1 Introduction

This chapter is an attempt to survey some of the major areas that have seen significant work from an HPSG perspective in the past decade or so. For most of this work, Pollard & Sag 1987; Pollard & Sag 1994 continues to be an important point of reference, but many of the analyses summarized here go significantly beyond the original theory, both in terms of empirical coverage (of English and other languages) and analytic depth and comprehensiveness. The present survey is necessarily biased both in the selection of topics and the way that the various analyses are presented and compared. But these caveats nothwithstanding we hope that it will give the reader a reasonable idea of the research efforts around the middle of the second decade of HPSG's existence.

In keeping with HPSG's emphasis on lexical information, the first section concentrates on the licensing of phrasal dependents. We begin with the highly influential idea of argument composition as a way to dynamically determine the valence information of certain heads and continue with the conceptual separation between argument structure and valence in much of recent HPSG work. A third major topic involves the argument/adjunct distinction (or the lack thereof). In §2, we concentrate on issues of linear order, first on lexicalist equivalents of configurational analyses and second on departures from the "phrase structure grammar" part of HPSG. The common thread of the topics covered in §3 is the notion of "syntactic abstractness". This pertains to both the issue of whether extraction phenomena involve "traces" and the limits of a radically lexicalist view of syntactic licensing. One of HPSG's design features that distinguish it rather strongly from transformational grammar its integrative view with respect to semantic and pragmatic information. In §5 we discuss a number of recent developments in this area, in particular the treatment of scope and distinctions in illocutionary force as well as information structure and the representation of speaker beliefs and intentions. After reviewing a selection of work dealing with morpho-syntactic issues in §6, we conclude with a summary of recent developments in the logical foundations of the HPSG formalism (§7).

2 Argument structure

One of the most significant conceptual changes that distinguish Generalized Phrase Structure Grammar from HPSG is the treatment of combinatorial properties. While in GPSG, lexical items are linked to the subcategorization frame in which they can occur by means of an numerical index, HPSG folds the

combinatorial potential into the lexical description of an item by means of a valence feature. The single list-valued valence feature SUBCAT, proposed by Pollard (1984) and Pollard & Sag (1987) thus can be seen as the equivalent of a type constructor as used in Categorial Grammar. As in Categorial Grammar, the elements of a SUBCAT list directly reflect the combinatorial potential of the word or phrase in question. For that reason, early HPSG exhibits a close similarity to formalisms that combine the combinatorial engine of a categorial grammar with the features of a phrase structure grammar (for instance, Karttunen 1989, Zeevat 1988).

A number of linguistic problems have since been explored in HPSG and solutions have been developed that have significantly refined the original ideas and provided new insights into the nature of valence.

2.1 Argument composition

Since GPSG was designed to be faithful to the formalism of context-free grammars,[1] the kinds of syntactic dependencies that can be expressed in the syntactic rules are very restricted.

Moving subcategorization information into lexical properties at first blush appears to simply redistribute the division of labor between syntax and lexicon. However, it turns out that the HPSG approach affords a much wider perspective on the kind of relationships that are lexically encoded. In particular, the lexicalization of valence makes it possible to consider second-order dependencies, i.e., the valence of valence elements etc. This makes it possible to incorporate a lexicalized version of functional composition into HPSG grammars. Functional composition in categorial grammar is a mode of combination whereby the combinatorial properties of one category (here: `B/C`) are, as it were, "transmitted" to a functor category (here: `A/B`). As a result, we obtain a category that will be of type `A` provided it can combine with an element of type `C`, notated as `A/C`.

(1) $$\frac{\mathrm{A/B} + \mathrm{B/C}}{\mathrm{A/C}}$$

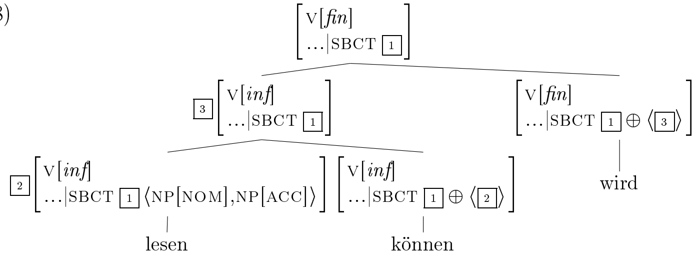
The HPSG analysis of controlled complements can be seen as a variant this basic idea, in that the subject requirement of the selected VP is identified with the subject requirement of a predicate selecting that VP (see Green):

(2) $\left[\text{SUBCAT} \left\langle \boxed{1}, \left[\text{V}\left[\text{SUBCAT} \left\langle \boxed{1}\ \textit{synsem} \right\rangle\right]\right]\right\rangle\right]$

[1] The one notable exception in this regard are proposals for the *liberation* of phrase structure, see §3.2 below.

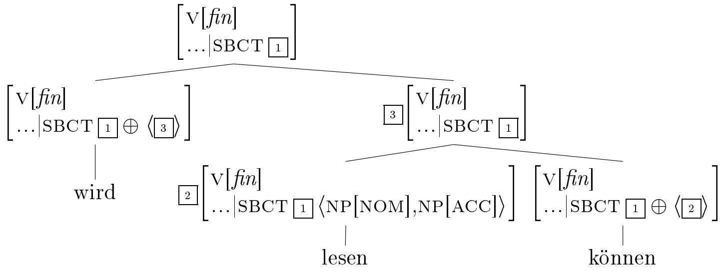
with left-branching structure (Hinrichs & Nakazawa 1989; Kathol 2000) illustrated in (8):[3]

(8)



Empirical evidence in favor of structures of this kind is presented by Hinrichs & Nakazawa (1989), who point out, among other things, that the order variation known as *Oberfeldumstellung* (or "aux-flip") receives an elegant account in terms of reordering of constituents under their left-branching analysis:

(9)



In §3, we will return to evidence presented by Kathol (2000) that a purely phrase structure-based view fails to cover the full range of order variation among verb cluster elements seen in German and Dutch.

Argument composition analyses in effect establish "extended" valence relations between governing verbs and the phrasal argument of more deeply embedded verbs. This property has been the basis for novel proposals for the treatment of passives suggested by Kathol (1994) and Pollard (1994b). Instead

[3]Chung (1993) argues that similar constructions in Korean should be handled by means of a valence feature distinct from SUBCAT that is exclusively responsible for combining verbal material. Rentier (1994) makes a closely related proposal for Dutch verb clusters, which is extended and further motivated empirically by Kathol (2000).

of just passing the valence requirements of the embedded verb, a passive auxiliary can be thought of as actively manipulating the set of valence elements that they inherit from the governed dependents. As a result, passives on the clausal level can be analyzed as a form of object-to-subject raising. Such an approach has a number of desirable consequences over the more standard manipulation of the verb's valence in terms of lexical rules, such as the fact that the morphologically spurious distinction between passive and past participles is no longer needed.

Other areas of German grammar for which argument composition analyses have been proposed include derivational morphology (Gerdemann 1994) and the problem of preposed complements of nouns (De Kuthy & Meurers 1998). In addition, Abeillé & Godard (1994) have argued that tense auxiliaries in French should be analyzed as inheriting the arguments of their main verbs via argument composition, albeit with a flat constituent structure. Abeillé *et al.* (1998) show how this idea can be extended to certain causative constructions with *faire*. Another language for which argument composition has yielded insightful analysis is Korean, both for auxiliaries (Chung 1993) and control verb constructions (Chung 1998a, cf. also Bratt 1996). Finally, Grover (1995) proposes to analyze English *tough*-constructions by means of argument composition, as an alternative to the more standard approach that attributes missing objects inside the VP complements of *tough*-adjectives to an extraction effect.

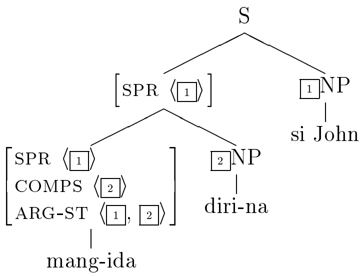
2.2 Valence and argument structure

Another development that has generated considerable work in recent years is the separation of valence and argument structure.

The previous section assumes that a single uniform valence attribute (SUBCAT) is responsible for defining the combinatorial potential of lexical and phrasal heads. This reflects a view of complementation assumed in early HPSG ("HPSG1", Pollard & Sag 1987) through the state of the theory represented in the first eight chapters of Pollard & Sag 1994 ("HPSG2"). The crucial assumption underlying this approach to valence is that grammatical relations are derivative of valence. For instance, the notion of subject, as it plays a role in agreement, binding theory, and other phenomena, can be recovered as the least oblique ("leftmost") among the valence elements of some predicator. Despite its conceptual simplicity, later versions of HPSG ("HPSG3"), beginning with chapter 9 of Pollard & Sag 1994, have adopted an approach that singles out subjects from other syntactic arguments by means of a separate valence feature SUBJ (as opposed to COMPS, see also Green forthcoming). This idea was first proposed by Borsley (1987), who points out a number of inadequacies

b.*[Mang-ida si John] diri-na.
AV-saw PM John self-his

c.

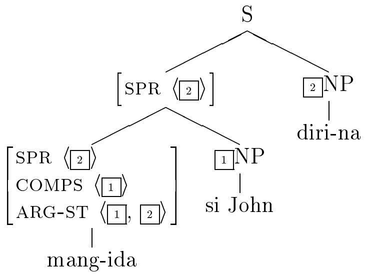


Compare this now with objective voice (OV) verbs. Taking again the distribution of reflexives as a diagnostic, we now have to assume that the VP-internal NP has the status of a subject. But this means that in the OV case, valence and argument structure are aligned in a way that is precisely opposite from the AV cases.

(14) a.*[Di-ida diri-na] si John.
OV-saw self-his PM John

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

c.



Separating information about valence (i.e., syntactic combinatorial potential) from argument structure (i.e., for the most part, semantic roles with syntactic relevance) it becomes possible to treat a number of phenomena as lexical in nature which otherwise would have to be handled in syntactic terms. In turn this keeps at a minimun the structural complexity in terms of genuine syntactic elements. The issue of structual complexity will also be of concern in the next subsection as well as in §4.

2.3 Dependents and Lexical Amalgamation

The following subsections deal with two issues in the area of argument structure which at first appear to be independent of each other but turn out to be closely linked in recent HPSG work. First, is there a fundamental distinction between complements and adjucts and, second, what is the role of the syntactic head in licensing information about missing dependents?

2.3.1 Complements and Adjuncts

It is a common and generally unquestioned assumption in much of contemporary linguistics that there is a syntactic distinction between complements and adjuncts, and that these two classes of dependents occupy different tree-configurational positions. This was also the position of early HPSG work.

However, the evidence for this syntactically understood complement/adjunct dichotomy has recently been re-examined within HPSG. For example, Hukari & Levine (1994, 1995) show that there are no clear differences between complement extraction and adjunct extraction, and Bouma *et al.* (2000) build on these observations and propose a unified theory of extraction based on the assumption that there is no tree-configurational distinction between complements and (at least a class of) adjuncts. Earlier, eliminating

Similar lexical amalgamation is also assumed for the purposes of the lexical analysis of quantifier scoping in Manning *et al.* 1999 and Przepiórkowski 1997, 1998, and for the flow of pragmatic information in Wilcock 1999.

3 Phrase structure and linear order

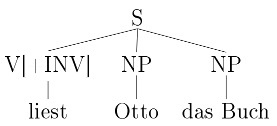
3.1 Configurationality

A theme running through much of the HPSG literature has been the lexicalization of relationships that have been treated in tree-configurational terms in other theories. HPSG's binding theory is a prime example of how certain asymmetries among coarguments can be reinterpreted in terms of obliqueness on valence/argument structure. As a result, there is no longer a need for expressing such asymmetries in tree-structure terms such as c-command.

Similarly, variation in phrase order of the kind seen in Japanese or German has typically been seen in terms of liberal linear precedence constraints over flat clausal tree structure rather than the result of manipulating highly articulate phrase structure via scrambling movements (cf., for instance, Uszkoreit 1987 and Pollard 1996 for German and Chung 1998a for Korean).[5] HPSG analyses of this kind thus are similar to recent LFG proposals to nonconfigurational languages in terms of flat clause structures (cf. for instance Austin & Bresnan 1996).

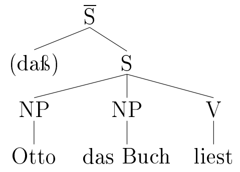
A issue closely related to order variation among phrasal dependent is that of the placement of verbal heads in the Germanic languages (and elsewhere). Given a flat structure analysis for the phrasal constituents of the clause, the different positionings of the finite verb in verb-first and verb-last clauses then reduce to clause-initial vs. clause-final placement of that verb (typically mediated by a binary-valued feature such as INV, familiar from HPSG analyses of English subject-auxiliary inversion), cf. Pollard 1996:

(19) a.



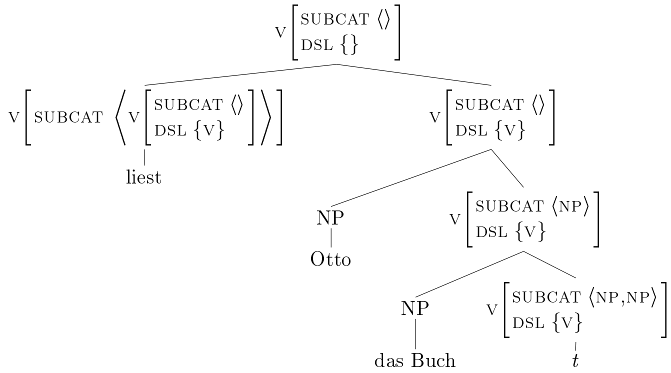
[5] Note however, that this correlation does not follow by necessity. For instance, Kiss 1995 and related works assumes a strictly binary branching clause structure for German of the kind familiar from transformational analyses.

b.



Analyses of this kind clearly differ sharply from the standard transformational approach in terms of movement of the finite verb from its clause-final base position to a clause-initial position (Comp) via head-movement. The underlying intuition that verb placement is dependent on constituent structure is in fact shared by various HPSG-based proposals that offer a number of different ways in which verb movement may be implemented in HPSG, cf. Kiss & Wesche 1991, Kiss 1995, Netter 1992, Frank 1994. The representation given in (20) illustrates how to capture the dependency between the finite verb (*liest*) and its putative base position in terms of the additional nonlocal feature DSL (for "double slash"):[6]

(20)



Accounts of verb placement in terms of nonlocal dependencies of this kind are discussed by Kathol (1998) and Kathol (2000), who points out that none of the putative evidence for a dislocation-based analysis in fact holds up under closer scrutiny.[7] In addition, he notes a number of technical and conceptual

[6] A feature with this name and function was first suggested by Jacobson (1987).

[7] Cf. also Wechsler 1986 for an earlier critique of movement-type analyses of verb placement in Swedish.

Reape's proposal bears a strong resemblance to previous, approaches to discontinuous constituents, in particular Pullum and Zwicky's notion of "liberation" (Pullum 1982, Zwicky 1986). Thus, the the VP in (22) can be thought of as being "liberated" in the sense that its immediate constituents may intermingle with elements from outside that VP. Unlike Pullum and Zwicky's proposals, HPSG order domains provide a level of syntactic representation from which the range of possible intrusion effects can be read off directly. Thus, while the VP *dieses Buch zu lesen* gives rise to two list elements in the clausal domain, the NP *dieses Buch* contributes only one element. Since domain elements cannot themselves be broken apart, it is predicted that discontinuities are allowed only in the former case, but not in the latter. Finally, if order domains take the place of local trees as the range of potential order flexibility, it is natural to interpret linear precedence constraints as well-formedness conditions over order domains.

3.2.1 Linearization-based vs. valence-based approaches

The initial appeal of structures such as (22) is that they allow an analysis of German which—notwithstanding the differences in linear order—is remarkably similar to the constituency commonly proposed for the equivalent English sentences in nontransformational approaches.

Therefore, it appears that argument composition and order domains constitute two alternative ways of allowing for embedded verbs and their notional objects to occur separated in a "middle distance dependency" construction. This has occasionally been perceived to be an embarrassment of riches with no obvious way of telling which analysis is to be preferred. However, as is discussed in detail in Kathol 1998, Reape's analysis can be shown to ultimately unsatisfactory in that it fails to link the argument structure of more deeply embedded predicates to that of the governing verbs—which is precisely the leading intuition behind the argument composition approach. Evidence that such linkage is in fact necessary comes from a phenomenon known as 'distant' or 'long' passive (cf. Höhle 1978). In (23), the NP *der Wagen* is the direct object of the embedded verb *zu reparieren*, yet its nominative case marks it as the subject of the passivized predicate *wurde versucht*.

(23) ?Der Wagen wurde zu reparieren versucht.
the car-NOM was to repair tried
'Someone tried to repair the car.'

If all predicates of the *versuchen*-class invariably embed VPs, as suggested by Reape, the direct object of the embedded verb (*den Wagen* in (23)) would

never be 'visible' to the valence change that accompanies the passivization of *versuchen*.[8] Thus, Reape's approach wrongly predicts that such constructions should not exist. In contrast, any argument composition approach can easily accommodate such cases because the syntactic arguments of the most embedded verbal predicate become also the syntactic dependents of the governing predicates.

Even though facts such as these cast doubt on the appropriateness of order domains in description of the particular phenomena that they were originally developed for, there nevertheless appear to be other discontinuous constituency phenomena for which order domains represent an elegant descriptive tool. For instance, Kathol (1998) points out that argument composition of the kind proposed by Hinrichs and Nakazawa fails to correctly account for certain orderings within Dutch verb clusters. In Dutch we typically find head-first ordering between the governing verb and the governed subcomplex. For example, in (24a), *moet* as the highest governing verb precedes *hebben gelezen*. Combinations of tense auxiliaries and their dependent verbs can generally occur in either order; when they occur in head-final order, as in (24b), the preferred occurrence of the governing verb *moet* (in standard Dutch) turns out to be between *gelezen* and *hebben*. This kind of ordering cannot be described assuming only argument composition and binary branching verbal complexes of the kind initially proposed by Hinrichs and Nakazawa.

(24) a. dat Jan dit boek moet$_1$ hebben$_2$ gelezen$_3$.
that Jan this book must-FIN have-INF read-INF
'that Jan must have read the book.'

b. dat Jan dit boek gelezen$_3$ moet$_1$ hebben$_2$.
that Jan this book read-PSP must-FIN have-INF

Kathol (2000) shows how facts such as these can be given an elegant solution if argument composition is combined with order domains that permit the discontinuous linearization of certain governed subcomplexes such as *gelezen hebben* in (24). Such an analysis goes a long way toward a uniform account of the ordering possibilities in a number of variants of German and Dutch by factoring out dialect-independent constituency and dialect-dependent linearization constraints.

[8] This argument of course pressuposes a lexicalist approach to passives in terms of variation in argument structure or valence rather than manipulation of tree configuration.

see it as a phrasal element of some category (usually nominal or prepositional) which is phonologically empty and contributes its own local information to the set of nonlocal SLASH information:

(28)
$$\begin{bmatrix} \text{PHON } \langle\ \rangle \\ \text{SYNSEM} \begin{bmatrix} \text{LOCAL } \boxed{1} \\ \text{NONLOCAL} \mid \text{SLASH } \{\boxed{1}\} \end{bmatrix} \end{bmatrix}$$

However, the notion of a phonologically empty syntactic element is somwhat antithetical to the spirit of a surface-true theory such as HPSG. Note also that for a variety of constructions the inaudibilia of transformational analyses have already been dispensed with. This is true in particular for PRO in infinitival constructions (simply an nonsaturated valence requirement) and the trace of A-bar movement (passive subject is not linked to a syntactic object position). Eliminating *wh*-traces thus is tantamount to shedding the last vestiges of a derivational view of grammar.

The abolishment of *wh*-traces poses no technical problem, especially if one adopts the distinction between "static" argument structure and "dynamic" valence. From this perpective, an extracted element is nothing but a locally unrealized element of the ARG-ST list. Rather than licensing a sister constituent of that predicator the SLASH element is realized as a filler (or bound some other way, as in the case of *tough*-constructions). Since the argument structure remains unaffected by the specifics of syntactic realization,[9] any evidence for asymmetries among coarguments can be explained as asymmetries among members of ARG-ST, rather than a valence feature. For instance, this easily accounts for the fact that fillers in English topicalization constructions may be reflexives with an antecedent in the following clause—notwithstanding the fact that the reflexive is presumably in a configurationally higher position than its antecedent (Pollard & Sag 1994:265):

(29) a. (John and Mary are stingy with their children.)
But themselves$_i$, they$_i$ pamper.

While many facts related to extraction phenomena allow for both a trace-based and a trace-less account, this does not entail that both styles of analysis are exactly equivalent in their empirical predictions.

As has been argued by Sag & Fodor (1994), the evidence for the existence of traces proposed in the literature is often extremely weak. At the same time

[9] In addition to being realized as a "gap" matched by a filler, another noncanonical argument realization is as a clitic. See §6.1 below.

there are phenomena that can be explained more straightfowardly if no traces are assumed.

As an example of arguments of the first kind, consider *wanna*-contraction, one of the most celebrated pieces of evidence in favor of traces. The basic idea is that *wh*-traces disallow the phonological contraction of *want* and *to*. The relative clause in (30a) is ambiguous between a subject or object control reading for the understood subject of *succeed*. In contrast, the variant in (30b) only permits the subject control reading which is supposedly explained by the lack of contractabily across a *wh*-trace.

(30) a. This is the man I want to succeed.
b. This is the man I wanna succeed.

However, as has been pointed out by Pullum (1997), there are numerous technical and conceptual problems with this assumption. Instead a fully lexical, traceless analysis of the above contrast is available if *wanna* is thought of as a morphosyntactically underived subject-control verb which does not license an object.

Turning to positive evidence against traces, consider the following extraction facts:

(31) a.*Who$_i$ did you see [__$_i$ and a picture of __$_i$]?
b.*Which student$_i$ did you find a picture of [a teacher of __$_i$ and __$_i$]?
c.*Who did you compare [__$_i$ and __$_i$]?

The operative constraint at work here is that no conjunct must itself consist only of an extraction site. However, this fact is not predicted by the constraints on extraction from coordination constructions which only require each conjunct to be affected in an "Across-the-Board" fashion. Thus, additional stipulations are necessary to capture the ungrammaticality of (31). In contrast, if licensing of extracted phrases is handled entirely by lexical amalgamation of gap information the facts in (31) fall out for free. This is because lexical amalgamation only applies to lexical heads. In order to license the extraction of an entire conjunct, there would have to be a lexical head that could serve as the locus for the gap amalgamation. But no such lexical head arguable exists in coordination constructions, hence there is no way to license the ungrammatical examples in (31).

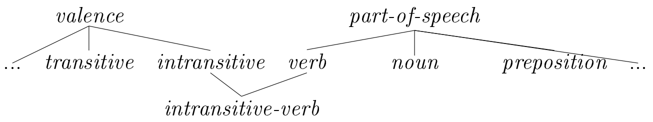
Together with the elimination of such inaudibilia as *pro* (or empty relativizers as discussed in the next subsection), the abolishment of traces from constructions can be defined entirely by reference to their topological structure, abstracting away from the combinatorial licensing. In the case of root declarative clauses this makes it possible to have a uniform description of this construction whether the initial element is a filler (as in (27) above) or some other element, such as the positional expletive *es*, illustrated in (34):

(34)
$$\begin{bmatrix} \textit{root-decl} \\ \text{DOM} \left\langle \begin{bmatrix} \textit{vf.} \\ \text{P'N } \langle \textit{es} \rangle \\ \text{EXPL} \end{bmatrix}, \begin{bmatrix} \textit{l. s.} \\ \text{P'N } \langle \textit{sah} \rangle \\ \text{V[FIN]} \end{bmatrix}, \begin{bmatrix} \textit{mf.} \\ \text{P'N } \langle \textit{niemand} \rangle \\ \text{NP[NOM]} \end{bmatrix}, \begin{bmatrix} \textit{vf.} \\ \text{P'N } \langle \textit{d. Blume} \rangle \\ \text{NP[ACC]} \end{bmatrix} \right\rangle \end{bmatrix}$$

4.3 Type hierarchies for nonlexical generalizations

A complaint often levelled against construction-based approaches is that they are merely descriptive and not explanatory and hence do not try to uncover the underlying factors that are responsible for the patterns observed in the data. Proponents of the constructional perspective tend to consider such criticism as misguided given that the reductionist approach often only succeeds because it relies on an arbitrary selection among the data considered worthy of explanation ("core" vs. "periphery"). In addition, the kind of reductionism seen in many varieties of abstract syntax fails to appreciate the degree to which constructional complexity is often simply hidding within a system of phonologically null elements for which little or no empirical motivation is provided.

Finally, critics of constructional approaches fail to realize that the flipside of describing what is special and irreducible about a given entity in the grammar is an account of all the ways in which a given construction SHARES properties with other elements of the grammar. A particularly powerful device in this respect are multiple inheritance hierarchies. Such hierarchies are well-known from the way that lexical information is organized in HPSG. For instance, a verbal form such as *walks* can intuitively be characterized in terms of at least two parameters of variation. The first is the lexical class or part of speech, which groups *walks* together with such forms as *is*, *proved*, and *singing*. The second is valence, which puts *walks* in the same class as *sleeping*, *house*, or *abroad*, cf. (35).

(35)


Thus once membership in these and other classes has been established for a given lexeme, only the lexically indiosyncratic properties need to be listed for it.

Since HPSG does not assume any ontological distinction between words other linguistic units (all are assumed to be instances of *sign*), it is straightforward to extend multiple inheritance hierarchies to phrasal constructions as well. For instance, the phrasal type *bare-rel-cl* in (33) above is simultaneously an instance of the phrase types *non-wh-rel-cl* and *fin-hd-subj-ph*. The first classifies the construction as a particular subinstance of non-*wh* relative clauses, which in turn are one way in which the "clausality" of a phrase are specified, that is its combinatorial and semantic properties.[11] The second accounts for its internal composition as a subject-predicate construction (and, for instance, not as a filler-head construction as in the case of *wh*-relative clauses). While there is often a residue of properties that cannot be accounted for by stating what larger constructional classes a given entity inherits from, it turns out that bare relative clauses are defined in their entirety by their supertypes. Thus, far from simply providing a list of available constructions, the construction grammatical approach is very much concerned with stating all available generalizations at all applicable levels. As a result, as Kathol (2000:***) points out, the equivalent of the representational complexity inherent in the abstract structures posited in transformational analyses lies in the various inheritance relationships that tie the constructions of a language into a complex web of dependencies of different kinds, sometimes referred to as the "constructicon".

5 Meaning in HPSG

As Halvorsen (1995), Nerbonne (1992, 1995) argue at length, LFG- or HPSG-style constraint-based semantics has several advantages over, e.g., Montagovian kind of semantics in that the latter but not the former assumes a homomorphism between syntax and semantics. In contrast, constraint-based semantics allows for a much greater freedom in stating analyses at the syntax/semantics interface, and also makes it easy to formulate phonological and pragmatic constraints on meanings (cf. §5.2). In addition, constraint-based semantics seems to be particularly well-suited for expressing semantic underspecification (cf. §5.1) and it allows to formulate theories of combinatorial semantics which go beyond compositionality, a notion recently argued to be vacuous at worst and dispensable at best (Zadrożny 1994;

[11] Other ways of instantiating "clausality" include imperative, declarative, or interrogative clauses.

(41) $$\mathrm{Desc}_1 = \begin{bmatrix} \textsc{ss}|\textsc{loc}|\textsc{cont} & \begin{bmatrix} \textit{nom-obj} \vee \textit{quant} \\ \textsc{qstore}\ \boxed{1} \end{bmatrix} \vee \begin{bmatrix} \textit{psoa} \\ \textsc{qstore}\ \boxed{2} \\ \textsc{quants}\ \boxed{3} \end{bmatrix} \\ \textsc{new-qs}\ \boxed{5} & \end{bmatrix}$$

where $\boxed{1} = \boxed{5} \uplus$ the union of QSTOREs of selected arguments,
$\boxed{4} =$ the set of elements of $\boxed{3}$,
$\boxed{1} = \boxed{2} \uplus \boxed{4}$.

(42) $$\mathrm{Desc}_2 = \begin{bmatrix} \textsc{ss}|\textsc{loc}|\textsc{cont}\ \boxed{1} \\ \textsc{arg-st}\ \langle \ldots, [\textsc{cont}\ \boxed{1}], \ldots \rangle \end{bmatrix}$$

(I'm still wondering if the preceding could instead be cast in prose) What this constraint says is that, unless a *word* inherits its CONTENT value from one of its arguments (cf. Desc_2), in which case there is no quantifier retrieval, it must satisfy the description Desc_1. In case the *word* has CONTENT value of type *nom-obj* or *quant*, it simply collects elements of QSTOREs of its arguments (and adds any quantifiers it may introduce in NEW-QS). In case of *word*s with CONTENT values of type *psoa*, though, the set of quantifiers collected from arguments (and from NEW-QS) is split between the *word*'s QSTORE (quantifiers to be retrieved higher in the tree) and QUANTS (quantifiers retrieved locally). AK

Finally, *selected arguments* in (41) is defined in such a way that, e.g., the *synsem* of *a unicorn* in (36a) is a selected argument of the lower verb (*approaching*), but not of the higher verb (*appears*). This way the quantifier is introduced by *a unicorn* at the level of *approaching*.

According to this analysis, (36a) has exactly two readings: *a unicorn* is either retrieved by the word *approaching*, or it is present in the QSTORE value of *approaching* and is retrieved higher, by the word *appears* (note that phrasal retrieval is not allowed by this analysis). See Pollard & Yoo 1998 and Przepiórkowski 1997, 1998 for details.

Recursive Modification Kasper (1997) notices that the original semantic theory of Pollard & Sag 1994 does not account for phrases that contain modifiers of their own as, e.g., in (43).

(43) a. Bob showed us an [[apparently] simple] example.

b. Congress reconsidered the [[[obviously] unintentionally] controversial] plan.

In particular, according to the analysis in Pollard & Sag 1994, such cases of recursive modification would receive iterative modification readings; for example,

(43) would be assigned the meaning in which the simple example is apparent, and not the actual reading in which the example is apparently simple.

On the basis of this and other considerations, Kasper (1997) proposes to distinguish between inherent and combinatorial semantics, with CONTENT values reflecting now only inherent semantics of a sign. For example, the adjective *controversial*, is assumed to always have CONTENT value as indicated in (44), whether it is used attributively or predicatively.

(44) $$\begin{bmatrix} \textsc{content} & \begin{bmatrix} \textsc{reln}\ \textit{controversial} \\ \textsc{inst}\ \boxed{1} \end{bmatrix} \end{bmatrix}$$

This differs from the position of Pollard & Sag 1994, where *controversial* has CONTENT of type *nom-obj* when used attributively, and of type *psoa* when used predicatively.

Now, in order to deal with recursive modification, Kasper (1997) enriches values of MOD as in (45) and revises the Semantics Principle as in (46).

(45) $$\begin{bmatrix} \textit{head} & \\ \textsc{mod} & \begin{bmatrix} \textit{mod} \\ \textsc{arg}\ \textit{synsem} \\ \textsc{icont}\ \textit{content} \\ \textsc{econt}\ \textit{content} \end{bmatrix} \end{bmatrix}$$

(46) Semantics Principle (ignoring quantification)

a. For a head-adjunct phrase, the semantic content (CONTENT) is token-identical with the MOD|ECONT value of the adjunct daughter, and the MOD|ICONT value of the adjunct daughter is token-identical withthe adjunct daughter's CONTENT.

b. For all other types of headed phrase the CONTENT is token-identical with the CONTENT of the head daughter.

The value of MOD|ARG corresponds to the value of MOD in Pollard & Sag 1994—it is the *synsem* of the modified element; the value of MOD|ICONT is equal to the CONTENT value of the maximal projection of the modifier (it is different from the modifier's CONTENT if the modifier is itself modified); and the value of MOD|ECONT specifies the combinatorial meaning of the modifier, i.e., the CONTENT value of the phrase resulting from the combination of the modifier phrase with the modified, i.e., ECONT is a function of ICONT and ARG.

Assuming lexical specifications of *potentially* and *controversial* as in (47) and (48), respectively, this analysis leads to the structure of the phrase *potentially controversial plan* schematically described in (49).

(50) a.#Jackie believed/doubted/assumed... Bo's weight / my phone number.

b. Jackie knows/discovered Bo's weight / my phone number.

Moreover, TF predicates treat proposition-denoting complements purely referentially, in the sense of **(Quine 1961, pp. 139–145)**: AP

(51) a. **Substitutivity**:

The Fed's forecast was that gold reserves will be depleted by the year 2000.
Brendan believes/denies... the Fed's forecast.
Hence, Brendan believes/denies... that gold reserves will be depleted by year 2000.

b. **Existential Generalization**:

Brendan believes/denies... that gold reserves will be depleted by year 2000.
Hence, there is a claim/hypothesis/prediction that Brendan believes/denies...

On the other hand, factive predicates do not seem to treat proposition-denoting complements purely referentially, e.g.:

(52) **Substitutivity**:

The Fed's forecast was that gold reserves will be depleted by the year 2000.
(The Fed's forecast is true.)
Brendan discovered/was aware of the Fed's forecast.
IT DOES NOT FOLLOW THAT Brendan discovered/was aware that gold reserves will be depleted by year 2000.

This suggests that the denotata of complements of TF predicates (i.e., propositions) are different from the denotata of complements of factive predicates (i.e., facts or, more generally, possibilities).

Another difference between facts and prepositions is that the former, but not the latter, may enter into causal relations:

(53) a. The fact that Tony was ruthless made the flight against her difficult.

b. The possibility that Glyn might get elected made Tony's hair turn white.

c.#The claim/hypothesis/proposition that Tony was ruthless made the flight against her difficult.

On the other hand, truth is predictable only of propositions, not of facts (or possibilities):

(54) a.#The fact that Tony was ruthless is true.

b. The claim/hypothesis/proposition that Tony was ruthless is true/false.

Apart from complements of factive verbs, facts are the content of the illocutionary acts of reminding and exclaiming, e.g.:

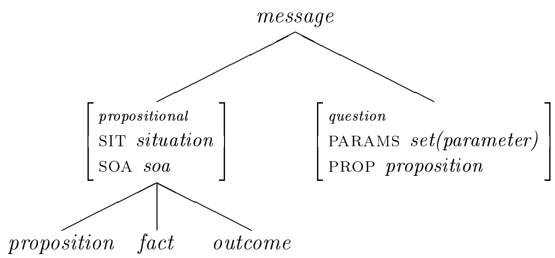
(55) a. Laurie: Why don't the vendors here speak Straits Salish?
Bo: We're in New York City for Pete's sake.

b. Bo reminded Laurie (of the fact) that they were in New York City.

It is considerations like these that lead Ginzburg & Sag (2000) to introduce *proposition* and *fact* as different subtypes of *propositional*. Another subtype of *propositional* which they distinguish is *outcome*, the type of imperative clauses, *inter alia*. What all these *propositional* contents have in common is their internal structure, which involves a situation (the value of the attribute SIT) and a state of affairs (SOA; the value of the attribute SOA), the latter corresponding to Pollard & Sag's (1994) parametrized state of affairs (*psoa*).

On the other hand, *questions*, which correspond to the denotata of clausal complements of such predicates as *wonder* and *ask*, are represented as propositional abstracts, with the relevant notion of abstraction being **(Aczel and Lunnon's 1992)** *simultaneous abstraction*. In terms of HPSG feature geometry, *questions* are *messages* with two new attributes, PARAMS, whose value is the set of (abstracted) parameters, and PROP, with values of type *proposition*. This is summarized below. AP

(56)



b. $$\begin{bmatrix} \textit{abstraction} & \\ \text{TYPE} & \begin{bmatrix} \textit{c-type} & \\ \text{IN} & \boxed{1}\ \textit{entity} \\ \text{OUT} & \boxed{2}\ \textit{truth} \end{bmatrix} \\ \text{VAR} & \boxed{3} \begin{bmatrix} \textit{var} & \\ \text{TYPE} & \boxed{1} \end{bmatrix} \\ \text{ARG} & \begin{bmatrix} \textit{application} & \\ \text{FUNC} & \begin{bmatrix} \textit{professor} & \\ \text{TYPE} & \begin{bmatrix} \textit{c-type} & \\ \text{IN} & \boxed{1} \\ \text{OUT} & \boxed{2} \end{bmatrix} \end{bmatrix} \\ \text{ARG} & \boxed{3} \end{bmatrix} \end{bmatrix}$$

In this approach, combinatorial semantics is particularly simple: the CONTENT value of a *phrase* is always the result of functional application of the CONTENT value of one daughter to the CONTENT value of the other daughter (with additional applications of β-reductions, as needed).

Richter & Sailer 1999a, 1999b also introduce the following Quantifier Raising lexical rule[13] responsible for type shifting.

(60) $$\begin{bmatrix} \textit{word} & \\ \text{SYNSEM}|\text{LOC}|\text{CONTENT} & \lambda x_1 \ldots \lambda x_i \ldots \lambda x_n.\phi \end{bmatrix} \Longrightarrow$$
$$\begin{bmatrix} \textit{word} & \\ \text{SYNSEM}|\text{LOC}|\text{CONTENT} & \lambda x_1 \ldots \lambda X_i \ldots \lambda x_n.X_i(\lambda x_i.\phi) \end{bmatrix}$$

With this type shifting lexical rule in hand, one of the two meanings of, say, *someone loves everyone* may be derived by type shifting the basic meaning of *love* (given in (61a)) to (61b) and, subsequently, to (61c), and then by usual functional applications, indicated in (62).

(61) a. $\lambda y \lambda x.\mathsf{love}'(x,y) \stackrel{(60)}{\Longrightarrow}$

b. $\lambda y \lambda X.X(\lambda x.\mathsf{love}'(x,y)) \stackrel{(60)}{\Longrightarrow}$

c. $\lambda Y \lambda X.Y(\lambda y.X(\lambda x.\mathsf{love}'(x,y)))$

[13] They call it *Quantifier Raising Derivational Rule* to indicate that this is a description-level (derivational) lexical rule in the sense of, e.g., Meurers 1995.

(62)
$\forall y \exists x.\mathsf{love}'(x,y)$
- $\lambda Q \exists x.Q(x)$ — *someone*
- $\lambda X \forall y.X(\lambda x.\mathsf{love}'(x,y))$
  - $\lambda Y \lambda X.Y(\lambda y.X(\lambda x.\mathsf{love}'(x,y)))$ — *loves*
  - $\lambda P \forall y.P(y)$ — *everyone*

Note that, on this approach, scope ambiguities as in *someone loves everyone* result from different placements of the new variable introduced by the Quantifier Raising lexical rule (60): were λY placed after λX in (61c), the opposite scoping would result (i.e., $\exists x \forall y.\mathsf{love}'(x,y)$).

Richter & Sailer 1999a, 1999b extensively illustrate this approach to HPSG semantics by utilizing it in their analyses of Negative Concord in French and Polish.

Underspecification One of the first discussions of the proper representation of semantic underspecification in HPSG is Nerbonne 1992, 1993, which shows how underspecified *descriptions* of meanings may correctly denote semantic *objects* corresponding to fully specified meanings. For example, although the grammar leaves open which quantifier outscopes the other in, say, *everybody loves somebody*, each object corresponding to this phrase is disambiguated one way or the other. This is, in fact, also the approach adopted in Pollard & Sag 1994, Pollard & Yoo 1998, and other works mentioned above. According to all these works, although *descriptions* of (semantic) objects are underspecified with respect to meaning, the *objects* themselves correspond to fully resolved semantic representations.

Recent years have witnessed a number of proposals of truly underspecified semantics for HPSG, i.e., semantics in which both descriptions *and objects* correspond to underspecified meanings. According to such approaches, the semantic object described (generated) by an HPSG grammar and corresponding to, say, *everybody loves somebody* does not resolve the relative scope of the two quantifiers. It is only an extragrammatical resolution step which provides such disambiguated readings, if they are necessary at all — some logics, such as Underspecified Discourse Representation Theory (UDRT; Reyle 1993), define truth conditions for underspecified semantic representations and provide a proof theory which makes it possible to draw inferences from such partial semantic structures. In fact, the first (to the best of our knowledge) proposal for underspecified semantics for HPSG simply embeds UDRT into HPSG — Frank & Reyle (1992, 1995, 1996) use this formalism in their analysis of interactions between word order and quantifier scope, and of the collective /

1997; Pollard 1998), has been employed in an analysis of modification in general and various uses of the locative *on* in particular (Pollard 1998), and in an analysis of English number names (Smith 1999), *inter alia.* An interesting variant of MRS has also been presented in Egg 1998 and used as a basis for a (syntactico-)semantic HPSG account of *wh*-questions. Finally, Richter & Sailer (1999c), following Bos (1995), show how, for any object logical language, a semantic underspecified version of this language can be defined as the semantic representation for HPSG, in a way generalizing over previous HPSG approaches to underspecified semantics.

5.2 Forays into Pragmatics

5.2.1 Information Structure

Since the HPSG framework is well-suited for studying interactions between various grammatical levels, it is only natural that there is some HPSG work on information structure (also called *topic-focus*, *theme-rheme*, *new-given*, *topic-ground*), which is known to interact with syntax and prosody in interesting ways. The most influential approach is based on Vallduví's (1992) account of information structure, and it includes Engdahl & Vallduví 1994, Engdahl & Vallduví 1996, Vallduví & Engdahl 1996, and Engdahl 1999. We will illustrate this approach with a simple example, from Engdahl & Vallduví 1996.

Consider the mini-dialogue in (66), where **bold face** corresponds to so-called B-accent (L+H*), while SMALL CAPITALS correspond to so-called A-accent (H*).

(66) A: In the Netherlands I got a big Delft china tray that matches the set in the living room. Was that a good idea?

B: (Maybe.) The **president** [$_F$ HATES] the Delft china set. (But the **first lady** LIKES it.)

Vallduví (1992) assumes a 3-way partition of information structure of sentences: first, the information conveyed by a sentence is split into new information (*focus*) and information already present in the discourse (*ground*). Second, *ground* is further subdivided into *link* (what the sentence is about, sometimes called *topic*) and *tail.* Under the assumption that every utterance contains new information, this leads to a four-way classification of utterances: *all-focus* (no ground), *link-focus* (no tail), *focus-tail* (no link) and *link-focus-tail.* The sentence in (66B) represents the *link-focus-tail* type.

Engdahl & Vallduví 1994, 1996 and Engdahl 1999 propose that information structure be represented within *signs*' CONX (context) values in the following way:

(67)
$$\left[\begin{array}{ll} \multicolumn{2}{l}{\textit{context}} \\ \text{INFO-STR} & \left[\begin{array}{ll} \multicolumn{2}{l}{\textit{info-struc}} \\ \text{FOCUS} & \textit{set(content)} \\ \text{GROUND} & \left[\begin{array}{ll} \multicolumn{2}{l}{\textit{ground}} \\ \text{LINK} & \textit{set(content)} \\ \text{TAIL} & \textit{set(content)} \end{array}\right] \end{array}\right] \end{array}\right]$$

They also posit principles expressing the claims that, for each word, this word's semantic contribution is part of the focus if and only if it bears the A-accent, and it is part of link if and only if it bears the B-accent:

(68)
$$\textit{word} \rightarrow (\left[\text{PHON}|\text{ACCENT } \mathsf{A}\right] \leftrightarrow \left[\ldots|\text{LOC} \left[\begin{array}{l} \textit{local} \\ \text{CONT } \boxed{1} \\ \text{CONX}|\text{INFO-STR}|\text{FOCUS } \{\boxed{1}\} \end{array}\right]\right])$$

(69)
$$\textit{word} \rightarrow (\left[\text{PHON}|\text{ACCENT } \mathsf{B}\right] \leftrightarrow \left[\ldots|\text{LOC} \left[\begin{array}{l} \textit{local} \\ \text{CONT } \boxed{1} \\ \text{CONX}|\text{INFO-STR}|\text{GROUND}|\text{LINK } \{\boxed{1}\} \end{array}\right]\right])$$

There are additional principles specifying how a phrases's information structure is constrained by information structures of its daughters.

This leads to the following (much simplified) structure of (66B), in which values of the DTRS attribute are presented in the familiar constituent tree notation.

Here, *milkshake* may refer to whoever purchased milkshake by virtue of the mutual belief of the speaker and the addressee that, within sales agents' parlance, the thing purchased may designate the purchaser. This means that the BACKGROUND value of the *sign* corresponding to (73) contains the following mutual belief (in addition to the belief that *milkshake* normally refers to a milkshake and other beliefs; see Green 1994 for further details):

(74)
$$\left[\begin{array}{ll} \multicolumn{2}{l}{\textit{mutually-believe}} \\ \text{EXPERIENCER} & \boxed{2}\ \text{(speaker)} \\ \text{STANDARD} & \boxed{3}\ \text{(addressee)} \\ \text{SOA} & \left[\begin{array}{ll} \multicolumn{2}{l}{\textit{normally-believe}} \\ \text{EXPERIENCER} & \textit{sales agents} \\ \text{SOA} & \left[\begin{array}{ll} \multicolumn{2}{l}{\textit{rfunction}} \\ \text{DEMONSTRATUM} & \textit{purchase} \\ \text{DESIGNATUM} & \textit{purchaser} \end{array}\right] \end{array}\right] \end{array}\right]$$

Further, Green 2000 seeks to represent the illocutionary force of utterances within the value of CONTEXT|BACKGROUND[17] as speakers' intentions. For example, the illocutionary force of promising is analysed as a speaker's intention that the addressee recognize the speaker's intention that the addresse believe that the speaker commits himself or herself to be responsible for the content of the promise:

(75) Illocutionary force of promising:
$$\left[\begin{array}{ll} \text{CONX} & \left[\begin{array}{ll} \text{C-INDS} & \left[\begin{array}{ll} \text{SPEAKER} & \boxed{1} \\ \text{ADDRESSEE} & \boxed{2} \end{array}\right] \\ \text{BKGRND} & \left\{ \left[\begin{array}{ll} \multicolumn{2}{l}{\textit{intend}} \\ \text{EXPERIENCER} & \boxed{1} \\ \text{SOA} & \left[\begin{array}{ll} \multicolumn{2}{l}{\textit{recognize}} \\ \text{EXPERIENCER} & \boxed{2} \\ \text{SOA} & \left[\begin{array}{ll} \multicolumn{2}{l}{\textit{intend}} \\ \text{EXPERIENCER} & \boxed{1} \\ \text{SOA} & \left[\begin{array}{ll} \multicolumn{2}{l}{\textit{believe}} \\ \text{EXPERIENCER} & \boxed{2} \\ \text{SOA} & \left[\begin{array}{ll} \multicolumn{2}{l}{\textit{commit}} \\ \text{AGENT} & \boxed{1} \\ \text{SOA} & \left[\begin{array}{ll} \multicolumn{2}{l}{\textit{responsible}} \\ \text{THEME} & \boxed{1} \\ \text{SOA} & \textit{psoa} \end{array}\right] \end{array}\right] \end{array}\right] \end{array}\right] \end{array}\right] \end{array}\right] \right\} \end{array}\right] \end{array}\right]$$

[17] Contrast this with the representation of basic illocutionary types within CONTENT in Ginzburg & Sag 2000; cf. §5.1.2.

6 Issues in morphosyntax

6.1 Romance and Slavic Clitics

Romance clitics. There is a recent body work in HPSG on Romance cliticization, represented by, e.g., Miller 1992, Miller & Sag 1997 (for French), and Monachesi 1993 and Monachesi 1999 (for Italian), which argues that Romance 'clitics' are actually lexical affixes and provides a lexicalist account, contra earlier claims that such a lexicalist approach to Romance cliticization cannot be uniformly executed (Sportiche 1996). We present the main features of this account on the basis of Miller & Sag 1997.

The main idea of this analysis is that French 'clitics' corresponding to arguments of a head are present on this head's ARG-ST, but not on its VALENCE attributes. Thus, 'clitics' do not constitute separately licensed syntactic entities. Instead, there is a morphological constraint which takes the presence of 'clitics' on ARG-ST into consideration when 'calculating' the actual morphological form of the head.

Specifically, *word*s are assumed to have a feature MORPH, whose values introduce three further features, STEM, I-FORM and FORM:

(76)
$$\left[\begin{array}{ll} \multicolumn{2}{l}{\textit{word}} \\ \text{MORPH} & \left[\begin{array}{l} \text{FORM} \ \ldots \\ \text{I-FORM} \ \ldots \\ \text{STEM} \ \ldots \end{array}\right] \end{array}\right]$$

The values of STEM correspond to the morphological stem of the head, I-FORM represents the inflected form of the head before 'clitics' are taken into account, while FORM values represent full inflected forms including any 'clitics' realized on the head. For example, the 3rd person singular present tense indicative form of the lexeme LAVER 'wash' with its object realized as an anaphoric affix has the following MORPH value:

(77)
$$\left[\begin{array}{ll} \text{FORM} & \textit{se-lave} \\ \text{I-FORM} & \textit{lave} \\ \text{STEM} & \textit{lav-} \end{array}\right]$$

Simplifying a little, FORM values are derived from I-FORM values, taking into account HEAD and ARG-ST information, via the following constraint:

(78)
$$\textit{word} \rightarrow \left[\begin{array}{ll} \text{MORPH} & \left[\begin{array}{ll} \text{FORM} & \text{F}_{\text{PRAF}}(\boxed{0},\boxed{1},\boxed{2}) \\ \text{I-FORM} & \boxed{0} \end{array}\right] \\ \text{SYNSEM|LOC|CAT} & \left[\begin{array}{ll} \text{HEAD} & \boxed{1} \\ \text{ARG-ST} & \boxed{2} \end{array}\right] \end{array}\right]$$

(84) a. Ty widział**eś** tę książkę.
you saw that book
'You saw that book.'

b. Ty**ś** widział tę książkę.
you saw that book

This does not mean, though, that Borsley (1999) is forced to postulate two different morphemes *-(e)ś*. On the contrary, there is only one lexical entry for the weak auxiliary *-(e)ś*, i.e., (85).

(85)
$$\begin{bmatrix} \textit{weak-aux} \\ \text{PHON -(e)ś} \\ \text{SYNSEM|CAT} \begin{bmatrix} \text{HEAD} \begin{bmatrix}\textit{verb}\\ \text{VFORM } \textit{fin}\end{bmatrix} \\ \text{VALENCE} \begin{bmatrix} \text{SUBJ } \boxed{1} \\ \text{COMPS} \left\langle \begin{bmatrix} \ldots|\text{HEAD} \begin{bmatrix}\textit{verb}\\ \text{VFORM } \textit{part}\end{bmatrix} \\ \ldots|\text{VALENCE}\begin{bmatrix}\textit{valence}\\ \text{SUBJ }\boxed{1}\\ \text{COMPS }\boxed{2}\end{bmatrix} \\ \ldots|\text{LEX} + \end{bmatrix}\right\rangle \oplus \boxed{2}\end{bmatrix}\end{bmatrix}\end{bmatrix}$$

(85) essentially states that *-(e)ś* is a finite verb which subcategorizes for a participle word (cf. the first element on the COMPS of *-(e)ś*), and takes over all arguments of this participle, in a way analogous to *avoir* in (83). As a result , a *syntactic* verbal complex 'participle + *-(e)ś*' is created, whose subcategorizing properties are exactly those of the participle. There is also a separate word order principle which states that the weak auxiliary must occur before (but not necessarily immediately before) the participle it subcategorizes for. A simplified version of this word order principle is given in (86).

(86)
$$\begin{bmatrix}\textit{weak-aux}\\ \ldots|\text{COMPS } \langle \ldots\boxed{1}\ldots\rangle\end{bmatrix} < \boxed{1}\begin{bmatrix}\ldots|\text{HEAD}\begin{bmatrix}\textit{verb}\\ \text{VFORM } \textit{part}\end{bmatrix}\\ \ldots|\text{LEX} +\end{bmatrix}$$

These two principles are responsible for (84b). In the case of (84a), however, *widziałeś* is analysed as a *morphological* verbal complex, described by (87).

(87)
$$\begin{bmatrix} \textit{complex-verb} \\ \text{PHON } \boxed{1} + \boxed{2} \\ \text{MORPH-B} \left\langle \begin{bmatrix}\text{PHON }\boxed{1}\\ \text{SYNSEM }\boxed{3}\end{bmatrix}, \begin{bmatrix}\textit{weak-aux}\\ \text{PHON }\boxed{2}\\ \text{SYNSEM|CAT}\begin{bmatrix}\text{HEAD}\begin{bmatrix}\textit{verb}\\ \text{VFORM } \textit{fin}\end{bmatrix}\\ \text{VALENCE}\begin{bmatrix}\text{SUBJ }\boxed{4}\\ \text{COMPS } \langle\boxed{3}\rangle \oplus \boxed{5}\end{bmatrix}\end{bmatrix}\end{bmatrix}\right\rangle \\ \text{SYNSEM|CAT}\begin{bmatrix}\text{HEAD}\begin{bmatrix}\textit{verb}\\ \text{VFORM } \textit{fin}\end{bmatrix}\\ \text{VALENCE}\begin{bmatrix}\text{SUBJ }\boxed{4}\\ \text{COMPS }\boxed{5}\end{bmatrix}\end{bmatrix} \end{bmatrix}$$

Here, Borsley (1999) follows Riehemann (1998) in assuming that morphologically complex words have the feature MORPH-B (morphological base), whose value is a list of *signs*. In (87), the same weak auxiliary occurs within the morphological makeup of the complex verb *widziałeś* as described in (85). However, since this finite auxiliary combines with the participle at the lexical level, it may (in fact, *must*, according to the order of elements of MORPH-B in (87)) occur after the verb (the LP constraint (86) does not apply at the level of MORPH-B) and it may participate in various word-level morphophonological processes.

(Add references to Kupść, Penn and Avgustinova and Crysmann?) AP

6.2 Mixed Categories

HPSG, with its type hierarchies and the mechanism of multiple inheritance, is particularly well-suited for analyzing mixed categories, i.e., categories which simultaneously share various properties of different major categories such as verb or noun.

Malouf (1998, 2000b) utilizes these mechanisms to provide an HPSG account of verbal gerunds in English (like (88a)–(88b), but not (88c)), well known for their mixed verbal/nominal properties.

(88) a. Everyone was impressed by [Pat's artfully folding the napkins].
(verbal POSS-*ing* gerund)

b. Everyone was impressed by [Pat artfully folding the napkins].
(verbal ACC-*ing* gerund)

c. Everyone was impressed by [Pat's artful folding of the napkins].
(nominal gerund)

Assuming that the CASE feature is introduced by the type *cased*, while ASPECT and NEGATION are introduced by the type *aspectual*, the facts mentioned above are accounted for as follows. Since *v-noun* is a subtype of *noun*, verbal nouns have the distribution of NPs and may be modified by adjectival elements. Since it is a subtype of *cased*, they inflect for case. And since it is also a subtype of *aspectual*, they bear the morphosyntactic features ASPECT and NEGATION. Similarly, since *adj-prt* is a subtype of *adjectival*, adjectival participles may modify nouns just like adjectives; since it is a subtype of both *cased* and *aspectual*, they bear the features CASE, ASPECT and NEGATION; and, finally, since it is a subtype of *verbal*, they assign (structural) case to their arguments according to general case assignment rules valid for all verbal elements.

6.3 Case and Case Assignment

Although Pollard & Sag (1994:30) suggest that in HPSG, "[t]here is no separate theory of case (or Case). Nominative case assignment takes place directly within the lexical entry of the finite verb," while "the subject SUBCAT element of a nonfinite verb... does not have a CASE value specified", it has since become clear that a (partially) syntactic theory of case assignment is needed.

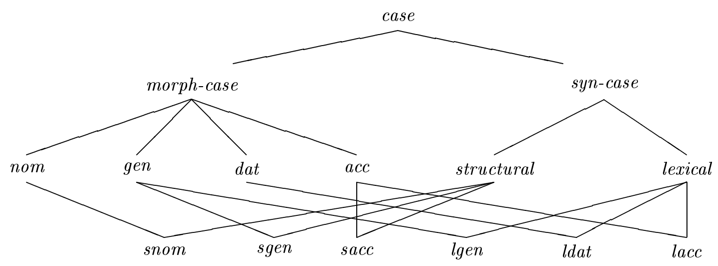
The most explicit such a theory is that of Heinz & Matiasek 1994.[19] This approach consists of three parts:

First, the type hierarchy for *case* does not simply list possible morphological cases (*nom*, *acc*, etc.) as subtypes of *case*, but is structured in such a way that it distinguishes between lexical (or inherent) case, assigned directly within lexical entries, and structural case, assigned in syntax proper.[20] For example, Heinz & Matiasek 1994 propose the following type hierarchy for *case* in German, which says that *nom*inative is always structural, *gen*itive and *acc*usative are either structural or lexical, and *dat*ive is always lexical.

[19] See Przepiórkowski 1999a, ch. 3 for a brief history of approaches to case assignment within HPSG and within other linguistic theories.

[20] This distinction is, of course, based on a similar dichotomy present in Chomskyan theories.

(92)



Second, lexical entries of predicates (verbs, nouns, etc.) are assumed to distinguish between *str*uctural arguments and *lex*ical arguments: only the latter, not the former, are morphologically specified in such lexical entries. For example, German verbs *unterstützen* 'support' and *helfen* 'help' are assumed to have following ARG-ST (originally, SUBCAT) specifications:

(93) a. *unterstützen*: [ARG-ST ⟨NP[*str*], NP[*str*]⟩]
b. *helfen*: [ARG-ST ⟨NP[*str*], NP[*ldat*]⟩]

The criterion for deciding which arguments are structural (i.e., bear a *str*uctural case) and which are lexical is roughly the stability of the morphological case of these arguments across syntactic configurations. For example, the case of the second argument of *unterstützen* (i.e., its object) is unstable because it is accusative in active voice and nominative in passive, cf. (94), while the second argument of *helfen* is stable, because it is dative in both voices, cf. (95).

(94) a. Der Mann unterstützt **den Installateur**.
the.NOM man supports the.ACC plumber
'The man is supporting the plumber.'

b. **Der Installateur** wird unterstützt.
the.NOM plumber AUX supported
'The plumber is supported.'

(95) a. Der Mann hilft **dem Installateur**.
the.NOM man helps the.DAT plumber
'The man is helping the plumber.'

other languages, as well as Calcagno & Pollard 1997, Chung 1998b, Kupść 1999, Calcagno 1999, Meurers 1999a, 1999b and Malouf 2000a for other applications.

6.4 Agreement

Considerably more detailed attention to agreement phenomena is paid in HPSG than other grammatical frameworks. Part of the reason may lie in the fact that the multiple layers of linguistics information represented simultaneously in HPSG-style signs are particularly amenable to a view of agreement that considers it to straddle (morpho-)syntax, semantics, and pragmatics. In fact, Pollard & Sag (1994) argue that agreement is not actually a unfied phenomenon at all, but instead may involve these three components of the grammar to different degrees, depending on the kind of dependency involved (e.g., NP-internal agreement vs. pronoun-antecedent agreement, etc.) and the choices made by particular grammars.

The central concept of the HPSG theory of agreement is that of an INDEX, a concept that unifies some of the properties of constants and variables from logical formalisms. In the simplest cases an index is an abstract linguistic entity that is referentially linked to some object in the interpretation domain. Indices are also used with quantificational expressions, in which case they behave very much like variables. Unlike constants and variables in logic, however, indices have internal organization that reflects properties of the associated linguistic entities or referential objects, or both. In English, this information includes number, gender, and person. This makes it possible to straightforwardly account for a number of agreement phenomena. For instance, if we assume that the relation between reflexive pronouns and their antecedents involves identity in index values, then the distribution of forms in (98) falls out automatically.

(98) a. I saw {myself/*himself/*herself} in the mirror.
b. He saw {*myself/himself/*herself} in the mirror.
c. She saw {*myself/*himself/herself} in the mirror.

The necessity of indices as essential mediaries between form and meaning has been challenged for instance by Dowty & Jacobson (1988), who propose a strictly semantic approach to agreement relations of the kind illustrated in (99). However, as Pollard & Sag (1994) point out, a purely semantic approach runs into difficulties when there exist conflicting ways of referring to some entity by a linguistic form. For instance, English allows pets to be referred to either in terms of the neuter pronoun or in terms of their natural

gender. A strictly semantic approach predicts that these conventions can be used independently of each other, and in fact, that is what we find across sentences, cf. (99):

(99) That dog is so stupid, every time I see **it** I want to kick **it**. **He**'s a damn good hunter, though.

However, within certain grammatical domains, the linguistic convention used must be respected in subsequent referrals. This is why the alternations between neuter and masculine pronominals in (100c,d) give rise to illformedness:

(100) a. That dog is so ferocious, it even tried to bite itself.
b. That dog is so ferocious, he even tried to bite himself.
c.*That dog is so ferocious, it even tried to bite himself.
d.*That dog is so ferocious, he even tried to bite itself.

If we adopt indices as a device which in a sense keeps a record of aspects of the linguistic form that was used to introduce an entity into the discourse then these domain effects can readily be explained simply via structure sharing among indices.

As Pollard & Sag (1994) point out, however, there are cases where properties of the linguistic form need to be distinguished from properties of the referent itself. An illustration from French of such a situation is given in (101):

(101) Vous êtes belle.
you are-PL beautiful-SG.FEM
'You are beautiful.'

Here, the subject *vous* with a single female as the intended referent is involved in two agreement relations. It triggers plural morphology on the verb *êtes*. At the same time, the predicative adjective exhibits feminine singular morphology. Whereas the first can straightforwardly be attributed to the number properties of the index of *vous*, Pollard & Sag (1994) propose that the singular marking of the adjective be seen as a reflection of inherent, semantic properties of the subject's referent. Thus, we need to distinguish between the index per se and the conditions under which an index is referentially linked ("anchored to") an entity of the world. The singular morphology on *belle* can be viewed as a fact about the pragmatics of using morphologically plural *vous* with a nonaggregate referent. The two-way split between syntactic/semantic index-agreement and pragmatic agreement of the latter kind is illustrated in (102):

study of these correlations and possible exceptions in Serbo-Croation is undertaken by Wechsler & Zlatić (forthcoming), who also also bring into view the role that declension classes play in determining agreement behavior. As a result, Wechsler & Zlatić distinguish four levels at which agreement-related information can be brought to bear. In addition to semantics (i.e., anchoring conditions), index, and concord, they propose that the declension class should also be represented lexically. While declension class is not a direct parameter of covariation, nevertheless the morphological shape determined by a declension class may be responsible for certain concord facts which are in apparent conflict with the semantically conditioned feature assignment (given in terms of *index* features). Consider the following data from Serbo-Croatian:

(107) a. *det-e* ('child')

declension class	I (typically for masc. and neut. nouns)
concord	neuter sing
index	neuter sing

b. *det-a* ('children')

declension class	II (typically for fem. nouns)
concord	feminine sing
index	neuter plural

The morphological realization of the plural *deta (det-a)* ('children') is in terms of declension class II, which is normally associated with femine nouns. The plural form of this noun acts "as if" it were singular feminine for the purposes of adjectival concord (108b):

(108) a. ovo lepo dete
that.NEUT.SG beautiful.NEUT.SG child.NEUT.SG
'that beautiful child'

b. ova lepa deca
that.FEM.SG beautiful.FEM.SG child.FEM.SG
'those beautiful children'

Outside of the NP more semantically based become operative again, as evidenced by plural marking on an agreeing verb, cf. (109):

(109) Ta dobra deca dolaze.
that.FEM.SG good.FEM.SG children come.PAST.3.PL
'Those good children came.'

Contrast this now with the situation in which the declension class mismatch has no bearing on the covariance behavior of dependent elements. For instance, *Steva* ('Steve') is also inflected according to declension class II, yet as the example in (110b) illustrates, the determiner and the adjective exhibit masculine agreement:

(110) a. *Stev-a* ('Steve')

declension class	II (typically for fem. nouns)
concord	masculine sing
index	masculine sing

b. Vratio mi je ovaj ludi Steva
returned me AUX this.NOM.M.SG crazy.NOM.M.SG Steve.NOM
violinu koju sam mu pozajmio.
violin which AUX him loaned
'This crazy Steve returned to me the violin which I loaned him.'

If we represent declension, concord, index, and semantics as four parameters of variation the case of totally transparent morphological and covariation properties can be represented as in (111a). Where there is a split between morphology, NP-internal concord and NP-external covariation behavior—as with *deca* in (108, 109), there is a misalignment between concord and index-based properties, as shown in (111b). Finally, the situation where the exceptionality is restricted to morphology, as in (110), can be represented schematically as in (111c).

(111)
a. declension ⇔ concord ⇔ index ⇔ semantics
b. declension ⇔ concord || index ⇔ semantics
c. declension || concord ⇔ index ⇔ semantics

As Wechsler & Zlatić (forthcoming) show, this conception of agreement as a multi-layer phenomenon based on a number of default alignments between "modules" makes correct predictions with respect to the expected scope of different kinds of covariation as well as possible possible exceptions.

7 Advances in Logical Foundations (RSRL)

Within the last 15 years or so, a number of different formalisms have been proposed for formalizing HPSG-style analyses, e.g., Kasper & Rounds 1986, King 1989 and Carpenter 1992. These different formalisms often reflect the state of the art in HPSG theorizing at the time when they were developed and more

(115) Principle A of Pollard & Sag's (1994) Binding Theory (in RSRL):

$$\forall x\ ((^{x}[\textsc{loc cont}\ \textit{ana}]\ \wedge\ \exists y\ \texttt{loc-o-command}(y,x))\ \rightarrow$$
$$\rightarrow\ \exists z\ \texttt{loc-o-bind}(z,x))$$

(explain notation here?) AK

Similarly, taking into consideration the fact that being *(locally) o-free* is tantamount to *not* being *(locally) o-bound* (cf. (113d)), Principles B and C could be formalized in RSRL as follows:

(116) Principles B and C of Pollard & Sag's (1994) Binding Theory (in RSRL):

a. $\forall x\ (^{x}[\textsc{loc cont}\ \textit{ppro}]\ \rightarrow\ \neg\exists y\ \texttt{loc-o-bind}(y,x))$

b. $\forall x\ (^{x}[\textsc{loc cont}\ \textit{npro}]\ \rightarrow\ \neg\exists y\ \texttt{o-bind}(y,x))$

For these formalizations of Principles A–C of Pollard & Sag's (1994) Binding Theory to have the intended effect it is necessary to define the meaning of relation symbols `loc-o-command`, `loc-o-bind` and `o-bind`. We will first define the simpler relation `more-oblique`:

(117) $\texttt{more-oblique}(x,y)\ \stackrel{\forall}{\Longleftarrow}$

$$^{w}\begin{bmatrix}\textit{word}\\ \textsc{ss loc cat subcat}\ \boxed{1}\end{bmatrix}\ \wedge\ \texttt{to-the-right}(x,y,\boxed{1})$$

According to this definition, x and y stand in the `more-oblique` relation if and only if there are w and $\boxed{1}$ such that w is a *word* whose SYNSEM | LOCAL | CATEGORY | SUBCAT is $\boxed{1}$ and y is `to-the-right` of x on $\boxed{1}$.[24] Note that this definition relies on the convention according to which (i) variables present on the left hand side of '$\stackrel{\forall}{\Longleftarrow}$' are quantified universally, while (ii) variables present only on the right hand side of '$\stackrel{\forall}{\Longleftarrow}$' are quantified existentially.

The definition of `loc-o-command` is more complex but its overall logical structure corresponds to the prose in (113b).

(118) $\texttt{loc-o-command}(x,y)\ \stackrel{\forall}{\Longleftarrow}$

$$(^{x}[\textsc{loc}\ \boxed{1}[\textsc{cont index}\ \textit{ref}]]\ \wedge$$
$$^{y}[\textsc{loc}\ \boxed{2}[\textsc{cont index}\ \textit{ref}]]\ \wedge$$
$$\neg\boxed{1}=\boxed{2})\ \wedge$$
$$(\texttt{more-oblique}(y,x)\ \vee$$

[24]See Richter 2000, §4.2 for the straightforward definition of `to-the-right` as used in (117) and `member` as used in (118). Also, note that both letters and tags are used as variables in RSRL descriptions.

$$(^{s}\begin{bmatrix}\textit{synsem}\\ \textsc{loc cat subcat}\ \boxed{3}\end{bmatrix}\ \wedge$$
$$\texttt{more-oblique}(s,x)\ \wedge$$
$$\texttt{member}(y,\boxed{3})))$$

Similar definitions can be given for relations `loc-o-bind` and `o-bind`.

One important aspect of RSRL that should not be overlooked is the restricted character of its quantification mechanism: the range of quantifiers used in an RSRL description is restricted to components of the described object. Let us illustrate this aspect with a generalization regarding Serbo-Croatian case assignment discussed in Wechsler & Zlatić 1999, 2000 and cited in (119) below.

(119) Serbo-Croatian Dative/Instrumental Case Realization Condition.

If a verb or noun assigns dative or instrumental case to an NP, then that case must be morphologically realized by some element within the NP.

The element which 'realizes' the dative/instrumental case on an NP does not have to be the head of this NP: in Serbo-Croatian, there is a class of uninflected female names which do not decline for case at all and, hence, are grammatical in dative and instrumental positions only when accompanied by a determiner or an adjective which is overtly inflected for case, cf. (120).

(120)

Divim	se	*(mojoj)	Miki.
admire.1ST.SG	REFL	my.DAT.SG	Miki

'I admire (my) Miki.'

The generalization in (119) is difficult to state without quantification (cf. Wechsler & Zlatić 1999 for an attempt), but straighforward when quantification is available; (121) is a slightly modified version of the constraint given in Wechsler & Zlatić 2000.

(121) $$\begin{bmatrix}\textit{phrase}\\ \textsc{synsem}|\ldots|\textsc{case}\ \boxed{1}(\textit{dative}\vee\textit{instrumental})\end{bmatrix}\rightarrow$$
$$\rightarrow\ \exists x\ |\ x=\begin{bmatrix}\textit{inflected-word}\\ \textsc{synsem}|\ldots|\textsc{case}\ \boxed{1}\end{bmatrix}$$

This constraint is already almost an RSRL principle. The RSRL version is given below.

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