then at English, where such an analysis seems possible, but where it is controversial.<sup>17</sup>

#### 3.2.1 Arabic

Alqurashi & Borsley (2012) argue that in Arabic finite relatives the word *?allađi* ‘that’ (transliterated as *llađi* in (34), from Alqurashi & Borsley (2012: 27)) and its inflectional variants should be analysed as a complementiser, roughly as in (35).<sup>18</sup>

<sup>17</sup> There are also cases which involve a relative pronoun *and* a complementiser, as in the following from Bavarian German (Hinrichs & Nakazawa 2015):

- (i) Der Mantl (den) wo i kaffd hob  
 the coat which that I bought have  
 ‘the coat which I bought’ (Bavarian German)

(Hinrichs & Nakazawa 2015) analyse these as *wh*-relatives, even when the relative pronoun is omitted, as it can be under certain circumstances.

<sup>18</sup> Here  $S_{fin}[\textcircled{3}]$  means a finite clause (a *verb* which is COMPS and SUBJ saturated) whose CONTENT is  $\textcircled{3}$ . According to (35) this content is merged with the restrictions of the modified NP. This is

- (34) jaaʔa      l-walad-u      llaḏi      qaabala      l-malik-a.  
 came.3.M.SG DEF-boy-NOM that.M.SG met.3.M.SG DEF-king-ACC  
 ‘The boy who met the king came.’ (Arabic)

$$(35) \left[ \begin{array}{c} \left[ \begin{array}{c} \left[ \begin{array}{c} \text{SS} \\ \text{LOC} \end{array} \right] \\ \text{NONLOC} \end{array} \right] \left[ \begin{array}{c} \text{CAT} \\ \text{CONT} \\ \text{SLASH} \end{array} \right] \left[ \begin{array}{c} \text{HEAD} \\ \text{COMPS} \\ \text{INDEX } \boxed{1} \\ \text{RESTR } \boxed{2} \uplus \{ \boxed{3} \} \end{array} \right] \left[ \begin{array}{c} c \\ \text{MOD NP}_{def}: \left[ \begin{array}{c} \text{INDEX } \boxed{1} \\ \text{RESTR } \boxed{2} \end{array} \right] \\ \langle S_{fin}: \boxed{3} \rangle \\ \left\{ \text{NP}_{\boxed{1}} \right\} \end{array} \right] \end{array} \right]$$

According to this, *ʔallaḏi* will combine with a sentential complement, to produce a phrase which will modify a definite NP. When it combines with that NP, its content will have the same INDEX as the NP, and the restrictions of the NP combined with the propositional content of the sentential complement. The SLASH specification is given here on *ʔallaḏi* itself, but presumably it could alternatively be specified on the complement clause. (35) does not indicate how percolation of the SLASH value outside the relative clause is prevented, but this could be achieved by an appropriate ‘to-bind’ value on the modified NP. Notice that, as Alqurashi & Borsley point out, the gap in cases like (34) is a ‘dishonest’ gap, in the sense that it does not have a corresponding filler.

Since *ʔallaḏi* shows inflections agreeing with the antecedent NP for NUMBER, GENDER, and CASE, different forms will impose additional restrictions on the modified NP (e.g. the form transliterated as *llaḏi* in (34) will add to (35) the additional requirement that its antecedent must be masculine singular).

Notice that Alqurashi & Borsley’s account is entirely lexical: no constructional apparatus is used at all. Hahn (2012) argues for a constructional alternative. There is, moreover, no role for a REL feature (obviously, since there is no relative pronoun).<sup>19</sup>

imprecise: as discussed above, what should be merged is a *fact* constructed from the content of the S.

<sup>19</sup> Arabic also has finite relatives that do not have an overt relativiser (and which occur with

### 3.2.2 English

A similar analysis could be proposed for English *that*-relatives as in (36). However, this is controversial: Pollard & Sag (1994) treat some uses of *that* as simply a ‘marker’ (i.e. the realisation of a MARKING feature whose value is *that*, as opposed to *unmarked*), and others as a relative pronoun, see Pollard & Sag (1994: 221-2), Sag (1997) prefers to treat *that* as a relative pronoun.<sup>20</sup>

- (36) a. person that — admires Kim  
       b. person that everyone thinks — admires Kim

Some support for a relative pronoun analysis comes from coordination. It is possible to coordinate *that* relatives with normal *wh*-relatives quite freely, as in (37). This is a natural consequence if the REL value of the coordinate structure is shared by both conjuncts (implying that both conjuncts contain relative pronouns, of course).

- (37) a book [ that/which you own or that/which you can borrow ]

Potential evidence against this, and in favour of a ‘complementiser’ (or perhaps ‘marker’) style analysis would be that *that* differs from normal relative pronouns in not allowing pied-piping, cf. (38b).

- (38) a. the person that I spoke to —  
       b. \*the person to that I spoke —

Sag (1997) and Pollard & Sag (1994) argue that this restriction is a result of relative pronoun *that* having nominative case, so that it cannot occur as e.g. the complement of a preposition. Notice, however, that the relative pronoun *who* follows the same pattern (i.e. it cannot appear as complement of a preposition, but can be associated with a gap that is complement of a preposition):

- (39) a. the person who I spoke to —  
       b. \*the person to who I spoke —

---

indefinite antecedents). Alqurashi & Borsley analyse these as involving a phonetically null complementiser. Arabic also has non-finite and free relatives, which have received some attention. See Melnik (2006), Haddar & Boukedi (2009); Zalila & Haddar (2011), Hahn (2012), and Crysmann & Reintges (2014) for further discussion.

<sup>20</sup> Pollard & Sag (1994) treat instances of *that* in relative clauses involving relativisation of a top level subject, like (36a), as a relative pronoun. In other relative clauses, in particular those involving relativisation of embedded subjects, like (36b), or non-subjects, *that* is treated as a marker, meaning that such clauses are treated as instances of ‘bare’ relatives. It is hard to find clear empirical evidence against this, but an analysis which provides a uniform treatment of English *that*-relatives is clearly more appealing.

### 3.3 Bare Relatives

Not all languages realise relative clauses using relative pronouns or complementisers. In this section we will discuss HPSG analyses of what we will call ‘bare’ relatives in Japanese and Korean (Section 3.3.1) and in English, where they are often called ‘*that*-less’ relatives (Section 3.3.2). The absence of relative pronouns means there is no question of pied-piping, hence no role for a REL feature in these constructions.

#### 3.3.1 Bare Relatives in Japanese and Korean

Japanese relative clauses corresponding to (1a) contain a gap, but are otherwise similar to normal clauses, cf (40) (from Sirai & Gunji 1998); in Korean they are distinguished by special marking on the topmost verb — cf the *-nun* affix on *sayngkakha* ‘think’ in (41) (from Kim 2016b).

- (40) Naomi-ga —<sub>i</sub> yon-da hon<sub>i</sub>  
 Naomi-NOM read-PAST book  
 ‘the book (that) Naomi read’ (Japanese)

- (41) [motwu-ka [ Kim-i —<sub>i</sub> ilk-ess-ta-ko ] sayngkakha-nun ]  
 everyone-NOM Kim-NOM read-PST-DECL-COMP think-PRES.MOD  
 chayk<sub>i</sub>  
 book  
 ‘the book (that) everyone thinks Kim read’ (Korean)

Evidence for a gap in these examples is that it is not possible to put an overt NP in place of the the gap (e.g. putting *sore-wo* ‘it-ACC’ in (40), or *sosel-u* ‘novel-ACC’ in (41) renders them ungrammatical).<sup>21</sup>

Sirai & Gunji (1998) provide a non-constructional account of Japanese bare relatives like (40). They show how an account that uses SLASH percolation could work, but their actual proposal is SLASH-less. They assume that the tense affixes are heads of verbal predications, and operate via ‘predicate composition’ — by inheriting the subcategorisation requirements of the associated verb. The adnominal tense affixes are special in that a) they are specified as nominal modifiers, and b) they inherit the subcategorisation requirements of the associated verb, less an NP that is co-indexed with the modified nominal. (A lexical equivalent

<sup>21</sup> As well as these ‘standard’ relatives, Korean and Japanese both have other kinds of relative construction, notably ‘internally headed’ relatives, and so-called ‘pseudo-relatives’, which are briefly mentioned below. See Section 4.2.2.



of this could be implemented with a lexical rule which removes an element from a verb's ARG-ST and introduces a MOD value containing a nominal with the corresponding index). Of course, a SLASH-less account like this will only deal with cases of 'local' relativization — where the relativized NP is an argument of the highest verb. Sirai & Gunji argue that cases of non-local relativization, like (42), should be treated as involving null-pronominals (which are a common feature of Japanese). They suggest that the requirement that the modified noun and the pronoun be co-indexed should be captured via a pragmatic condition that requires the relative clause be 'about' the modified noun.

- (42) [ Ken-ga [ Naomi-ga —<sub>i</sub> yon-da ] to sinzitei-run ] hon<sub>i</sub>  
 Ken-NOM Naomi-NOM read.PAST COMP believe-PRES book  
 'the book that Ken believes Naomi read' (Japanese)

Kim (2016b) provides a constructional analysis for Korean which resembles Sag (1997)'s analysis of English (see also Kim (1998b) Kim & Yang (2003)). He suggests that Korean allows verb lexemes to be realised as 'modifier verbs' (*v-mod*) subject to a constraint like (43) — these are verbs that can head a subordinate clause (IC –) which modifies a Nominal:<sup>22</sup>

- (43) 
$$\left[ \begin{array}{c} \text{HEAD} \left[ \begin{array}{c} \text{verb} \\ \text{IC} \quad - \\ \text{MOD} \quad \text{Nom} \end{array} \right] \end{array} \right]$$

He also proposes a construction (a sub-type of *head-adjunct-phrase*) to combine a structure headed by such a 'modifier verb' with a head Nominal, along the lines of (44). In words: a nominal structure can consist of a head noun, and a clause headed by a 'modifier verb' containing an NP gap which is co-indexed with the head noun. The empty SLASH value on the mother is necessary to prevent the gap being inherited upwards. The SLASH value on the S daughter ensures the presence of a gap, the MOD value on the S daughter ensures that it is headed by a verb with the right morphology. It will license structures like (45). Kim does not discuss the semantics, but it would be straightforward to add constraints along the lines of those presented above to this construction.

<sup>22</sup> Different sub-types of *v-mod* are associated with different tense affixes. (43) differs from Kim's formulation, e.g. Kim's formulation involves a pos (part-of-speech) feature and he assumes that MOD is list valued (see Kim 2016b: 285). This is not important here.

- (44) 
$$\left[ \begin{array}{ll} \textit{hd-adj-ph} & \\ \text{HEAD} & \textit{noun} \\ \text{SLASH} & \{ \} \\ \text{HD-DTR} & \boxed{2} \text{N}_{\boxed{1}} \\ \text{NON-HD-DTR} & \text{S} \left[ \begin{array}{ll} \text{HEAD} \mid \text{MOD} & \boxed{2} \\ \text{SLASH} & \{ \text{NP}_{\boxed{1}} \} \end{array} \right] \end{array} \right]$$

- (45)
- 
- ```

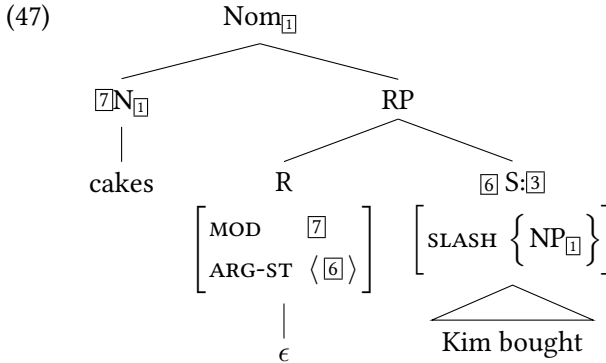
graph TD
    N1[N1] --> S1[S]
    N1 --> 2N1[2N1]
    S1 --> MOD2[MOD 2]
    S1 --> SLASH3NP1[SLASH {3 NP1}]
    MOD2 --> 2
    SLASH3NP1 --> NP1[NP]
    SLASH3NP1 --> VP1[VP]
    NP1 --> motwu[motwu-ka  
everyone-NOM]
    VP1 --> MOD2_2[MOD 2]
    VP1 --> SLASH3_1[SLASH {3}]
    MOD2_2 --> 2_2
    SLASH3_1 --> S2[S]
    SLASH3_1 --> V1[V]
    S2 --> SLASH3_2[SLASH {3}]
    SLASH3_2 --> NP2[NP]
    SLASH3_2 --> VP2[VP]
    NP2 --> Kimi[Kim-i  
Kim-NOM]
    VP2 --> SLASH3_3[SLASH {3}]
    SLASH3_3 --> V2[V]
    V2 --> ilk[ilk-ess-ta-ko  
read-PST-DECL-COMP]
    2N1 --> chayk[chayk  
book]
    V1 --> MOD2_3[MOD 2]
    MOD2_3 --> 2_3
    2_3 --> sayng[sayngkakha-nun  
think-MOD]
    
```

### 3.3.2 Bare Relatives in English

English also has ‘bare’ relative clauses, both finite, as in (46a), and non-finite as in (46b):

- (46) a. the cakes Kim bought —  
 b. some cakes (for Sam) to eat —

In English, there is no obvious motivation for suggesting a special sub-type of ‘relative clause heading’ verb, so an alternative way of licensing noun-modifying clauses with appropriate SLASH values is required. In Pollard & Sag (1994) this was the role of a null relativizer similar to that described above, differing only in taking a single argument — a slashed clause (see Pollard & Sag (1994: 222); recall that the relativizer discussed above takes two arguments: a *wh*-phrase, and a slashed clause).<sup>23</sup>

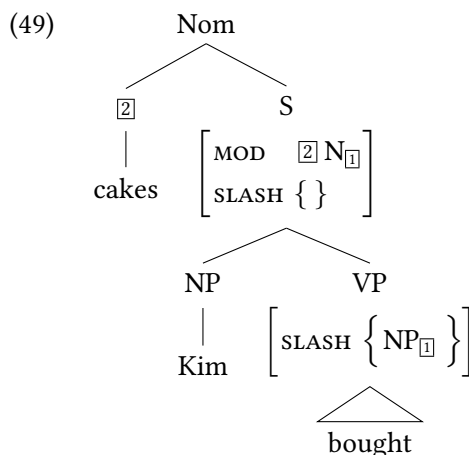


In Sag (1997) the task of licensing such ‘bare’ relatives is the task of a construction (an immediate subtype of *relc*) as in (48). In words: a relative clause can be a noun-modifying clause whose head daughter contains an NP gap that is co-indexed with the modified nominal.

<sup>23</sup> According to Pollard & Sag (1994: 222), the clausal argument of this single argument version of R can either be bare, as here, or marked by *that*. Thus, terminological accuracy demands the observation that for Pollard & Sag some instances of *that*-relatives are actually ‘bare’ in the sense of containing neither a relative pronoun nor a complementiser (though others, in particular those involving relativisation of a top level subject, are analysed as containing a version of *that* which is actually a relative pronoun). See above footnote 20.

$$(48) \text{ non-wh-rel-cl} \Rightarrow \left[ \begin{array}{l} \text{HEAD} \left[ \text{MOD} \left[ \text{HEAD Nom}_{\boxed{1}} \right] \right] \\ \text{SLASH} \{ \} \\ \text{HD-DTR} \left[ \text{SLASH} \left\{ \text{NP}_{\boxed{1}} \right\} \right] \end{array} \right]$$

This licenses structures like (49).<sup>24</sup>



This differs from Kim's proposal for Korean in where the SLASH value is bound-off: in particular, where Kim's analysis involves a Nominal and slashed S, Sag's involves a nominal and an *unslashed* S — the clause is SLASH { }, it is the VP which is SLASH { NP }. This reflects the fact that in English the gap in the relative clause cannot be the subject, accounting for the contrast in (50).<sup>25</sup>

- (50) a. \*person spoke to Sam  
 b. person who spoke to Sam

The issue of where upwards termination of SLASH percolation should occur highlights the impossibility of having a entirely lexical and non-constructional

<sup>24</sup> Sag also proposes a subtype of (48) to deal with non-finite bare relatives, which he calls *simple infinitival relatives* (p469ff). One of the issues that he does not address is the special 'modal' semantics associated with non-finites e.g. *cakes for Sam to eat* means something like 'cakes that Sam can (or should) eat'.

<sup>25</sup> Examples like (50a) are acceptable in some 'non-standard' dialects of English. Sag suggests this is not problematic, since they could be analysed as 'reduced' relatives (see Sag (1997: 471)), but see immediately below where we cast doubt on this. If we are right, then the 'non-standard' dialects would have something like (44) instead of (48).

account of bare relatives that does not employ empty elements. At first glance, a purely lexical approach might seem simple: since all we need is to create clauses specified as [MOD Nom] which contain a co-indexed gap, all we seem to need is verbs specified as in (51).

$$(51) \left[ \begin{array}{l} \text{HEAD} \left[ \begin{array}{l} \textit{verb} \\ \text{MOD Nom}_{[1]} \end{array} \right] \\ \text{COMPS} \langle PP \rangle \\ \text{SLASH} \left\{ \text{NP}_{[1]} \right\} \end{array} \right]$$

In the absence of special constructions or empty elements, this would license structures like (49), except that the upwards percolation of the SLASH value will not be terminated, allowing an additional spurious filler for the gap, as in (52):<sup>26</sup>

(52) \*That book<sub>j</sub>, I enjoyed [ the book<sub>i</sub> Kim read —<sub>i</sub> ]

There is one class of exceptions to this – that is, cases of ‘relative clauses’ for which a purely lexical account *is* possible. Examples involving participial phrases and a variety of other post-nominal modifiers, notably APs and PPs, are often called ‘reduced relatives’, and analysed as a type of relative clause. Sag (1997: 471) follows this tradition. What this comes down to is the assumption that such examples involve clauses containing predicative phrases with *PRO* subjects, co-indexed with the nominals they modify.

- (53) a. a person standing by the door (VP-*pres-part*)  
 b. a train recently arrived at platform four (VP-*past-part*)  
 c. a person given a pay rise (VP-*passive-part*)  
 d. a person in the doorway (PP)  
 e. a person fond of children (AP)

It is not obvious to us what is gained by treating these as relative clauses introduced by a special construction. A lexical account seems at least as appealing, where the relevant properties of the phrases (e.g. noun modifying semantics) are projected directly from lexical entries for the head words. The reason such a non-constructional approach is possible is that such examples involve neither relative

<sup>26</sup> The SLASH based analysis of Japanese relatives outlined in Sirai & Gunji (1998) manages to avoid this problem, without either special constructions or empty elements, but it is not fully lexical, because it assumes tense affixes combine with the associated lexical verb in the syntax (hence the affix is able to block higher percolation of the gap introduced by the lexical verb).

pronouns nor genuine gaps, so there are neither REL nor SLASH dependencies to terminate.<sup>27</sup> This approach seems particularly appealing in the cases like (53e), which would be analysed as just involving an attributive adjective (*fond*) which happens to take a complement, along the lines of (54), where [3] stands for the restrictions the adjective itself imposes. But we think a similar account of verbal participles and prepositions is equally plausible.

$$(54) \left[ \begin{array}{c} \text{HEAD} \\ \text{CONTENT} \end{array} \left[ \begin{array}{c} \text{MOD} \left[ \begin{array}{c} \textit{noun} \\ \text{INDEX [1]} \\ \text{RESTR [2]} \end{array} \right] \\ \text{INDEX [1]} \\ \text{RESTR [2] } \oplus \text{ [3]} \end{array} \right] \right]$$

Notice that in (54) we omit mention of the SUBJ. If we assume the noun-modifying entry is derived from a predicative entry, there are two obvious alternatives: a) that the predicative subject is suppressed; or b) that it is constrained to be unexpressed (i.e. *PRO*). In the latter case, the two approaches are very similar, the only difference being whether examples like those in (53) are classified as ‘clausal’. It is not clear whether this has empirical consequences.

### 3.4 Non-restrictive (Supplemental) Relatives

The examples of relative clauses considered so far have been ‘restrictive relatives’ (RRCs); they are interpreted as restricting the denotation of the nominal they modify to a subset of what it would be without the relative clause. So-called ‘supplemental’, ‘appositive’, or ‘non-restrictive’ relatives (NRCs) are different. They do not affect the interpretation of any associated nominal, and are generally interpreted with wide scope, much like independent utterances. For example, if *who understand logic* is read as an NRC as in (55a) it will be interpreted outside the scope of *Kim thinks*.

- (55) a. Kim thinks linguists, who understand logic, are clever. [NRC]  
 b. Kim thinks linguists who understand logic are clever. [RRC]

NRCs are often set off intonationally, and are subject to a number of surface morphosyntactic restrictions in English. In particular, they must be finite and

<sup>27</sup> This argument does not necessarily carry over to languages which allow relativisation of non-subjects in reduced relatives, such as Arabic. See Melnik (2006).

contain a *wh*-pronoun, witness the ungrammaticality of (56a) and (56b).<sup>28</sup>

- (56) a. \*Kim, for Sandy to speak to, will arrive later.  
 b. \*Kim, that Sandy spoke to, will arrive later.

The analysis of non-restrictives has attracted some attention in the HPSG literature.<sup>29</sup>

Where RRCs are typically nominal modifiers, NRCs are compatible with a wide range of antecedents. Holler (2003) provides an analysis of German non-restrictives which are adjoined to S, as in (57). Her account uses a version of the Pollard & Sag (1994) relativizer whose MOD value specifies a clausal (rather than nominal) target for modification, and looks for an appropriate antecedent for its first argument (the *wh*-expression) among the discourse referents contributed by the modification target (for example, the discourse referent corresponding to the proposition expressed by the main clause in (57)). The relative pronoun is thus treated rather like a normal pronoun.

- (57) Anna gewann die Schachpartie, was Peter ärgerte.  
 Anna won the game of chess, which Peter annoyed  
 ‘Anna won the game of chess, which annoyed Peter.’ (German)

Arnold (2004) provides an analysis of English non-restrictives of all kinds. This analysis also takes the relative pronouns involved in NRCs to be much like normal pronouns, but accounts for the syntactic restrictions by making minor modifications to constructions given in Sag (1997)’s analysis of restrictives. It assumes a uniform syntax for restrictives and NRCs, but provides a way for relative clauses to combine with their heads in two semantically distinct ways, either restrictively (in the normal way) or non-restrictively (making their semantic contribution at the same level as the root clause, accounting for the wide-scope interpretation). The fact that supplementary relatives are required to be finite

<sup>28</sup> More extensive discussion of differences between NRCs and RRCs can be found in Arnold (2007).

<sup>29</sup> Bilbiie & Laurens (2009) discuss what they call ‘verbless relative adjuncts’, such as (i), in French and Romanian

- (i) Trois personnes, [parmi lesquelles Jean], sont venues.  
 three people(FEM), [among which.FEM John], AUX come  
 ‘Three people, among which John, have come.’ (French)

These have non-restrictive semantics, and some similarities with relative clauses, but Bilbiie & Laurens point out significant differences, and argue for analysis that treats them rather differently, as involving different constructions.

and contain a *wh*-pronoun can then be simply stated (e.g. non-restrictive semantics entails a non-head daughter which is a *finite-wh-rel-cl*).<sup>30</sup> Likewise, the wider range of antecedents available to NRCs can be captured by relaxing the [MOD *noun*] constraint associated with *rel-cl* (so in principle all kinds of relative clause are compatible with any antecedent), and adding it as requirement associated with restrictive semantics.

The approach to NRCs developed in Arnold (2004) is ‘syntactically integrated’ – NRCs are treated as normal parts of the syntactic structure on a par with restrictive relatives. On the face of it, examples like (58b) are problematic for such an approach:

- (58) a. What did Jo think?  
b. You should say nothing, which is regrettable.

In context, the interpretation of (58b) is that it is regrettable that *Jo thinks* you should say nothing. This has been taken as an indication that the interpretation of NRCs requires antecedents that are not syntactically realised and only available at a level of conceptual structure (Blakemore 2006). However, Arnold & Borsley (2008) show that this is incorrect, and in fact a syntactically integrated account combined with the approach to ellipsis and fragmentary utterances of Ginzburg & Sag (2001) makes precisely the right predictions in this case and in a range of others.

Arnold & Borsley (2010) look at NRCs where the antecedent is a VP, and where the gap is complement of an auxiliary, as in (59).

- (59) Kim has ridden a camel, which Sam never would —.

This is unexpected, because such examples seem to involve an NP filler (*which*) being associated with a gap in a position where an NP is generally impossible, cf. \**Sam never would that activity*. Arnold & Borsley consider a number of analyses, including an analysis which treats *which* as a potential VP, and an analysis which introduces a special relative clause construction. However, they argue that the best analysis is one which relates examples like (59) to cases of VP ellipsis (as in *Kim has ridden a camel but Sam never would*), which involve the VP argument of an auxiliary verb being omitted from its COMPS list. The idea is that auxiliary verbs allow such an elided VP argument to have (optionally) a SLASH value that

<sup>30</sup> As stated, given Sag’s assumption that *that*-relatives are a variety of *wh*-relative, this wrongly predicts that supplemental *that*-relatives should normally be allowed. One way round this is to adopt an different analysis of *that*, but Arnold also considers an analysis whereby *that* has a different kind of REL value from ‘real’ relative pronouns.



contains an appropriately co-indexed NP. If such a SLASH value is present, normal SLASH amalgamation and percolation will yield (59) as a normal relative clause, without further stipulation.

NRCs normally follow their antecedents. However, as Lee-Goldman (2012) observes, there are some special cases where the NRC precedes the antecedent. Such cases involve the relative pronouns *which* and *what* with antecedents that have clausal interpretations, i.e. either actual clauses, as in (60a,c), or other expressions interpreted elliptically as with *later* in (60b).

- (60) a. It may happen now, or — *which would be worse* — it may happen later.  
 b. It may happen now, or — *which would be worse* — later.  
 c. It may happen now. *What is worse*, it may happen later.

Lee-Goldman provides a constructional account. It makes use of a feature RELZR, which is shared between the a relative clause and its filler daughter, and whose value reflects the identity of the relative pronoun (so possible values include *which*, *what*, etc.). Cases like (60c) are dealt with simply by means of a special construction which combines a *what*-relative clause with its antecedent in the desired order. The account of cases like (60a) and (60c) makes use of the idea of word order domains for linearisation originally proposed by Reape (e.g. Reape (1994), and ChXXXX). The relevant construction combines a phrase whose RELZR value is *which* (e.g. *which would be worse*) with a clause whose word order DOMAIN has a coordinator as its first element (e.g. the DOMAIN associated with *and it may have occurred more often*) and produces a phrase where the DOMAIN value of the *which* phrase appears after the coordinator and before the remainder of the clause, giving the desired result.<sup>31</sup>

## 4 Other Functions, Other Issues

For reasons of space, we have so far restricted the notion ‘relative clause’ to the typical case: clauses which are nominal modifiers, adjoined to nominals. This ignores a number of relevant phenomena, notably the fact that relative clauses are not necessarily nominal modifiers, and the possibility that even when they

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<sup>31</sup> Lee-Goldman handles the wide scope interpretation of NRCs by implementing a ‘multidimensional’ notion of CONTENT inspired by Potts (2005). He also extends the analysis described here to deal with cases of *as*-parentheticals (e.g. *As most of you are aware, we have been under severe stress lately*), arguing that *as* should be analysed as a relativizer, and that such clauses should be analysed as relative clauses.

function as nominal modifiers they need not be adjoined to nominals. In this section we will provide some discussion of these issues. Section 4.1 will briefly review HPSG analyses of cases where relative clauses are not adjoined to nominals. Section 4.2 will overview HPSG approaches on cases where clauses resembling relative clauses are not nominal modifiers.<sup>32</sup>

## 4.1 Extraposition

As noted above, relative clauses are typically nominal modifiers, and typically adjoined to the nominals they modify. However, this is not invariably the case: under certain circumstances relative clauses can be *extraposed*, as in (61), where the relative clauses (emphasised) have been extraposed from the subject NP to the end of the clause.

- (61) a. Someone might win *who does not deserve it*.  
b. Something happened then (*that*) *I can't really talk about here*.  
c. Something may arise *for us to talk about*.

Several different approaches to extraposition have been proposed in the HPSG literature.

One approach uses the idea of Word Order Domains, mentioned briefly in Section 3.4 above (and see Chapter ChXXXX). The idea is that an extraposed relative clause is composed with its antecedent nominal in the normal way as regards syntax and semantics, but that rather than being ‘compacted’ into a single DOMAIN element, the nominal and the relative clause remain as separate DOMAIN elements, with the effect that that relative clause can be ‘liberated’ away from the nominal, so that its phonology is contributed discontinuously from the phonology of the nominal, as in the examples in (61). See e.g. Nerbonne (1994), and Kathol & Pollard (1995) for details.

A second approach treats extraposition as involving a non-local dependency, introducing a non-local feature, typically called something like EXTRAP, which functions much like other non-local features (e.g. SLASH). Here the idea is that a

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<sup>32</sup> Among the other phenomena we have neglected, one should mention ‘amount’ relatives (e.g. Grosu & Landman (2017)), that is, relative clauses where what is modified semantically is not a nominal, but an *amount* related to the nominal, as for example in (i) where the relative clause gives information about the *amount* of wine, rather than the wine itself.

(i) It would take me a year to drink the wine [that Kim drinks on a normal night].

relative clause can make its semantic contribution as a nominal modifier ‘downstairs’, but rather than being realised as a syntactic DAUGHTER (sister to the nominal), the relevant properties (e.g. the LOCAL features) are added to the EXTRA list of the head, and percolated up the tree until they are discharged from the EXTRAP list by the appearance of an appropriate phrase-final daughter constituent, which contributes its phonology in the normal way, but makes no semantic contribution. Thinking from the top downwards, this is equivalent having a construction which allows a relative clause to appear e.g. as sister to a VP (as in (61a)) without affecting the VP’s syntax or semantics, so long as it is pushed onto the EXTRAP list of the VP, from where it percolates downwards until a nominal occurs which it can be interpreted as modifying (the apparatus needed to deal with the ‘bottom’ of the dependency might be a family of lexical entries derived by lexical rule, or a non-branching construction). See e.g. Keller (1995), Bouma (1996), Müller (2004), Crysmann (2005), Crysmann (2013).

A third approach is suggested in Kiss (2005), and adopted in Crysmann (2004) and Walker (2017). This approach exploits the more flexible approach to semantic composition provided by Minimal Recursion Semantics (MRS, Copestake et al. (2005)), in the case of Kiss (2005), and Lexical Resource Semantics (LRS, Richter & Sailer (2004)) in Walker (2017). The idea is that an extraposed relative clause appears as a normal syntactic daughter in its surface position, but the notion of semantic modification is generalised so that rather than the index of a modifying phrase being identified with that of a sister constituent (as standardly assumed), it may be identified with that of any suitable constituent *within* the sister. That is, adjuncts can be interpreted as modifying not just their sisters, but anything *contained in* their sisters — words and phrase to which they have no direct syntactic connection. This is implemented by means of a set valued ANCHORS feature, which is percolated upwards in the manner of a non-local feature, and which allows access to the indices of constituents from lower down. The flexibility of semantic composition afforded by MRS and LRS means that the right interpretations can be obtained.

A number of authors have argued for the superiority of an approach using EXTRAP-style apparatus (e.g. Müller (2004) and Crysmann (2013)), but in terms of theoretical costs and benefits there seems to be little to choose between these alternatives — the first and third approaches rely on particular approaches to word order and semantic composition, while EXTRAP-style analyses involve only on the more commonplace apparatus of non-local features (though with the added cost of special constructions or lexical operations to introduce and remove elements from EXTRA lists). Empirically, there are several issues that all approaches

deal with more or less successfully (for example, the ‘Right Roof Constraint’ Ross (1967) that prevents extraposition beyond the clause, cf. (62b)). However, a more significant factor may be how well different accounts integrate with analyses of extraposition involving other kinds of adjunct and complement (e.g. complement clauses, as in (63)), capturing similarities and differences (see e.g. Crysmann (2013)).

- (62) a. [That someone might win *who does not deserve it* ] is irrelevant.  
 b. \*[That someone might win ] is irrelevant *who does not deserve it*.
- (63) The question then arises *whether we should continue in this way*.

## 4.2 Other Functions

In this section we will briefly discuss phenomena involving clauses whose internal structures resemble relative clauses but which do not function as nominal modifiers.<sup>33</sup>

### 4.2.1 Complement Clauses

Perhaps the most obvious cases of this kind involve clauses with the internal structure of a relative clause which occur as complements, rather than adjuncts. The following are some examples.

- (64) a. This story is the \*(most) interesting *that we have heard*.  
 b. diejenige Frau \*(*die dort steht*)  
     the+that woman who                      there stands  
     ‘the very woman who is standing there’ (German)  
 c. It will not be hope *that will determine our future*, but action.  
 d. It will not be with hope *that we prevail*, but with action.  
 e. On l’a vu *qui enfuyait*  
     We him-have seen who                      run-awayIMPERF  
     ‘We saw him running away’ (French)

<sup>33</sup> One omission here is discussion of ‘relative-corerelative’ constructions, which can be found in Hindi and Marathi, *inter alia*, and which were given an analysis in Pollard & Sag (1994: 227ff). These involve the ‘paratactic’ combination of a clause that contains one or more relative pronouns, and what looks like a main clause containing coreferential pronouns, something like ‘which boy<sub>i</sub> saw which girl<sub>j</sub>, he<sub>j</sub> proposed to her<sub>j</sub>’ (meaning *the boy who saw the girl proposed to her*). Pollard & Sag’s analysis involves associating a set of indices in the REL value of the first clause, which are realized as relative pronouns in the normal way, and an identical set of CORRELATIVE set in the main clause, which are realised as normal pronouns.

In (64a) we have what looks like a *that* relative which is plausibly analysed as the complement of the superlative (notice that omitting the superlative makes (64a) ungrammatical).

The German example in (64b) exemplifies the *diejenigen* class of determiners, which require a complement that looks like a relative clause (and is analysed as such in Walker (2017)).

In (64c) we have a so-called *it*-cleft, a construction which features a clause resembling a relative clause, but rather than adding information about an associated nominal (as it would if it were a normal relative clause), the clause is interpreted as providing a presupposition ('something will determine our future'), for an associated 'focus' phrase (here the nominal *hope*, so the interpretation is roughly '...and/but that thing is not hope'). Notice that the focus phrase need not be nominal (e.g. in (64d) it is a PP *with hope*), again this is unlike normal (restrictive) relative clauses (which are nominal modifiers). In HPSG, following Pollard & Sag (1994: 260ff), *it*-clefts have typically been analysed as involving a lexical entry for *be* that takes an *it* subject, and two complements: an XP and an S which is marked as containing an XP gap. This makes *it*-clefts look rather different from relative clauses (the only real similarity being the existence of an unbounded dependency). It is not clear how this approach can be extended to examples like (65), where we seem to have an NP focus (*Sam*) which is not directly associated with an XP gap — instead the gap seems to be associated with what looks like a normal relative phrase (*on whom*). This might suggest that a better analysis might take more seriously the relationship of relative clauses and the clausal elements of *it*-clefts.

(65) It was Sam [ on whom she particularly focused her attention ].

Example (64e) contains what Koenig & Lambrecht (1999) call a 'Predicative Relative Clause' (PRC). Such clauses have the superficial form of a finite relative clause, but differ from them syntactically, semantically, and pragmatically. Koenig & Lambrecht analyse them as a form of 'secondary predicate' (cf. *running away* in English *We saw him running away*). Syntactically, they are restricted to post-verbal positions, and are only permitted with certain kinds of verb (notably verbs of perception, like *voir* 'see', and discovery, like *trouver* 'find'), and the relative pronoun must be a top level subject. Semantically, they are subject to constraints on tense, modality and negation (there must be temporal overlap between the perception/discovery event and the event reported in the relative clause, and the relative clause content cannot be either modal or negative). Pragmatically, their content must be asserted (rather than presupposed). Koenig &

Lambrecht develop a constructional analysis.<sup>34</sup>

#### 4.2.2 ‘Dependent Noun’ and ‘Pseudo-relative’ Constructions

The following exemplifies a Korean structure that contains what looks superficially like a relative clause:

- (66) Kim-u [[ sakwa-ka cayngpan-wi-ey iss-nun] kes]-ul mek-ess-ta  
 Kim-TOP apple-NOM tray-TOP-LOC exist-MOD KES-ACC eat-PST-DECL  
 ‘Kim ate an apple which was on the tray’ (Korean)

Here what is traditionally called a ‘dependent noun’ (*kes*) is preceded by a clause whose verb bears the morphological marking that is characteristic of relative clauses (the *-nun* affix).<sup>35</sup>

However, unlike a normal relative clause, this ‘dependent’ clause does not contain a gap, instead it contains what might be regarded as the semantic head of the construction (in this case, *sakwa-ka* ‘apple’), notice that the clause+*kes* constituent satisfies the selection restriction of the verb *mek-ess-ta* ‘ate’; this is what motivates the translation and explains why such clauses are often regarded as ‘internally headed’ relatives. Kim (2016b: 303ff) notes a number of differences between *kes*-clauses and normal relatives (e.g. *kes*-clauses do not allow the full range of relative affixes to appear), and suggests these clauses are better analysed as complements of *kes*. See also Kim (1996), Chan & Kim (2002), Kim (2016a), and references there.<sup>36</sup>

<sup>34</sup> An interesting aspect of this analysis is that it makes use of a non-empty REL value to distinguish finite clauses that can function as PRCs from other finite clauses — that is, PRCs are treated as genuine relative clauses.

<sup>35</sup> Japanese has a similar construction, involving the ‘nominalising’ particle *no*, which has received some attention in the HPSG literature (e.g. Kikuta (1998), Kikuta (2001), Kikuta (2002)). A difference is that there is no special ‘relative morphology’ on the clause in Japanese.

<sup>36</sup> Pollard & Sag (1994: 232ff) discuss a number of cases of what appear to be more plausible instances of ‘internally headed’ relatives from a number of languages (Lakhota, Dogon, and Quechua); the following is from Dogon:

- (i) [ ya inde mi we go ] yimaa boli.  
 yesterday person 1sg see-PN-Ø DEF die-PSP go-PN-3sg  
 ‘The person I saw yesterday is dead.’ (Dogon)

Here we have a determiner *go* preceded by a clause containing what would be the external head of a standard relative clause (in this case *inde* ‘person’). The key difference between this and the Korean case is the absence here of any obvious clause external nominal like *kes* which can be treated as the head which takes the relative clause as a complement. Pollard & Sag (1994) suggest (following Culy (1990)) that NPs like that in (i) involve an exocentric construction, but

Another Korean structure that has some similarity with relative clauses is the so-called ‘pseudo-relative’ construction, exemplified in (67)<sup>37</sup>

- (67) [ komwu-ka tha-nun ] naymsay  
 rubber-NOM burn-MOD smell  
 ‘the smell that characterises the burning of rubber’ (Korean)

There is again no gap in the relative clause; again, only one kind of marking is allowed on the verb (only past tense *-un*); and only a limited range of nouns allow this kind of relative clause; this makes them rather like complement clauses. However, it is less plausible to think of a noun like *naymsay* (‘smell’) taking a complement (unlike *kes*), and these clauses are like canonical relative clauses in not allowing topic marking (not surprising, there is no obvious topic ‘source’ clause). Kim suggests this is a special construction where the relation of head noun and relative clause is that the noun describes the ‘perceptive result’ of the situation described by the clause (e.g. the smell is the perceptive result of the rubber burning. See Kim (1998a), Yoon (1993), Chan & Kim (2002), Cha (2005), Kim (2016b).

#### 4.2.3 Free Relatives

Perhaps the most significant case of a clause type that resembles a relative clause but which does not function as a nominal modifier are the so-called ‘free’ (‘head-less’, or ‘fused’) relatives, exemplified in (68). These have received considerable attention in the HPSG literature.

- (68) a. She ate [*whatever I suggested*].  
 b. She ate [*what I suggested*].

These differ from canonical relatives (and interrogative clauses, which they also resemble) in having the external distribution of NPs rather than clauses (for example in (68b) *what I suggested* is the complement of *eat*, which does not allow

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no empty elements (neither an empty nominal, nor an empty relativiser). The NP consists of a determiner and a Nominal, where the Nominal consists of just a clause whose REL value contains the index of the Nominal. This REL value percolates down into the clause where it is identified with the index of one of the NPs, here the index of *inde* ‘person’: the effect of this is that the index of *inde* ‘person’ becomes the index of the whole NP (This ignores a number of technical and empirical issues to do with the percolation and binding-off of REL values).

<sup>37</sup> A similar construction can be found in Japanese, cf Kikuta (1998; 2001; 2002); Chan & Kim (2002).

clausal complements). They can contain relative pronouns which are not permitted in normal relatives, notably the ‘-ever pronouns’, *whatever*, *whoever*, etc, and *what*, witness the ungrammaticality of the following:<sup>38</sup>

- (69) a. \*She ate the thing(s) [*whatever I suggested*].  
 b. \*She ate the things(s) [*what I suggested*].

As the examples in (68) suggest, free relatives can be interpreted as involving either existential quantification, as in (68b) ‘the thing that I suggested’, or universal quantification, as in (68a) ‘everything I suggested’. There are some special restrictions. For example, in English free relatives must be finite, as can be seen from (70a), and there are restrictions on what *wh*-words are allowed (e.g. *what* is permitted, but *which* is not, compare (68b) and (70b)).

- (70) a. \*She ate [*what to cook*].  
 b. \*She ate [*which I suggested*].

The agreement properties of free relatives are somewhat surprising. For example, in (71a) the *wh*-phrase, *whoever’s dogs*, is plural, and triggers plural agreement on the verb in relative clause. This is not surprising since it is headed by a plural noun (*dogs*). However, the free relative as a whole triggers singular agreement, consistent with the agreement properties coming from the relative pronoun — *whoever* is singular, as can be seen from (71b). This is also consistent with the semantics: the free relative in (71a) denotes the person whose dogs are running around, not the dogs (in this it resembles an NP like *anyone whose dogs are running around*, which involves a normal relative clause construction).<sup>39</sup>

- (71) a. [[*Whoever’s<sub>sg</sub> dogs*]<sub>pl</sub> *are running around*]<sub>sg</sub> is in trouble.  
 b. *Whoever is/\*are running around (is in trouble).*

A further property of free relatives is that the relative pronouns are often sensitive to requirements imposed from the outside as well as those imposed within the relative clause (this is the so-called ‘matching effect’ in free relatives).

Consider, for example, the following German data, taken from Kubota (2003). (72a) shows a free relative in a position which requires nominative case marking, containing a relative pronoun whose role requires nominative marking. Since *wer* ‘who’ is nominative, all is well. By contrast, in (72b) while the nominative

<sup>38</sup> *What* is not a relative pronoun in ‘standard’ English, but it is in some other varieties, and (69b) is grammatical in those.

<sup>39</sup> This is not a universal property: Borsley (2008) notes that examples in Welsh resembling (71a) are interpreted as meaning that the dogs are in big trouble, not the owner.



*wer* satisfies the requirements within the relative clause, there is a case conflict because the free relative as a whole is the complement of a verb *vertrauen* ‘trust’ that requires a dative complement. The result is ungrammatical. Examples like (72c) show a complication. Here again there is a case conflict: within the relative clause, the relative pronoun is required to be accusative (complement of *empfehlen* ‘recommend’), and the free relative as a whole is in a nominative position. However, the result is grammatical, apparently because the morphological form of the neuter relative pronoun *was* ‘what’ can express with either nominative or accusative case (unlike the masculine *wer*).

- (72) a. Wer schwach ist, muß klug sein.  
 who.NOM weak is must clever be  
 ‘Whoever is weak must be clever.’  
 b. \*Wer klug ist, vertraue ich immer.  
 who.NOM clever is trust I ever  
 intended: ‘I trust whoever is clever.’  
 c. Was du mir empfiehlst, macht einen guten Eindruck.  
 what.NOM/ACC you me recommend makes a good impression  
 ‘What you recommend me makes a good impression.’

Following Müller (1997) and Müller (1999) on German, Free Relatives have received quite a lot of attention in the HPSG literature, with analyses dealing with a variety of languages, including: Arabic (Alqurashi 2012; Hahn 2012), Danish (Bjerre 2012; 2014), English (Kim & Park 1996; Kim 2001; Wright & Kathol 2003; Francis 2007; Yoo 2008; Kim 2017), German (Hinrichs & Nakazawa 2002; Kubota 2003), Persian (Taghvaipour 2005), and Welsh (Borsley 2008).

The central analytic problem is this: leaving aside the complication arising from case syncretism just mentioned, the existence of matching effects suggests that the *wh*-expression should be the head of the free relative (by and large, the distribution of free relatives depends on the properties of the *wh*-expression). So, for example, the NP *what* would be the head of *what I suggested*. But this is inconsistent with *what* being the filler of the gap in *what I suggested* (i.e. the missing object of *suggested*), because in a normal filler-gap construction the filler is *non-head*. If, instead, we assume that *what* is primarily the filler of the gap in the free relative, then we should assume that the clause *I suggested* — is the head of the free relative — and the distributional properties of the free relative are unexplained.

#### 4.2.4 Pseudo-clefts and Transparent Free Relatives

Two constructions that show some similarity with free relatives, and have received some attention in the HPSG literature, are ‘specificational’ pseudo-clefts, exemplified in (73), and so-called ‘transparent free relatives’ (TFRs), exemplified in (74).

- (73) a. A new coat is [what Kim will be wearing].  
 b. [What Kim will be wearing] is a new coat.  
 c. [What she did] was cut her hair.  
 d. [What she did not bring] was any wine.
- (74) a. She replied in [ what anyone would consider — a belligerent tone ].  
 b. Her reply was [ what anyone would consider — belligerent ].

Specificational pseudo-clefts typically consist of a *wh*-clause, *be*, and a ‘focal phrase’ (e.g. *any wine* in (73d)). The focal phrase corresponds to a gap in the *wh*-clause (e.g. in (73d) *any wine* is interpreted as the missing object of *bring*). They raise a number of issues that are not typical of relative clauses, notably the existence of ‘connectivity’ effects whereby the ‘focal phrase’ behaves as though it was part of the *wh*-clause (e.g. in (73d) the negative polarity item *any* is licensed by the negation in the *wh*-clause). Beyond this, it is not obvious whether the *wh*-clauses should be analysed as related to interrogatives, as in Yoo (2003), or as related to free relatives, as in Gerbl (2007).<sup>40</sup>

In TFRs the relative appears to function somewhat like a parenthetical modifier of a ‘nucleus’ (e.g. *a belligerent tone* in (74a)), which seems to provide the head properties of the phrase as a whole — so for example the TFR in (74a) has the characteristics of an NP, that in (74b) has those of an AP (it is a natural starting point to assume the nucleus is internal to the relative clause, since otherwise one has the puzzle of a relative clause which is both incomplete and occurs before the head it modifies). TFRs are in some ways even more restricted than other kinds of relative (only *what* is allowed as the relative expression), but in others less restricted (e.g. FRs have the external distribution of NPs, but the TFR in (74b) has the distribution of an AP, like its nucleus *belligerent*). Some approaches to TFRs

<sup>40</sup> It can be difficult to distinguish this kind of pseudo-cleft from cases involving a normal free relative. An example like *What she is wearing is a mess* is superficially similar to (73b), but it involves a free relative. Notice, for example, it can be paraphrased with a normal NP plus relative clause (as ‘The thing that she is wearing is a mess’) and *what* can be replaced with *whatever*. It does not have a paraphrase with an it-cleft or a simple proposition — it cannot be paraphrased as ‘It is mess that she is wearing’ or ‘She is wearing a mess’.

novel kinds of structure (e.g. ‘grafts’, van Riemsdijk (2006)), but Yoo (2008) and Kim (2011) provide HPSG analyses which capture the relevant properties using existing apparatus with only minor adjustments.

## Abbreviations

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