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Determiners as Functors: NP Structure in Italian

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This article offers a comprehensive HPSG treatment of determiners within the Noun Phrase, accounting for their rich variety as regards distributional behaviour, category features, dependency relations and semantic contribution. To introduce the reader to the empirical problems at issue, a contrastive examination of English vs. Italian data is carried out at various points in the work, but the Romance language in particular is focussed on; especially the study of co-occurrence restrictions on Italian determiners is detailed and systematic. On the other hand, the suggested solutions go beyond language-specific considerations and provide evidence for a revision of HPSG that gives due prominence to the notion of 'functor', resulting in a formally simpler approach to head-specifier dependencies and an improved version of the Semantics Principle, inter alia. The paper is divided into three main sections: section 1 briefly summarizes some general theoretical background which will be presupposed in the rest of the work; section 2 offers an extensive discussion and preliminary analysis of data concerning determiners and related issues; section 3 presents the formal treatment in terms of revised HPSG.

1 Background

According to standard semantic accounts, a determiner is taken to denote some function that yields a generalized quantifier qua Noun Phrase denotation from

the 'restriction' set or property denoted by the nominal head.[1] A generalized quantifier is a set of sets in extensional systems (v. Barwise & Cooper 1981) or a set of properties in intensional systems (mainly in the line of research following Montague 1974), or equivalently, the characteristic function of such a set. But the problems we will bring into focus in the article arise irrespective of how generalized quantifiers are model-theoretically constructed. We will thus assume a rather liberal variant of the familiar approach to indirectly interpreting a natural language fragment by translating it into some suitable logical language, as alternative styles of model-theoretic interpretation will be considered available in principle for the proposed translations.

Here the logical translations to be derived from linguistic descriptions basically conform to the language adopted by Pollard & Sag (1987, 1994), which is inspired by Situation Semantics, but remains model-theoretically 'open' inasmuch as they do "not attempt ... to formulate in precise terms the principles that relate ... linguistic descriptions to any one version of situation semantic analysis" (Pollard & Sag 1994: p. 318). Taking a further step towards the open-endedness of interpretation, as already suggested by Fenstad et al. (1987: Ch. 1), so-called 'situation schemata' or equivalent logical expressions can be understood as suited but not necessarily committed to Situation Semantics with its ontology including 'realistic' intensional objects. In particular, one need not resort to Situation Semantics to justify the two differences from unrestricted first-order quantification that Pollard and Sag introduce in their own logical language:

> First, the variables over which we quantify are always *restricted*: instead of 'for every x, x howls', we have 'for every cat x, x howls'. ... And second, in addition to the determiners 'exists' and 'forall' countenanced by first-order logic, we have a full range of generalized determiners such as 'most', 'no', 'exactly three', 'more-than-two-but-less-than-seven', etc. Pollard & Sag (1987: p. 89)

These, in essence, correspond to the innovations already available in standard Generalized Quantifier Theory under a purely extensional interpretation, cf. Barwise & Cooper (1981).

Technically, in Barwise and Cooper's GQT language the restriction of a generalized quantifier $\boldsymbol{Q}$ and the expression which $\boldsymbol{Q}$ applies to (call it 'external scope') are set terms, atomic or formed by 'abstraction'. However, one can re-interpret in an equivalent way also a notation like the one adopted by Pollard & Sag (1987, 1994), with $\boldsymbol{Q}$ quantifying over a restricted variable of the form $\boldsymbol{x_i}|\boldsymbol{\varphi}$ and taking some $\boldsymbol{\psi}$ as external scope, where $\boldsymbol{\varphi}$ and

[1] We will stick to the traditional – although not uncontroversial – assumption that the constituent made up by a determiner and its nominal sister be nominally headed. In section 3.1 we will briefly defend it from the alternative offered by the so called 'DP Analysis'.

$\boldsymbol{\psi}$ are formulae.[2] For example, in the intended extensional interpretation, $\boldsymbol{(\exists x_1 | man(x_1))\, runs\, (x_1)}$ is the exact counterpart of the standard GQT formula $\boldsymbol{Some(man)(\lambda x_1[runs\,(x_1)])}$. Of course, an extensional system implies leaving aside all irreducibly intensional constructions, but such an idealization is basically harmless for the purposes of the present article. Thus, for methodological convenience, our point of reference when model-theoretic considerations will occasionally come into play in the next sections will be the extensional GQT analysis of generalized quantifiers, rather than one of its situation semantic alternatives (cf. Fenstad et al. 1987, Richard Cooper 1990).

What really matters for our purposes is how to handle quantification within the syntax-semantics interface of an extended phrase structure grammar framework. In the Generalized Phrase Structure Grammar by Gazdar et al. (1985), the independently motivated syntactic apparatus of X-bar Theory receives a semantic interpretation in terms of Montague-style denotation types. E.g., consistently with the standard manner of interpreting determiners which has been mentioned at the beginning, a GPSG determiner denotes some function from denotations of $\overline{N}$ (or N') constituents to denotations of $\overline{\overline{N}}$ (or N'') constituents, with $\overline{\overline{N}} = NP$; that is, in the simplified notation of Gazdar et al. (1985: p. 193), a determiner corresponds to a semantic functor of type:

(1) $< \overline{N}, NP >$

where the syntactic categories NP and $\overline{N}$ conventionally stand for the respective semantic types (generalized quantifiers of some kind and their restrictions). Henceforth we will exploit the X-bar system analogously in order to state syntax-semantics correspondences, although without committing ourselves to GPSG and its Montagovian account of what the denotations ultimately are. Indeed, as a first approximation (neglecting the more complex assumptions about the structuring of linguistic information that are required for handling quantifier scope ambiguities)[3], the syntax-semantics correspondence scheme underlying (1) can be applied also to Pollard & Sag's (1994) treatment of determiners in Head-driven Phrase Structure Grammar, to be summarized now.

[2]The variable-with-restriction of a quantifier $\boldsymbol{(Dx_i|\varphi)}$ can be seen here as a set-denoting term built up by abstraction and classified according to the variable at issue. That is, for any positive integer i, $\boldsymbol{x_i|\varphi}$ is an *x_i-set term* (with the same denotation as $\boldsymbol{\lambda x_i[\varphi]}$, v. Dowty et al. 1981: pp. 98-102). Now quantifiers can be classified according to their restricted variable: if $\boldsymbol{D}$ is a determiner operator and $\boldsymbol{\eta}$ is an x_i-set term, $\boldsymbol{(D\eta)}$ is a *quantifier capturing* x_i. Variable binding is defined accordingly: an occurrence $\boldsymbol{v}$ of x_i is bound iff $\boldsymbol{v}$ occurs in some $\boldsymbol{Q}$ capturing x_i or in that $\boldsymbol{Q}$'s external scope; else $\boldsymbol{v}$ is free. Roughly, a quantified formula $\boldsymbol{Q\psi}$ with $\boldsymbol{Q}$ capturing x_i can be interpreted in such a way that $\| \boldsymbol{Q\psi} \| = \boldsymbol{1}$ if $\| \boldsymbol{\lambda x_i[\psi]} \| \in \| \boldsymbol{Q} \|$, and $\| \boldsymbol{Q\psi} \| = \boldsymbol{0}$ if $\| \boldsymbol{\lambda x_i[\psi]} \| \notin \| \boldsymbol{Q} \|$. Cf. Allegranza (1994) for compositionality in a closely related system.

[3]Scoping techniques will be taken into account hereafter in section 3.3.

Let us start from the syntactic backbone. Unlike the GPSG feature BAR with numerical values (Gazdar et al. 1985: pp. 22-26), bar levels in HPSG are not postulated as primitives, however they can be reconstructed in other terms. For instance, the approach in Ch. 9 of Pollard & Sag (1994) defines the levels by combining the *word* vs. *phrase* distinction with the 'valence' of signs w.r.t. the list-valued feature SPR. Signs of sort *word* are 0-bar constituents; signs of sort *phrase* with an element on the SPR list (i.e. [SPR < [...] >]) are 1-bar constituents; signs of sort *phrase* with empty SPR list (i.e. [SPR <>]) are 2-bar constituents. SPR stands for SPECIFIER, but unlike the corresponding structural notion within Chomsky's original X-bar model, an HPSG specifier is characterized in valence terms: it is the dependent a head subcategorizes for via SPR, discharging the element from the SPR list when it is structurally realized. The HPSG notion of specifiers applies to determiners in that "N's [i.e. $\overline{N}$s] are the heads of NPs and subcategorize for their determiners" (Pollard & Sag 1994: p. 50). Following Pollard & Sag (1987: pp. 139-141), this subcategorization is used to account for the empirical requirement that singular count nouns, as opposed to mass nouns and plural count nouns, obligatorily take an article or another overt determiner with the same distribution, in English and other languages (cf. section 2.3 below). Thus the relevant information is simply encoded in the lexical entries (e.g. in the format [SPR < [...] >] for a singular count noun vs. [SPR <([...])>] – with optionality – for a plural or mass noun) and applied through HPSG's independently motivated, utterly general Valence Principle (Pollard & Sag 1994: p. 348), without introducing any category-specific phrase structure rule with 'built-in' determiner-noun co-occurrence restrictions.

On the semantic side, Pollard & Sag (1994) assume that a determiner is lexically assigned a generalized quantifier description to be passed up to the NP node (cf. section 3.3 below for details). This analysis exploits the 'partiality' (or 'underspecification') of linguistic descriptions in the HPSG formalism, since the lexical information of sort *quant* in the determiner specifies a particular value of sort *semdet* (a *semantic-determiner* operator) for the attribute DET but leaves unspecified the value of RESTIND|RESTR, i.e. the quantifier restriction, which is up to the *nom-obj* (*nominal-object*) semantic content of the $\overline{N}$ to instantiate. See in (2), slightly simplified, an HPSG quantifier corresponding to the logical translation of "every book" as $(\forall \boldsymbol{x_1} | \boldsymbol{book}(\boldsymbol{x_1}))$. Accordingly, the semantic contribution of "every" alone can be seen as the class of generalized quantifiers satisfying the schematic expression $(\forall \boldsymbol{x_i} | \boldsymbol{\varphi})$, where $\boldsymbol{\varphi}$ stands for any formula translating the relevant RESTR value.[4]

[4]Since RESTR is a set-valued feature, its compositional translation can be achieved by a conjunctive $\boldsymbol{\varphi}$ of the form $\wedge\{\boldsymbol{\psi_1}, \boldsymbol{\psi_2}, \ldots \boldsymbol{\psi_n}\}$, where each $\boldsymbol{\psi_k}$ is a formula translating one of the n elements of the RESTR set, for $1 \leq k \leq n$. This notation, prefixing the

(2)
$$_{quant}\left[\begin{array}{l}\text{DET } \textit{forall} \\ \text{RESTIND}\left[\begin{array}{l}\text{INDEX } \boxed{1} \\ \text{RESTR}\left\{ {}_{book}\left[\text{INSTANCE } \boxed{1}\right]\right\}\end{array}\right] \\ \quad \textit{nom-obj}\end{array}\right]$$

Formal details apart, at the current stage of our presentation we can sum up by saying that in HPSG too the semantics of a determiner maps $\overline{N}$-level restrictions into NP-level quantifiers, essentially in the sense discussed before.

There is a related technical issue which deserves further discussion here:

> How does it come about that ... the RESTIND value ... within the content of the determiner is token-identical to the content of the noun? At first blush it might be thought that this identity could be lexically specified within the ... value of the noun['s SPR]. This will not work, however, since if the head noun were modified (say, by relative clauses or attributive adjectives), the semantic contribution of the modifiers would not be taken into consideration in the content of the determiner... Under present assumptions, it is clear that the determiner must in some sense be able to select its N' sister, in order to 'have its hands on' the N' sister's content. Pollard & Sag (1994: p. 50)

The result, according to Pollard and Sag's treatment, is a cyclic feature structure in which the head noun and the determiner qua specifier reciprocally select each other. This can be criticized from various angles, as also noticed by Netter (1994). For one thing, cyclic graphs were explicitly excluded from the HPSG formalism by Pollard & Sag (1987: p. 37). And although logical and computational systems compatible with HPSG linguistics and allowing cyclicity have been developed in the while (v. Carpenter 1992), we believe that general methodological considerations should favour the formally more restrictive and conceptually simpler acyclic graphs, especially if one can show that the extension of expressive power is not strictly necessary for achieving linguistic adequacy. Linguistically, the prima facie appeal of treating SPR as a valence/subcategorization feature, with consequent exploitation of independently available mechanisms, is weakened inasmuch as also a feature SPECIFIED (SPEC) on the specifier and a corresponding selection principle (the 'SPEC Principle', Pollard & Sag 1994: p. 51) are required because SPR proves insufficient for the purpose of relating head and specifier. Indeed, SPEC lends

relevant connective to a non-empty set of formulae, is inspired by Situation Semantics (cf. Richard Cooper 1990: p. 125), but also a traditional Boolean interpretation of connectives can be generalized to the n-ary case, e.g. as standardly done for the AND and OR 'logical gates' of digital circuits in electronics. Now, given (2), "every book" translates more precisely as $(\forall \boldsymbol{x_1}| \wedge \boldsymbol{\{book(x_1)\}})$, which is however truth-conditionally equivalent to $(\forall \boldsymbol{x_1}|\boldsymbol{book(x_1)})$.

itself to enforce agreement and other constraints on the two constituents, so that the subcategorization power of SPR is hardly exploited in full and its status is less clear than what Pollard and Sag claim.

The present article is an attempt to overcome these and other related drawbacks of Pollard and Sag's version of HPSG, without abandoning some basic assumptions about specifiers in X-bar Theory and the headedness of the Noun Phrase. We will attain that end by investigating especially the 'functor' role of determiners for the syntax-semantics interface (cf. (1)). As our goals are ultimately empirical rather than purely formal, we will make the discussion concrete by focussing in particular on the determination system of a specific (Romance) language, namely Italian. The Italian system, in our view, is interesting because of some non-trivial differences from the English one (which is the obvious 'reference system' for much work on determination and quantification), though being still close enough to it to make a contrastive analysis easy and straightforward.

2 Empirical issues

2.1 A pre-theoretical typology of determiners

A major objective of our work is to verify whether a treatment as $< \overline{N}, NP >$ functors of a suitable kind (cf. section 1 above) reflects the actual grammatical behaviour of determiners qua natural language expressions, with special reference to Italian. Barwise & Cooper (1981), who proposed essentially the same syntax-semantics correspondence scheme apart from notational details, were obviously aware of the issue, although they neglected it in their work on a fragment of English:

> we use "determiner" to refer to a wide class of syntactic elements which also include what are sometimes called predeterminers, postdeterminers, numerals, etc. A more detailed investigation may well show that some of these finer distinctions are necessary. (ibid., fn. 2)

We will not attempt any survey of the pertinent literature on syntactic determination produced in descriptive linguistics. However, in following sections we will deem it useful to contrast the theoretical approach in $< \overline{N}, NP >$ terms with the empirical and informal typology of determiners that is alluded to in the above quotation and can be found extensively exemplified in a well-established descriptive grammar of English, such as the one by Quirk et al. (1985). For a start, the current section is meant to show that the basic 'classification grid' thus offered for English determiners applies to Italian determiners too.

In a nutshell, we can draw from Quirk et al. (1985) and other related work a typological characterization of determiners according to two pre-theoretical parameters:

(A) an intuitive grouping into varieties consisting of morpho-syntactically and/or semantico-pragmatically related items;

(B) the relative position of co-occurring items.

Concerning (A), a reasonable coverage of the English determiners would take into account at least the following six varieties [5]:

- **articles** – *the*, *a*(*n*);
- **demonstratives** – *this*, *that*, *these*, *those*;
- **possessives** – *my*, *your*, *his*, *her*, *its*, *our*, *their*, as well as the determinative Saxon genitives (headed by *'s* according to Pollard & Sag 1994: p. 53);
- **q-determiners** [6] – e.g. *every*, *some*, *both*, *many*, etc.;
- **cardinals** – the numerals *one*, *two*, *three*, ... ;
- **ordinals** – the numerals *first*, *second*, *third*, ... , and the non-numeral ordinals [7].

Mutatis mutandis, the same classification applies to Italian determiners [8]:

[5] Quirk et al. consider also other varieties of determiners, namely 'multipliers' (e.g. *double*, *twice*, *three times*, etc.), 'fractions' (e.g. *one-third*, *two-fifths*, etc.) and 'wh-determiners' (e.g. *whose*, *what*, *whichever*, etc.), but we believe we can leave them aside for the time being without altering the overall scenario.

[6] For want of better terminology, we call like this (or, in full, 'quantificational determiners') the non-numeral determiners with explicit quantificational import. Note also that we don't cover here those constructions with a 'quantificational noun' followed by *of* (or equivalent in other languages), e.g. "the *majority* of...", "*lots* of...", "two *bottles* of...", "all the *rest* of...", "a great *number* of...", etc. A construction of the kind in our view does not yield a (complex) quantificational determiner, but an ordinary noun phrase headed by the italicized noun, whose predicate-argument structure one should investigate to shed light on the semantics of the amount / partition / grouping relation between the noun itself and its *of*-PP complement. We don't think our assumption is contradicted by examples like "Lots of food was on the table" where the verb agrees with the second noun and not with the first, since this can be considered just an instance of 'short-distance concord' by-passing dependency relations as shown in completely different constructions (cf. "Neither they nor Jack was able to come").

[7] Namely, "'general ordinals' ... like *next*, *last*, *past*, (*an*)*other* ..., which resemble the ordinal numerals grammatically and semantically" (Quirk et al. 1985: p. 262).

[8] We mostly list citation forms in the masculine singular for morphologically and/or graphemically variable items. Renzi (1988) and Serianni (1988) offer detailed presentations of Italian determination data, among others.

- **articles** – *il* ('the'), *uno* ('a'), *del* (partitive);
- **demonstratives** – *questo* ('this'), *quello* ('that'), and the formal/literary *codesto* (proximity to the addressee);
- **possessives** – *mio* ('my'), *tuo* (informal 2nd pers. sing.), *suo* ('his'/'her'/'its', or formal 2nd pers. sing.), *nostro* ('our'), *vostro* (2nd pers. plur., or very formal 2nd pers. sing.), *loro* ('their', or very formal 2nd pers. plur.);
- **q-determiners** – e.g. *ogni* ('every'), *qualche* ('some'), *entrambi* ('both'), *molti* ('many'), etc.;
- **cardinals** – the numerals *uno* ('one')[9], *due* ('two'), *tre* ('three'), ... ;
- **ordinals** – the numerals *primo* ('first'), *secondo* ('second'), *terzo* ('third'), ... , and the general/non-numeral ordinals, e.g. *prossimo* ('next'), *ultimo* ('last'), etc. (cf. note 7).

An interesting question is how in the two languages this repertory bears on the overall system of 'parts of speech' qua X-bar Theory categories stripped of the bar level (Pollard & Sag 1994: p. 22). That is, does 'determiner' correspond to a single part of speech, subclassified according to the above varieties, or is the notion to be understood in some other way, allowing determiners of different varieties to be assigned to different parts of speech? We will come back to the subject at various points in our paper.

Let us now address the parameter (B). In this respect, considering left-to-right order, English determiners can be classified as **I. predeterminers** (typically the quantificational determiners "all" and "both"), **II. central determiners** (e.g. articles, demonstratives) and **III. postdeterminers** (e.g. cardinals):

> The three classes of determiners have been set up on the basis of their position in the noun phrase in relation to each other. Thus we do not find central determiner + predeterminer (* their all trouble), or postdeterminer + central determiner + predeterminer (* five the all boys), but only the order I + II + III given above: all their trouble, all the five boys. Quirk et al. (1985: p. 253)

In other words, (B) yields a classification according to positional behaviour in case of co-occurrence (though leaving determiners free to co-occur or not) and implies that predeterminers co-occurring with determiners of the other classes

[9]Unlike the identical form of the indefinite article (whose plural semantic counterpart is the plural form of the partitive article "del"), the singular cardinal in Italian can be directly pluralized in an extremely restricted class of constructions: see e.g. *gli uni esempi non si accordano con gli altri* ('the one-plur. examples do not agree with the others').

must precede, whereas postdeterminers co-occurring with determiners of the other classes must follow. It can be shown that the same kind of classification holds also for other languages, such as Italian. Indeed one can easily ascertain that in Italian too the counterparts of "all" and "both" are predeterminers, the articles and demonstratives are central determiners and the cardinals are postdeterminers (see data in Renzi 1988: Ch. 4 by A. Giorgi, Ch. 7 by L. Renzi). For example:

(3) a. entrambi questi libri / * questi entrambi libri
('both these books') ('these both books')

b. i due libri / * due i libri
('the two books') ('two the books')

c. tutti i nove volumi / * i nove tutti volumi
('all the nine volumes') ('the nine all volumes')

However, the positional class for determiners of some (A)-type variety may differ according to the language, as in the case of English vs. Italian possessives to be discussed in section 2.3. It is also worth adding that sometimes determiners of the same variety in the same language may differ from each other as regards positional behaviour, belonging to different (B)-type classes; q-determiners in particular are positionally heterogeneous. E.g., in English "all" and "both" are predeterminers (as already mentioned), "each" is a central determiner (cf. *each book*, * *the/a each book*, * *each the/a book*) and "few" is a postdeterminer (cf. *these few books*, * *few these books*). Equivalently, in Italian "tutti" and "entrambi" are predeterminers (see examples in (3)), "ogni" is a central determiner (cf. *ogni libro*, * *l'/un ogni libro*, * *ogni il/un libro*) and "pochi" is a postdeterminer (cf. *questi pochi libri*, * *pochi questi libri*).

2.2 The problem of co-occurring determiners

While referring to the rest of the article for more data and details of an empirically motivated characterization of determiners along the lines sketched in section 2.1, here we would like to briefly highlight the difficulties arising when one tries to match it with the $< \overline{N}, NP >$ view of determiners. For example, Barwise & Cooper (1981) eschew the problem of article-numeral combinations as in "*the twenty* books" by treating each *the* + n in their fragment of English as an unanalyzed determiner of the usual semantic type. Although the solution is clearly 'ad hoc' inasmuch as the definite article and the cardinals need not co-occur and thus are required also as separate determiners, Barwise and Cooper try to obviate this objection by assuming the stand-alone "the" as mere abbreviation for the instance of *the* + n with $n = 1$. But what about

more complex combinations of determiners, as in "*the first twenty* books", "*all the twenty* books", "*all the first twenty* books", and so on? It is evident that an approach to article-numeral combinations as unanalyzed determiners is not extensible (cf. also Hoeksema 1983 for related criticism). Hence the problem of how to generate all possible combinations of determiners together with their semantic interpretation, which is left open in Barwise and Cooper's standard GQT, but the same still holds for Pollard and Sag's recent work in HPSG:

> In our fragment, we can get by with a small finite number of atomic subsorts of *semdet*. A more complete grammar would require a separate subgrammar for an infinite set of semantic determiners (including, e.g., cardinality determiners for each natural number).
>
> Pollard & Sag (1994: p. 397, fn. 7)

In other words, irrespective of the formal framework one is going to adopt, the idea that a combination of determiners yields a linguistic unit of type $<\overline{N}, NP>$ requires that the unit be a phrase constructed from really atomic determiners that combine their respective meanings so as to derive the meaning of the whole. Therefore, the role of $<\overline{N}, NP>$ functor applying to an adjacent nominal would be played more precisely by some 'determiner phrase' (whereas 'determiner words' would be assigned also other semantic types – e.g. $<<\overline{N}, NP>, <\overline{N}, NP>>$ – according to their role within that phrase).

A major problem with the putative 'determiner phrases' to be constructed is their uncertain syntax. This can be readily seen by contrasting the combinatorial possibilities of determiners with the lack of criteria for deciding their structural and dependency relations. If only binary branching is considered, a combination of (pre-, central and post-) determiners like *all the twenty* allows a priori eight alternative analyses, depending on whether the article is attached to the left or to the right and on which constituent heads the resulting embedded two-word constituent and/or the whole phrase. If structures with more than one sister per head are not excluded, there are other three options, depending on the head to be assumed for the resulting 'flat' three-word phrase. Thus one has to investigate eleven alternatives (which is still a simplification inasmuch as it is not obvious that all non-heads in *all the twenty* play the same dependency role, e.g. as modifier) [10]. On the other hand, standard syntactic criteria for choosing among alternatives of the kind do not look helpful in this case. Indeed, all the three determiner words in the putative determiner phrase *all the twenty* can be considered distributionally equivalent to it (cf. "*all* books", "*the* books", "*twenty* books"), hence equally good candidate heads; moreover, one can hardly discriminate among them by looking at the type of morpho-syntactic category that characterizes a phrasal projection

[10] We have equally left aside related issues of 'bar level'.

according to the lexical head, because their 'part of speech' is far from clear a priori, as previously mentioned in section 2.1.

In our view, there is a simple explanation for these and other difficulties one finds when trying to establish non-arbitrary head-dependent relations between two or more determiners taken as constituents of a 'determiner phrase'. That is, the postulation of such a phrase is just a source of spurious problems, implying syntactic links that are an artefact of the analysis and do not have any counterpart in terms of the speaker's intuitions about the behaviour and function of determiners in English (and other languages). The problems indeed disappear altogether by adopting a radically alternative approach to the co-occurrence of determiners, according to which they attach directly to the nominal backbone without combining with each other first. In this way, if binary branching is assumed, the attachments of determiners are dictated by the nominal headedness of the NP, hence the three determiners in our example can only attach to the right, one at a time, yielding a new nominal projection from a nominal head in each case. Consequently, only one analysis is possible as regards the aspects considered so far (i.e. without specifying bar levels, replaced here by a place-holder):

(4) $[^{N^{(bars)}}\ all\ [^{N^{(bars)}}\ the\ [^{N^{(bars)}}\ twenty\ [^{N^{(bars)}}\ \ldots]]]]$

The heuristic advantage of pursuing this instead of the previous approach is clear – a single, relatively well understood kind of structure to be investigated, instead of eight obscure ones. Although other three analyses become possible in addition to (4) if structures with more than one sister per head are considered (cf. [*all the* [*twenty* [...]]], [*all* [*the twenty* [...]]], [*all the twenty* [...]]), on the whole the advantage is confirmed, since we get four options against eleven. Anyway, the present work will adopt the kind of analysis exemplified by (4), as maximally restrictive working hypothesis on heuristic grounds. Alternatives thereby rejected may well have some merit which we overlook here, but we leave the burden of proof to those who advocate them. On the other hand, in section 2.4 we will show that interesting Italian data offer also direct empirical evidence in favour of our approach.

A warning is in order, at this point, however. We are not implying that determination items necessarily lack any internal phrase structure. A counterexample already mentioned cursorily in section 2.1, but irrelevant to Italian (and Romance languages in general), would be the determinative Saxon genitives, which can be considered a projection of the 'genitive morpheme' qua sort of possessive determiner taking an NP complement. Above all, in any language we are informed of, there are constructions of the kind shown in (5) below, such that one can plausibly assume that the adverbial in these sample

Italian NPs is a dependent of the adjacent determiner word and therefore the latter heads the bracketed phrasal constituent.

(5) a. [*quasi* ogni] libro
('almost every book')

b. [*assai* pochi] libri
('very few books')

c. [*al massimo* due] libri
('at most two books')

On the other hand, there are also determiners that do not allow any plausible dependent like the above; a good example is offered by the articles, as argued by Van Eynde (1994: § 3.1.1). Somebody might object that in Italian, unlike English, some predeterminers cannot combine with a common noun if they do not co-occur with an appropriate central determiner such as the article (cf. En. *all* (*the*) *boys*, It. *tutti i ragazzi* / * *tutti ragazzi*). This behaviour could be understood as a proof that in the relevant constructions the article takes the predeterminer as dependent. Nevertheless, we believe the conclusion to be wrong, because the same predeterminers can occur without any central determiner in case the nominal head is an appropriate proper name or personal pronoun or coordinate structure: e.g. *tutta Roma* ('all Rome'), *tutti noi* ('all us'), *entrambi Giovanni e Antonio* ('both Giovanni and Antonio'). Since the embedded nominals in these examples can be full NPs on their own, just like nominals introduced by a central determiner, the most natural generalization underlying the behaviour of Italian predeterminers is that they adjoin to an $\overline{\overline{N}}$ to yield another $\overline{\overline{N}}$, under some restrictions to be accounted for by our system in section 3.2.

If articles are confirmed to be always without dependents, there is no reason for assuming that they project some vacuous unary-branching phrase structure. Rather, one could plausibly conjecture that the lack of phrase structure projection is the reason why they cannot take dependents. Thus, following Gazdar et al. (1985: pp. 22, 25), among others, we find it appropriate to adopt a distinction between 'major' and 'minor' categories, in the sense of syntactic categories respectively allowing and disallowing phrasal projection, hence attachment sites for dependents. Applied to determiners, the distinction accounts for their different behaviour in this respect, e.g. quantificational determiners are major-category words/phrases and articles just minor-category words (cf. Van Eynde 1994, 1995). We will formalize the relevant notions in HPSG terms in section 3.1. For the moment, suffice it to acknowledge that complex 'determiner phrases' actually exist, but in a sense that does not affect our conclusions about combinations of predeterminers, central determiners

and postdeterminers. All what was said in that connection holds irrespective of the internal complexity of the determiners to be combined. Constructions with complex determiners like those in (5) above are not in the focus of the present article (e.g., we will not discuss whether the adverbial dependent acts as specifier or adjunct), but they are quite compatible with our approach and will be briefly touched on again in section 3.2.[11] In general, we will keep on referring just to 'determiners' without distinguishing between 'determiner words' and genuine 'determiner phrases' projected by the same words (when major), unless this distinction is explicitly required by the argumentation.

Let us now get back to our original subject, the implications for the $< \overline{N}, NP >$ view of determiners. It is clear that in the approach with right-recursive nominal structure exemplified for English in (4) above, one cannot maintain that every determiner attaching to the nominal backbone corresponds to an $< \overline{N}, NP >$ functor in the sense assumed so far. Several separate determiners may attach along the same nominal projection line, whereas at most one of them triggers the relevant change in bar level. As a first approximation, let us specify the structural backbone of (4) as (6) below, where the central determiner is the only $< \overline{N}, NP >$ functor:

(6) $[^{\overline{\overline{N}}}\ \textit{predet.}\,[^{\overline{\overline{N}}}\ \textit{central}\,[^{\overline{N}}\ \textit{postdet.}\,[^{\overline{N}}\ \ldots]]]]$

Is such an X-bar analysis of NP structure syntactically and semantically adequate, in particular for the Italian language? We have already offered some reasons for believing that predeterminers indeed are adjuncts yielding an $\overline{\overline{N}}$ from another $\overline{\overline{N}}$ (hence $< NP, NP >$ functors in semantic terms, cf. also section 3.3 below). An examination of data about central determiners and postdeterminers in the remaining sections of 2 will complete the scenario, paving the way for a suitable HPSG treatment.

2.3 Italian adjectival possessives

An important restriction on the co-occurrence of determiners, already mentioned for English by Quirk et al. (1985: p. 254), requires central determiners to be mutually exclusive with each other:

[11] Other constructions showing complex determiners of some sort are: i) comparatives, as in "[more *than twenty*] books" (where the italicized phrase can be argued to be a complement of the quantificational determiner word, see e.g. Pollard & Sag 1994: p. 367); ii) when possible, coordinations of simple or complex determiners (cf. "[two *or* three] books", "[at least two *but* no more than twenty] books", etc.). Both comparison and coordination raise notoriously hard construction-specific problems which are well beyond the scope of our article.

(7) $(*\left\{\begin{array}{l} a \\ the \\ this \\ my \end{array}\right\}) \left\{\begin{array}{l} a \\ the \\ this \\ my \end{array}\right\}$ book

Such a behaviour, corresponding to distributional equivalence to the articles qua typical central determiners, identifies the NP-determination items that can be reasonably considered 'specifiers' in the HPSG sense, given the relevant co-occurence link that holds between them and the head noun. Indeed, as already mentioned in section 1, the determiners with that very distribution are the ones required for the NP projection of singular count nouns in English (cf. $[^{NP}\, the\, book\,]$ vs. * $[^{NP}\, book\,]$) and therefore can be assumed to be lexically selected, obligatorily by those nouns and optionally by the others. Similar considerations hold for Italian too, but a difference is that English possessive determiners share the distribution of the articles (see in (7) above)[12], whereas Italian possessive determiners are allowed – and often required – to co-occur with an article, or equivalent, and therefore are not central. More precisely, they are postdeterminers, because a central determiner can precede but not follow them. Cf. the Italian counterparts of the examples (7):

(8) $(*\left\{\begin{array}{l} un \\ il \\ questo \\ mio \end{array}\right\}) \left\{\begin{array}{l} un \\ il \\ questo \end{array}\right\}$ (*mio*) libro

Interestingly, the behaviour of possessive determiners lends itself to be related to their 'part of speech' by supposing that they are adjectival in Italian, but not in English. The following data should make clear that Italian items of this variety share with qualifying adjectives the whole pattern of occurring pre- or post-nominally after the central determiner position (v. (9a) and (9b)), possibly without an overt head-noun (v. (9c)), and also as predicative complements (v. (9d)).

(9) a. il *mio/vecchio* libro ('the my/old book') a′. *my* book / the *old* book

[12] Actually, the conclusion applies to the whole paradigm of possessive determiner-words proper ("my", "your", etc.), but determinative Saxon genitives would rather appear to be postdeterminers inasmuch as they can also occur after some central determiner or even another postdeterminer: cf. "a *girls'* school", "ten *farmer's* wives". In constructions of the kind the Saxon genitive phrase clearly acts as a restrictive modifier, but this does not suffice to exclude it from determination items (pace Quirk et al. 1985: § 5.122), considering that our discussion in the next sections will show that also cardinal and quantificational determiners can play an analogous modifier role. However, Saxon genitives do not exist in Italian (where they translate as PP arguments/modifiers of the head noun) and therefore we will henceforth neglect them in this article.

b. il libro *mio/vecchio* (‘the book my/old’)
b′. the book *of mine* / the *old* book

c. il *mio/vecchio* (‘the my/old-sing.’)
c′. *mine* / the *old one*

d. il libro è *mio/vecchio* (‘the book is my/old’)
d′. the book is *mine/old*

To interpret such a parallelism in terms of common adjectival status is obviously not a matter of logical necessity, but looks quite plausible as an empirical generalization over the Italian data (v. also Serianni 1988: p. 228). By contrast, English possessive determiners are not related to the qualifying adjectives in the same way: the former, unlike the latter, are restricted to the central determiner position (but see note 12) and unavailable for other uses, which in English require possessive pronouns qua nominal pro-forms generally distinct from the corresponding determiners. (Cf. (9a′)-(9d′).)

In fact, if we qualify as ‘substantive’ the parts of speech that allow a predicative use either directly or by projecting a predicative complement – that is, the four traditional X-bar Theory types of category: *Adjective* (with [N+,V+]), *Noun* (with [N+,V–]), *Preposition* (with [N–,V–]) and *Verb* (with [N–,V+])[13] – we see that articles and, in English, distributionally equivalent possessive determiners are ‘non-substantive’ in that they cannot be predicated at all. Other examples of items whose part of speech is non-substantive, hence not falling within the aforementioned four-type system, are complementizers and conjunctions. In various cases, non-substantives are minor-category words in the sense of our previous section 2.2, i.e. they do not project phrasal structure and therefore cannot take dependents. However, we tend to agree with Van Eynde (1995) that the dicotomies substantive / non-substantive[14] and major / minor need not always coincide. In our characterization of the notions, whereas an article is both minor and non-substantive, there appear to be also non-substantive major-category determiners, such as It. *ogni* (‘every’), for instance. This is a central q-determiner which can take adverbial dependents (cf. (5), section 2.2) yet cannot be considered substantive – and, in particular, an adjective – because it disallows predicative use, nor shows other aspects of the distributional pattern of adjectives according to (9) above. An investigation

[13]For this typology in extended phrase structure grammar frameworks, cf. Gazdar et al. (1985: Ch. 2) and Netter (1994), among others. We take for granted also a feature distinction [PRD+] vs. [PRD–] (see e.g. Pollard & Sag 1994: p. 23) making explicit when the use of a substantive part of speech is actually predicative or not.

[14]But he follows Pollard & Sag (1994) in using the label “functional” as the opposite of “substantive” – which we abstain from doing, in order to avoid any danger of confusion with the functor notion and related functional properties.

into the relevance of non-substantive major categories for areas other than determination would take us too far afield, but certainly bears on classificatory decisions about items whose part of speech is controversial, such as adverbs and, perhaps, some subordinating conjunctions.

Now, getting back to the point of the adjectival status of Italian possessives, a possible objection could contend that the various uses of a possessive like "mio" in (9) above correspond to different readings which need not be part-of-speech-preserving; that is, all Italian possessive forms would be affected by the same kind of ambiguity that in English is restricted to "his" and "its". Thus, for example, "mio" in (9a) would be a non-substantive determiner, presumably forming with the article a 'complex determiner phrase' in the sense we discussed in section 2.2, whereas the contexts that in English call for the nominal pro-form "mine" [15] would analogously imply in Italian some *Noun*-type reading(s) of "mio", making the possessive appositive in (9b), head of the NP in (9c) and predicative in (9d). However, it seems to us that an approach of the kind would miss a generalization without really improving the analysis of Italian in other respects. It is indeed likely that at least the predicative reading be distinguished and derived from a non-predicative reading modulo some lexical rule (cf. Pollard & Sag 1987, 1994), but in the adjectival approach one can assume the lexical rule of Italian that derives the predicative reading of qualifying adjectives to apply to possessives as well. Even if this remains to be worked out in technical detail and we have to postpone the task to future work on predicative complements, a priori there is an advantage over the alternative approach where the generalization is impossible because Italian possessives are denied adjectival status, changing their part of speech from non-substantive to nominal.[16]

It must be added that possessive words in the Italian grammatical tradition are considered basically adjectival, though admitting also a pronoun reading to account for their 'suppletive' use (which disallows an overtly co-occurring head noun) as opposed to the 'completive' use (which implies the co-occurrence at issue). That is, "mio" is taken to be a determinative adjective completing the NP headed by a common noun in (9a)-(9b) above, but a (pro)nominal head supplanting the noun in (9c); moreover, as mentioned e.g. in Renzi (1988: Ch. 13 by P. Cordin), predicative counterparts can be found for both adjectival and

[15] Or "mío" – instead of "mi" – in Spanish, an example of Romance language with two distinct paradigms of possessives.

[16] In the alternative approach one could factorize the 'lexical transformation' of possessives according to two steps – from non-substantive to [PRD–] nominal and from the latter to [PRD+] nominal – and thus it may look as if a generalization were nonetheless achieved: the second step could follow from the lexical rule of Italian that derives the predicative reading of nouns. However, this argument is flawed by the additional first step, not required in the adjectival analysis.

nominal possessives, cf. respectively (9d) and *quel libro è il mio* ('that book is the my'). In this approach, the idea of some 'lexical transformation' yielding a nominal element is not in contradiction with a generalization over adjectives, as it is uncontroversial that qualifying adjectives in Italian can evolve into nouns (the so-called "aggettivi sostantivati" in the Italian grammarians' traditional terminology). E.g., the adjective *vecchio* ('old') has developed a common noun reading with a more specialized meaning, translating as 'old man', and therefore it does not seem implausible to suppose that the Italian lexicon incorporates also a previous stage of the process, with *vecchio* playing a suppletive role modulo an 'old one' nominal reading (v. (9c) above). Conversely, the extreme result of the process of transformation into noun is attested for possessives as well, although marginally, as shown by the specialized expression *i miei* ('the my-plur.') meaning 'my parents' in colloquial Italian.

In principle, the completive / suppletive distinction should lend itself to straightforward formalization in terms of a lexical rule changing *Adjective*-type items – whether qualifying or determinative – into *Noun*-type items. Another possible line of research would rather treat the suppletive use of adjectives as implicitly completive, modulo an empty nominal head (as suggested e.g. by Netter 1994 for German). This second option would allow to preserve the adjectival status of Italian possessives in all syntactic contexts. The choice between an account by lexical rules and an account by empty elements clearly has broader implications for HPSG (cf. also Pollard & Sag 1994: Ch. 9) and in the present article we will not address it, as we will treat only (pre- and post-nominal) completive occurrences of determiners in NPs headed by an overt common noun. Nonetheless, what has been said so far appears to be sufficient to confirm the empirical plausibility and heuristical advantages of the hypothesis that Italian possessive determiners are adjectives at least in the syntactic contexts under investigation here.

Various questions remain open as to how adjectival possessives contribute to NP interpretation. This implies some role as restrictive modifiers of the semantic content of the nominal head (in line with the HPSG treatment of attributive adjectives), but also quantification and 'binding' aspects. However, before trying to answer (in section 3), we want to extend the scope of our discussion, in order to investigate better the relevance of the determiner notion. Indeed, under the commonplace assumption that the notion corresponds to a specific (non-substantive) part of speech distinct from *Adjective*, one could accept that Italian possessive words are adjectives and, by the same token, stipulate their irrelevance to a study of determiners. We will show the weakness of this position by arguing for the adjectival status of most items that are generally classified as determiners in modern linguistics. Non-substantive

determiners like the articles will turn out to be the exception rather than the rule.

2.4 On cardinals and other postdeterminers

Cardinality determiners have been argued to be adjectival modifiers within the framework of formal semantic treatments of plurality as varied as those of Hoeksema (1983), Link (1983, 1987), Ojeda (1993) and Carpenter (in press). In its simplest formulation, which highlights the parallelism with (extensional) qualifying adjectives, the assumption is that a cardinal adjective is 'intersective' in the sense that its combination with a nominal denotes the intersection of the set denoted by the adjective and the set denoted by the nominal (Ojeda 1993). Mutatis mutandis, the same can be expressed in terms of some language of predicate logic by taking the two input sets as denotations of corresponding predicates (hence intersection corresponds to conjunction, etc.).

Substantial differences between semantic treatments of plurality arise in relation to the way of characterizing the content of the relevant sets. E.g. the cardinal *five* can simply denote the set of all sets of 5 individuals, if a plural noun (or equivalent) is assumed to denote an appropriate set of sets of individuals.[17] On the other hand, in 'mereological' approaches with a structured universe of discourse including both atomic and plural/molecular individuals, as proposed by Link (1983, 1987) and Ojeda (1993), any predicate-type expression denotes a set of individuals of some sort; the cardinal *five*, for instance, the set of all 'molecules' that have exactly 5 'atoms' as parts. It is worth noting that within a mereological framework the same authors offer also a straightforward treatment of the semantics of noncountables, such as mass nouns and the like, although we will leave these aside for convenience in the present work. More generally, we will not address various linguistic issues which may bear on a choice between the two above kinds of model-theoretic account of number, simply eschewing such a choice inasmuch as both are compatible with the view of cardinals that is relevant here. For our purposes, suffice it to say that "five" or the corresponding Italian cardinal "cinque", in a way strictly conform to the HPSG treatment of restrictive adjectival modifiers (Pollard & Sag 1994: pp. 55-56), can be lexically assigned the *nominal-object* represented in (10), where the tag $\boxed{2}$ stands for the set of restrictions to be incorporated from the nominal head. This yields restricted variables like $\boldsymbol{x_1}| \wedge \{\boldsymbol{five}(\boldsymbol{x_1}), \boldsymbol{books}(\boldsymbol{x_1})\}$ for instance.[18]

[17] One will then need also quantification over sets (possibly extended to individuals represented as singletons) and some version of GQT with plural generalized quantifiers. Cf. Hoeksema (1983), Ojeda (1993) and Carpenter (in press) for discussion of related issues.

[18] It should go without saying that the use of set union in (10) does not contradict the

(10)
$$_{nom\text{-}obj}\left[\begin{array}{l}\text{INDEX } \boxed{1}_{ref}\left[\text{NUMBER } plur\right] \\ \text{RESTR } \left\{_{five}\left[\text{ARG } \boxed{1}\right]\right\} \cup \boxed{2}\end{array}\right]$$

Of course, it is not enough to demonstrate that cardinality determination is formally tractable as an instance of adjectival modification. One has to provide empirical evidence that there are advantages over the traditional treatment modulo some numerically defined existential operator, acting as the 'semantic determiner' of a generalized quantifier in Barwise & Cooper (1981). What can be readily noticed here, in the light of our previous discussion in section 2.2, is that the adjectival modification approach allows a quite natural semantic account of the article-numeral combinations treated inadequately in standard GQT. That is, the NP where the cardinal occurs can be independently quantified through a preceding determiner that expresses an $<\overline{N}, NP>$ functor, as shown below by the generalized quantifier (11) corresponding to the NP "the five books" or, in Italian, "i cinque libri".[19]

(11) a. $\boldsymbol{(the\, x_1 | \wedge \{five(x_1), books(x_1)\})}$

b.
$$_{quant}\left[\begin{array}{l}\text{DET } the \\ \text{RESTIND } _{nom\text{-}obj}\left[\begin{array}{l}\text{INDEX } \boxed{1}_{ref}\left[\text{NUMBER } plur\right] \\ \text{RESTR } \left\{_{five}\left[\text{ARG } \boxed{1}\right], _{books}\left[\text{INSTANCE } \boxed{1}\right]\right\}\end{array}\right]\end{array}\right]$$

Moreover, Italian data offer evidence against the seeming counterargument – generally acknowledged as a difficulty for adjectival analyses – according to which "numerals precede all other adjectives in the noun phrase" (Hoeksema 1983) and thus "cannot simply be plugged into the recursive adjective node in front of a noun" (Link 1987). This may well be a property of (dialects of) English, but does not hold universally, since sample Italian NPs like the following show that postdeterminers such as a cardinal and a possessive can combine with each other and a qualifying adjective practically in any order:[20]

intersective nature of cardinals (or extensional modifiers in general), as what is meant to be unioned is sets of representations and not denotations. The result being equivalent to an order-free conjunctive logical formula (v. note 4), we get exactly the intersective interpretation we want at the denotation level.

[19]For the purposes of the present article we take for granted some 'Russellian treatment' of definite descriptions (adapted to generalized and plural quantification). On a possible alternative offered by File Change Semantics, v. Heim (1982) and Allegranza (1994, 1995), among others.

[20]The various cases in (12) are all grammatical and acceptable with appropriate (but

(12) a. i tuoi due famosi libri
('the your two famous books')

b. i due tuoi famosi libri
('the two your famous books')

c. i due famosi tuoi libri
('the two famous your books')

d. i tuoi famosi due libri
('the your famous two books')

e. i famosi tuoi due libri
('the famous your two books')

Note that a qualifying adjective interposing between determiners, as in (12c)-(12e), counts also as a serious counterexample against the idea that a combination of several determiners would make a single, complex 'determiner phrase'. Apart from the fact that any decision concerning head-dependent relations within that phrase seems to us quite arbitrary even in simpler cases (as we have argued in section 2.2), an approach of the kind would apparently force "famosi" in (12c)-(12e) to be taken as modifying an embedded determiner (sub-)phrase, whereas the qualifying adjective intuitively modifies the nominal head, in (12c)-(12e) type examples as much as in (12a)-(12b) type ones. The natural way of treating the examples in (12) is to assign them a structure of this sort:

(13) $[^{\overline{\overline{N}}}\ i\,[^{\overline{N}}\ AP\,[^{\overline{N}}\ AP\,[^{\overline{N}}\ AP\,[^{\overline{N}}\ libri\,]\,]\,]\,]\,]$

consistently with the analysis we have conjecturated at the end of section 2.2. That is, the article qua specifier triggers bar-level change from $\overline{N}$ to $\overline{\overline{N}}$ (at the beginning of our sample NPs, since these lack predeterminers), and the postdeterminers are adjoined rather freely between it and the head noun, acting as adjectival modifiers of $<\overline{N}, \overline{N}>$ type just like the qualifying one.

Finally, it must be added that Hoeksema (1983) noticed the general linguistic motivation of an adjectival analysis for cardinal, ordinal and quantificational postdeterminers:

> The present account can handle such expressions as *the first three books*, *John's last two days*, *the almost ninety exceptions* in a natural fashion.

not necessarily emphatic) intonational patterns, and the intuitive judgements of Italian speakers here hardly distinguish between 'marked' and 'unmarked' orders, or do that rather subjectively. Different orders may have different implications for *ne* extraction (Luca Dini, p.c.), yet this does not seem to affect our argument.

> ... For *many* and *few* a similar story can be told, and in this case it is even more clear that we have to analyze them as adjectives: they form comparatives and superlatives, they can be modified by degree expressions like *too* or *very* and may take part in the construction *as ADJ as* (*as big as*, *as many as*). That cardinal numerals do not have these features is easily explained: they are not vague, and therefore lack these properties, which are typical for vague adjectives.

Comparable examples can be provided for Italian, where the superlative suffix of adjectives, *-issimo* (masc. sing. citation form), also applies to numerically vague quantificational postdeterminers and general ordinals, e.g. *moltissimi* ('many-superl.'), *ultimissimo* ('last-sing.-superl.').[21] And indeed the fact that Italian cardinal, ordinal and quantificational postdeterminers allow predicative use – v. *sono due/ultimi/pochi* ('... are two/last-plur./few') – means that they are substantive, thus reinforcing the plausibility of an adjectival analysis, according to the syntactic considerations already presented for possessives in section 2.3. On the other hand, Italian possessives (and, in a much more limited fashion, ordinals) behave differently from cardinals and q-determiners in that only the former can occur also post-nominally within the NP. This, however, is not surprising if one takes into account that qualifying adjectives too may differ from each other in their positional behaviour. E.g., some classes of attributive qualifying adjectives in Italian allow exclusively the postnominal position (v. Renzi 1988: Ch. 4 by A. Giorgi) and therefore it is not implausible that other kinds of adjectives may be subject to other positional restrictions.

2.5 Taking stock

At first sight, the empirical scenario emerging from the discussion in our sections 2.3 and 2.4 could be summarized by concluding that while the central determiners are non-substantives as regards their part of speech and specifiers in X-bar / dependency terms, the postdeterminers are respectively adjectives and modifiers. This prima facie generalization would be essentially compatible with the analysis, proposed by Pollard & Sag (1994: p. 49), according to which the head noun's SPR feature selects syntactico-semantic (or, technically, *synsem*) objects with a non-substantive part of speech *Determiner*. Simply, the resulting range of application of the analysis would be defined in such a way that the postdeterminers qua adjectival modifiers would be irrelevant to

[21] Interestingly, *primo* ('first') allows the superlative suffix, unlike the other numeral ordinals: cf. *primissimo*, **secondissimo*, **terzissimo*, etc. This can be explained by assuming it has developed a less numerically precise 'general ordinal' sense, symmetric to that of *ultimo* ('last').

it; in fact, they would not be considered determiners at all, contrary to Quirk et al.'s (1985) assumption and terminology.

A first problem with such a quick adaptation of Pollard and Sag's analysis is that the major drawback we noticed in the original (v. section 1 above) is preserved too. That is, a cyclic structure is produced, because the nominal head selects the specifier by structure sharing but nevertheless this selection must be complemented by an analogous selection of the nominal head by the specifier, in order to account for head-specifier dependencies correctly. Furthermore, in the current section we will offer some evidence that the tentative empirical generalization on which the adapted analysis should be based is inadequate, at least according to our interpretation of Italian data. It will be argued that in Italian (i) not all central determiners are non-substantive and (ii) postdeterminers need not always behave as modifiers.

Concerning (i), we have to look at demonstrative determiners. In previous sections (v. 2.1, 2.3) we have cursorily mentioned and exemplified their 'central position'; that is, they are distributionally equivalent to the articles as far as completive use within the NP is concerned, thus being specifiers according to a line of reasoning that should be clear by now. However, not in every syntactic context articles and demonstratives are distributionally equivalent, because the latter in addition allow predicative and suppletive uses[22]: e.g. *il libro da premiare è questo* ('the book to be awarded a prize is this'), *questo sarà premiato* ('this will be awarded a prize'). In particular the predicative potential of demonstratives is enough to classify them as substantive by our criteria, cf. section 2.3 above. As already discussed for possessives in that section, one could object that the need for distinct lexical readings reflecting the typology of possible uses of the items under consideration could be exploited to enforce also a change in part of speech, so as to oppose a non-substantive completive reading of demonstratives to their uncontroversially substantive (adjectival or nominal) readings corresponding to the other uses. And again we judge this approach methodologically infelicitous in that some otherwise unmotivated lexical rule(s) would be required to relate the two opposite kinds of reading. By contrast, if a completive demonstrative is a non-predicative adjective as assumed in the Italian grammatical tradition, it is subject to the lexical rules available for adjectives to derive predicative and, possibly, (pro)nominal readings[23], irrespective of the independent lexical property that makes it a specifier instead of an adjunct (cf. section 3.2 below).[24]

[22]See Renzi (1988: Ch. 14 by A. Calabrese).

[23]The latter readings are necessary (for suppletive uses) only in approaches that do not postulate an empty nominal head.

[24]Of course, a lexical rule applying to both adjuncts and specifiers presupposes that the information to be encoded on its left-hand side be equally appropriate for the two kinds

Further evidence in favour of adjectival determiners playing the specifier role can be offered, in accordance with (ii) above, by considering some (uses of) postdeterminers. In order to eventually clarify this, we have to address an important issue that was not settled in section 2.4, viz. the quantificational treatment of noun phrases with a postdeterminer – especially a cardinal – but without central determiner, for instance the NP corresponding to the string "three men"[25]:

> Under the present view, the phrase *three men* is not a G[eneralized] Q[uantifier] yet, it is simply a numerically ... [modified] nominal. But then, at which point does the quantification occur? Link (1987)

Unlike Link (1987) and Carpenter (in press), we will not introduce any 'zero determiner' with existential (or other) quantificational force. It can be shown that the use of such an empty element is made superfluous by elaborating on the version of X-bar Theory proposed by Pollard & Sag (1994: Ch. 9), in which 'bare plural' nominals such as "*pictures of Mary* ... are perfectly good X'' [i.e. $\overline{\overline{X}}$] even though *pictures* (in this case) does not require a specifier" (ibid., pp. 362-363). The treatment of bare plurals comes into play here – under the view of cardinals as adjectival modifiers, alluded to in Link's quotation above and previously discussed in section 2.4 – because an NP like "three men" could be considered a bare plural in much the same way as "pictures of Mary" (or better still "nice pictures", for an example with adjectival modifier).[26]

Let us briefly discuss some syntactic aspects first. In the relevant class of X-bar systems (cf. Gazdar et al. 1985: p. 50) a word X may project $\overline{\overline{X}}$ directly, skipping any intermediate $\overline{X}$ step, if unnecessary, and thus avoiding to postulate not only a phonetically unrealized specifier but also a corresponding unary-branching derivation, e.g. from $\overline{N}$ to the maximal level of a specifier-less NP.[27] As a first approximation, one can achieve the result in terms of the HPSG approach to specifiers à la Pollard & Sag (1994: Ch. 9), by encoding plural nouns (or other possible heads of 'bare nominals', such as mass nouns) through lexical entries whose SPR valence is optionally unsaturated: [SPR $<$ ([...]) $>$], equivalent to [SPR $<$ [...] $>$ $\vee$ $<>$]. In the lexical saturation option, a

of items. This is not guaranteed in Pollard and Sag's orthodox system, but the version of HPSG we will offer in section 3 is expected to remove all those differences in the feature structure of adjuncts and specifiers that would hinder relevant lexical generalizations.

[25]To be distinguished from the $\overline{N}$ corresponding to the same string in "the three men".

[26]Hoeksema (1983) is quite explicit in this connection: "Noun phrases of the form numeral - common noun will be analyzed as bare plurals". See also Carpenter (in press).

[27]When a bare plural noun takes no complement, there is a unary-branching derivation from N to NP in order to change the sort of sign from *word* into *phrase*, according to Pollard & Sag (1994: Ch. 9). Yet the derivation skips $\overline{N}$ and does not introduce any semantic information that is not found already in the lexicon.

nominal construction simply percolates the [SPR $<>$] value of the noun up to the immediately dominating *phrase* level, where the two pieces of information result in a maximal, 2-bar projection, according to Pollard and Sag's way of defining bar levels summarized here in section 1. Consequently, the lack of $\overline{N}$ level implies that bare plurals with an adjectival modifier that would otherwise adjoin to $\overline{N}$ are NPs deriving from adjunction of that modifier to an embedded NP. As made clear by Netter (1994), an additional feature is required to distinguish bare plurals from NPs with specifier and reject incorrect adjunction to the latter (e.g. * [^{NP} *nice* [^{NP} *the pictures of Mary*]]). In section 3.2 we will show that this is actually a particular instance of an independently motivated 'marking' system with far-reaching effects on NP syntax.

Another issue to be considered is what are the consequences for semantics. In principle, one can imagine an appropriate generalized quantifier to be associated with the bare plural reading of a noun directly in the lexicon. Thus, the possible modifiers of the bare plural – such as qualifying adjectives, or postdeterminers behaving alike – will act semantically as $<NP, NP>$ functors on a par with predeterminers, mapping from the quantifier of the adjacent nominal head to some different (though variously related) quantifier. Section 3.3 below presents an improved HPSG version of the treatment in some detail. However, although we believe that the general picture of bare plurals thus sketched is correct and we agree that some varieties of postdeterminers can modify a bare plural accordingly, we will not include cardinals among these. That is, we deem an adjunct-style account of cardinal determiners convincing when they co-occur with a central determiner acting as specifier, not when they don't.

Indeed, there appears to be syntactic evidence that a cardinal in Italian NPs without central determiner is a specifier and not an adjunct. This is so because examples of the kind become ungrammatical – v. (14b) below – if the cardinal is preceded by a qualifying adjective, unlike corresponding NPs introduced by a central determiner or others in which the same qualifying adjective occurs without determiners:

(14) a. gli splendidi due cavalli
('the splendid two horses')

b. * splendidi due cavalli
('splendid two horses')

c. splendidi cavalli
('splendid horses')

Examples like (14a) above (or also *i famosi tuoi due libri*, i.e. (12e) in section 2.4) show that there is nothing wrong in a qualifying adjective preceding a cardinal within the NP. And examples like (14c) above (or also *famosi tuoi*

libri) show that there is nothing wrong in a qualifying adjective introducing a bare plural NP. But the ungrammaticality we have noticed is explained, if we accept that a cardinal can be either an adjunct or a specifier and becomes the specifier in absence of a determiner that requires that role. Under this hypothesis, (14b) is analyzed as $[^{NP}\, splendidi\, [^{NP}\, due\, [^{\overline{N}}\, cavalli\,]\,]\,]$ and its ungrammaticality follows from the same reasons that hold for * *splendidi i cavalli*. On the other hand, it is sufficient to assume that cardinals always apply to an embedded $\overline{N}$ (irrespective of the number of bars of the resulting projection) to rule out a bare plural analysis and ensure that the only remaining alternative is $[^{\overline{N}}\, splendidi\, [^{\overline{N}}\, due\, [^{\overline{N}}\, cavalli\,]\,]\,]$, a nominal that cannot be accepted as full NP but must combine with some specifier.

Limitations of space prevent us from indulging here in a really comprehensive discussion of somewhat subtle and intricate Italian data, showing similarities or differences between cardinals and other postderminers as far as relevant behaviour is concerned. Suffice it to say that possessives and some ordinals, in appropriate contexts, can be accepted without central determiner and are not affected by the phenomenon of incompatibility with a preceding qualifying adjective.[28] Hence the plausible conclusion that postdeterminers of these varieties behave like the qualifying adjectives in disallowing the specifier role while being accepted as adjuncts also in bare plurals. On the other hand, quantificational postdeterminers such as *molti* ('many') tend to pattern with the cardinals, as shown by examples where the preceding adjective is a possessive, although we feel a general incompatibility with preceding qualifying adjectives, which holds irrespective of the occurrence of a central determiner:

(15) a. $\left\{ \begin{array}{l} i \\ *\emptyset \end{array} \right\} \left\{ \begin{array}{l} suoi \\ *famosi \end{array} \right\}$ *molti* libri

b. *molti* $\left\{ \begin{array}{l} suoi \\ famosi \end{array} \right\}$ libri

In section 3.2 we will try to account for all these considerations within a formalized system which handles co-occurrences of Italian adjectives and determiners of various kinds.

The question now is whether the specifier use of a cardinal or quantificational postdeterminer is simply a case of adjectival specifier or requires the introduction of a non-substantive reading, in addition to the adjectival reading that is already required for modifier use. We find the former option more

[28] See examples like: *inquietanti loro notizie ebbero larga diffusione* ('worrying news of theirs had broad propagation'), *conoscerai carissimi miei amici* ('you will know dearest friends of mine'), *malinconici ultimi fuochi ardevano nella pianura* ('melancholy last fires burned in the plane'), *giungono promettenti primi segnali di pace* ('there arrive promising first signals of peace').

adequate, in line with analogous decisions we have taken before, as it does not call for any lexical rule changing the part of speech of a determiner from substantive to non-substantive, or vice versa. Somebody might object that this line of reasoning is flawed by the consideration that at any rate some duplication of lexical readings looks necessary in order to make a cardinal (or similar) available for both specifier and adjunct uses in standard HPSG. Their semantics would be partly different, insofar as a cardinal specifier would be assigned not (only) the *nom-obj* of the corresponding modifier (cf. (10), section 2.4), but a generalized quantifier description (with existential or other operator) embedding the former semantic object qua restriction. And two different features – SPEC and MOD, respectively – would be used to enforce selection of the adjacent head in the two cases, according to Pollard & Sag (1994). In the rest of the article, however, we will avoid additional lexical readings and rules by developing a revised version of the HPSG approach, one in which the structuring of linguistic information and the underspecification of lexical entries are such as to allow the same entry for a relevant determinative adjective to project a specifier or a modifier, depending on the syntactic context.

3 Formal treatment

3.1 Syntactic categories and dependencies in HPSG

In order to develop more formally the approach to determiners that was sketched and discussed in the previous sections, we assume a variant version of the linguistic framework by Pollard & Sag (1994). The information at the topmost level of organization of the sign is indeed the same as theirs, so that we find the attributes PHONOLOGY, SYNSEM, QSTORE, RETRIEVED, and – in case the sign is a *phrase* – DAUGHTERS (DTRS). Looking into SYNSEM values, we will be concerned with the LOCAL component only, whose values again are standardly organized, in terms of the attributes CATEGORY, CONTENT and CONTEXT. A first difference of our feature system arises in connection with the CATEGORY values, because we follow Van Eynde (1995) in taking them to reflect (an elaboration of) the distinction between 'major' and 'minor' categories, i.e. categories respectively allowing and disallowing phrasal projection as mentioned in section 2.2 above.

Let us start from the feature declaration for the sort of values CATEGORY receives here:

(16) $\textit{category}: \begin{bmatrix} \text{HEAD } \textit{head} \\ \text{MARKED } \textit{marking} \end{bmatrix}$

Next to these features, which we will discuss afterwards, the subsort *major* of *category* introduces additional ones unavailable for the subsort *minor*:

(17) $_{major}\!:\begin{bmatrix}\text{SUBJ } list\,(synsem)\\ \text{COMPS } list\,(synsem)\end{bmatrix}$

Such a characterization of categories is clearly related to the approach in Ch. 9 of Pollard & Sag's (1994) book, where distinct valence attributes, SUBJ (for subjects), COMPS (for complements) and SPR (for specifiers), are used for subcategorization, adopting a proposal by Robert Borsley. In the present version, however, only SUBJ and COMPS are (list-valued) valence attributes proper, relevant to the Valence Principle; we will see that SPR can be simply treated as a binary feature (with boolean values) reminiscent of Netter's (1994) FCOMPL encoding the 'functional (in)completeness' of signs. Moreover, as stated above, we assume valence features in the strict sense to be appropriate to major categories alone, since minor categories cannot subcategorize for dependents.

Subject and complements link up with argumental slots in the CONTENT component of a selecting head and therefore can be considered its 'arguments', the head being the 'semantic functor' in this kind of constructions (v. section 3.3 below). Following Pollard & Sag (1994: Ch. 9), argument selection according to the head's subcategorization frame is effected by application of the Valence Principle, which unifies the SYNSEM values of structurally realized dependents with corresponding elements on the SUBJ / COMPS lists of the head and makes the resulting phrase subject-saturated (i.e. with [SUBJ$<>$]) and/or complement-saturated (i.e. with [COMPS$<>$]). Subcategorization for some subject qua 'external argument' is relevant to the treatment of NPs when these are used predicatively (as suggested e.g. by Pollard & Sag 1994: p. 360), but we will not address the issue here. As regards complements, we adopt the restriction that all signs of sort *phrase* be complement-saturated (as proposed again in the 'Ch. 9 approach'; ibid., p. 346).[29] Let us enforce it through the following implicational constraint (in the formal style of Pollard & Sag 1987: Ch. 2):

(18) $_{phrase}\!\left[\ \right] \Longrightarrow \left[\text{SYNSEM|LOC|CAT } projected\right]$

where *projected* is one of the two partitions we envisage for *major* and requires complement-saturation by means of its feature declaration:

(19) *projected*: $\left[\text{COMPS } elist\right]$

[29]Such a restriction is probably too strong for an adequate analysis of complementation in Italian. Yet, we can ignore the issue for our present purposes.

(20) *unprojected*: $\left[\text{SUBCAT } \mathit{list}\,(\mathit{synsem})\right]$

Note that by using the sort *projected* our constraint (18) additionally entails that phrases can only be major categories (as expected). On the other hand, words will be encoded in lexical entries with CATEGORY sort *unprojected*, when they are major categories, or *minor*, when they are minor categories. Interestingly, we can avail ourselves of the feature declaration (20) for *unprojected* in order to implement the "proposal, suggested [...] by Klaus Netter (personal communication, 1991), according to which the SUBCAT feature is appropriate only for words" [30] (Pollard & Sag 1994: p. 376).

Leaving aside valence/subcategorization features, let us briefly consider SPR, whose purpose has to be related to X-bar Theory. As we mentioned in section 1, the version of the theory adopted for the 'Ch. 9 approach' by Pollard & Sag (1994) defines bar projections by combining the distinction between signs of sort *word* and *phrase* with their (un)saturation w.r.t. SPR qua valence attribute. The corresponding boolean SPR information proposed here is included within MARKED values (for reasons that will become clear soon), in such a way that [SYNSEM | LOC | CAT | SPR< [...] >] and [SYNSEM | LOC | CAT | SPR< >] are replaced with [SYNSEM | LOC | CAT | MARKED | SPR–] and [SYNSEM | LOC | CAT | MARKED | SPR+], respectively. That is, words are X (null projections) as usual, phrases marked [SPR–] are $\overline{X}$ (intermediate projections) and phrases marked [SPR+] are $\overline{\overline{X}}$ (maximal projections). Adapting Netter's (1994) terminology to X-bar Theory thus conceived, we can say maximal projections are 'functionally complete' w.r.t. specifiers, which means they cannot combine with any sign fulfilling that function, whereas intermediate projections are expected to combine with some ('functional incompleteness'). It is actually in the latter case that our version entails a not merely notational difference from Pollard and Sag's original, their valence feature being more complex and obviously more informative in that the element on the list allows the encoding of particular requirements on the specifier called for. However, in section 3.2 we will see the simpler feature is enough for our treatment.

Now, in order to arrive at a suitable phrase structure system, we present the DTRS feature of those signs that are phrasal and, in particular, headed, hence [DTRS *headed-structure*]. We introduce a main distinction between two

[30] More precisely, in our case, major category words. Minor categories are correctly excluded since they play no role in Binding Theory, where SUBCAT is crucially used by HPSG (Pollard & Sag 1994: Ch. 6). A problem for Binding Theory may arise in our approach because of the status of SPR as a boolean feature, which prevents its value from being concatenated with the list values of SUBJ and COMPS to form the list value of SUBCAT. But see section 3.2 below for a tentative solution.

partitions *head-argument-structure* and *head-functor-structure*, not available in Pollard & Sag (1994).[31] The former encompasses the standard 'Ch. 9'-HPSG constructions in which the possible daughters are subject or complement phrases and a head sign. Here the more specific – indeed maximal – sorts *head-comp-struc*, *head-subj-struc* and *head-subj-comp-struc* adopted by Pollard and Sag are partitions of *head-arg-struc*, with feature declarations which specify different constraints on the actual realization of head and nonhead daughters as in (21a) below. The three maximal sorts correspond to three disjuncts of the Immediate Dominance (ID) Principle, or 'ID schemata', the Head-Complement Schema, the Head-Subject Schema and the Head-Subject-Complement Schema, essentially as they are defined by Pollard & Sag (1994: Ch. 9). In fact, as far as the basic syntactic backbone of these constructions is concerned, we envisage only one difference from the original: owing to our revised characterization of *category*, the token-identity between the SPR values of mother and head (originally following from application of the Valence Principle to specifierless constructions) will be obtained as a consequence of making the MARKED values of the two nodes token-identical in phrases with [DTRS *head-arg-struc*].

(21) *headed-struc*: $\begin{bmatrix}\text{HEAD-DTR } \textit{sign} \\ \text{SUBJ-DTR } \textit{list}\,(\textit{phrase}) \\ \text{COMP-DTR } \textit{list}\,(\textit{phrase})\end{bmatrix}$

a. *head-arg-struc*

head-comp-struc: $\begin{bmatrix}\text{HEAD-DTR } \textit{word} \\ \text{SUBJ-DTR } \textit{elist}\end{bmatrix}$

head-subj-struc: $\begin{bmatrix}\text{HEAD-DTR } \textit{phrase} \\ \text{SUBJ-DTR } \textit{singleton-list} \\ \text{COMP-DTR } \textit{elist}\end{bmatrix}$

head-subj-comp-struc: $\begin{bmatrix}\text{HEAD-DTR } \textit{word} \\ \text{SUBJ-DTR } \textit{singleton-list}\end{bmatrix}$

b. *head-fun-struc*: $\begin{bmatrix}\text{HEAD-DTR } \textit{phrase} \\ \text{FUN-DTR } \textit{sign} \\ \text{SUBJ-DTR } \textit{elist} \\ \text{COMP-DTR } \textit{elist}\end{bmatrix}$

[31] Note that we neglect Pollard and Sag's 'head-filler structures' (and corresponding constraints) throughout the article. To integrate them into our system, different options look feasible in principle. In one hypothesis, fillers could be closely related to subjects, as argued by Richard Cooper (1990) and Balari (this vol.). An alternative that would be worth considering could instead try to treat fillers by developing further the functor notion which we will explain soon.

The really innovative part of the hierarchy shown in (21) above is the other general sort of structures, *head-fun-struc* (21b). The idea is that *head-fun-struc* encompasses all constructions in which the syntactic head is not the selecting element, nor the semantic functor according to the approach that will be developed in section 3.3. Such constructions always consist of two daughters, here a FUNCTOR-DAUGHTER (FUN-DTR) sign – unconventional feature of our version of HPSG [32] – and a head phrase.[33] While we assume that the use of separate attributes SUBJ-DTR and COMP-DTR to distinguish between subject and complement arguments is well motivated in current HPSG, FUN-DTR replaces the standard SPR-DTR, ADJ-DTR and MARK-DTR altogether. This means that in the DTRS component of our HPSG a dependency notion of '(non-head) functor' is taken as primitive [34], so as to generalize over 'specifier', 'adjunct' and 'marker', three dependency notions treated as alternative DTRS-component primitives in the original Ch. 9 approach. The generalization, which will prove useful in expressing syntactic and semantic principles, suggests itself if one considers the strong resemblance SPR-DTR, ADJ-DTR and MARK-DTR elements, as standardly characterized, bear to each other. Indeed they all select the head of a binary branching structure by token-identity of some feature value with the head's SYNSEM value: in Pollard & Sag (1994), specifiers and markers apply the selection via SPEC, while adjuncts do that via MOD – yet the two features can hardly be said to differ in any really significant way. Moreover, adjuncts and markers are clearly similar in that they select the head's SYNSEM value but their SYNSEM value is not selected by the head; on the other hand, while the SYNSEM value of a specifier à la Pollard & Sag (1994) is assumed to be simultaneously selected by subcategorization, yielding a cyclic structure, this does not hold in our version, where SPR is not a valence/subcategorization feature and therefore the similarity to the other head-functor structures is further enhanced.

Of course, there are also linguistically intuitive, less theory-laden differences w.r.t. the dependency relations at issue, especially in connection with the specifier vs. adjunct distinction, which any grammatical framework should capture. However, the differences can be simply derived from the non-head notion of functor in a relevant construction α:

[32] But cf. also Reape (1994) for a previous proposal of the same label.

[33] Actually, we also envisage empty lists for subject and complements (consistently with the characterization of related structures in Pollard & Sag 1994: App.). This allows the Valence Principle to apply to the construction, in order to percolate unchanged from head to mother the SUBJ and COMPS values of the head.

[34] Unlike the more general, second-order notion of 'semantic functor', which covers distinct DTRS-component attributes: the FUN-DTR if any, the HEAD-DTR otherwise. See further section 3.3, and cf. Pollard and Sag's related notion of 'semantic head' (the ADJ-DTR if any, the HEAD-DTR otherwise).

specifiers are functors from $\overline{X}$ to $\overline{\overline{X}}$, i.e. they trigger the change of SPR value from the head (marked [SPR–]) to the mother node (marked [SPR+]) of α;

adjuncts are functors from $\overline{X}$ to $\overline{X}$ or from $\overline{\overline{X}}$ to $\overline{\overline{X}}$, i.e. they preserve the SPR value from the adjacent head to α's mother node;

so-called 'markers', e.g. the complementizers, are (semantically vacuous) minor-category adjuncts whose occurrence in α is recorded on the mother node by the MARKED value.[35]

To achieve the desired result, any FUN-DTR sign is provided with these two HEAD features:

- ARG-SLOT, which replaces SPEC and MOD in the task of selecting the 'argument of the functor', i.e. (the SYNSEM value of) α's head;
- MARKER, whose value (of sort *marking*) is token-identical with the MARKED value on the mother node of α and therefore conveys that node's MARKED|SPR information, inter alia.[36]

Being HEAD features, ARG-SLOT and MARKER are subject to the Head Feature Principle (Pollard & Sag 1987: p. 43, Pollard & Sag 1994: p. 399), thus ensuring that phrasal functors share the pertinent properties of their internal head. Note that both features are expected to be available for all sorts of HEAD values[37], irrespective of the substantive or non-substantive status of the part of speech, as encoded through corresponding partitions of *head*. Concerning *substantive* (which introduces the characteristic feature PRD with boolean values), its partitions correspond to the four lexical head types traditional in

[35] Pollard & Sag's (1994) original notion of markers, in our view, is a hybrid which collapses two different properties – being 'minor' and marking – and at the same time involves an unmotivated restriction of their range of application. Cf. also Van Eynde (1994, 1995) for related criticism and a precursory attempt to revise the notion.

[36] The reason for using two attributes, MARKED and MARKER, instead of the single MARKING by Pollard & Sag (1994: pp. 45-46) is that our non-head functors, unlike their 'markers', can be phrases. Without the distinction between the MARKED|SPR feature, relevant for determining the bar level of the node where it occurs, and the MARKER|SPR feature, used for marking a different node, a phrasal functor would be forced to share the number of bars of the mother node it is attached to. X-bar Theory systems with similar properties have been occasionally proposed and motivated for NP structure analysis (cf. Sadler & Arnold 1994), but we will not investigate the hypothesis here.

[37] In case of a word (reading) that cannot be or project a FUN-DTR constituent, it is up to the lexical entry to specify the two features for some 'linguistically vacuous' value. So, the ARG-SLOT values are of sort *arg-slot* with partitions *synsem* and (vacuously) *none*.

X-bar Theory, i.e. *noun*, *verb*, *adj* and *prep*, whereas possible partitions of *non-substantive* are *complementizer*, *conjunction*, *article*, and others, which would deserve more careful discussion (cf. section 2.3 above).

Our treatment is completed by the following ID schema to be taken as one of the disjuncts of the ID Principle:

(22) **Head-Functor Schema**

$$\left[\begin{array}{l} \text{SYNSEM|LOC|CAT|MARKED } \boxed{1} \\ \text{DTRS} \left[\begin{array}{l} \text{FUN-DTR|SYNSEM|LOC|CAT} \left[\begin{array}{l} \text{MARKED|SPR } + \\ \text{HEAD} \left[\begin{array}{l} \text{MARKER } \boxed{1} \\ \text{ARG-SLOT } \boxed{2} \end{array}\right] \end{array}\right]_{syntagma} \\ \text{HEAD-DTR|SYNSEM } \boxed{2} \end{array}\right]_{head} \end{array}\right]_{head\text{-}fun\text{-}struc}$$

In itself, (22) is a formally simple, non-disjunctive constraint on all phrases with a non-head functor, whether adjunct or specifier, substantive or non-substantive, major or minor. (As regards the last dichotomy, the functor's category is of sort *syntagma* generalizing over *minor* and *projected*[38], so as to exclude unprojected major-category words, and is marked [SPR+], so as to exclude phrases that are not maximal projections.) The Head-Functor Schema replaces Pollard and Sag's Head-Specifier Schema, Head-Adjunct Schema and Head-Marker Schema, in the same way in which *head-fun-struc* qua maximal subsort of *headed-struc* replaces their *head-spr-struc*, *head-adj-struc* and *head-mark-struc*. Moreover, our schema incorporates the selection that they envisaged as a separate SPEC Principle (v. section 1 above) and extends to all non-head functors the part of marking mechanism that they confined to 'markers' (cf. note 35).[39] We will present our marking system in some detail in section 3.2 below. Suffice it to notice here that adjuncts to $\overline{X}$ mark for [SPR–], adjuncts to $\overline{\overline{X}}$ and specifiers mark for [SPR+]; so, the bar-change triggered by specifiers can be lexically encoded as the difference between their HEAD|MARKER|SPR value and the MARKED|SPR value of the category they select via ARG-SLOT.

[38]To sum up the resulting sort hierarchy for CATEGORY values: the partitions of *category* are *syntagma* and *major*; the partitions of *syntagma* are *minor* and *projected*; the partitions of *major* are *projected* and *unprojected*; *minor*, *projected* and *unprojected* are maximal. Note that *projected* is a common subsort of *syntagma* and *major* (v. Carpenter 1992 for formalization of sort hierarchies where common subsorts are allowed under certain restrictions).

[39]Accordingly, the part of marking mechanism pertaining to heads (which mark at least vacuously, i.e. for *unmarked*, if no other marking is appropriate) is now applied to head-argument structures alone, modulo the already mentioned token-identity of the MARKED values of head and mother in these constructions. The constraint can be stated directly in the relevant ID schemata or as an implication of phrases with [DTRS *head-arg-struc*].

To appreciate better our approach, imagine a different way of dispensing with the Head-Specifier Schema: one could treat the same class of constructions in terms of some version of the Head-Complement Schema, under the assumption that the constituent that we consider a specifier be taken as the head. This would be in line with the so-called 'DP Analysis' (see e.g. Abney 1987 and – in HPSG – Netter 1994), which claims that a determiner-nominal combination traditionally labelled NP is actually a DP projected by the determiner (D). Now, a typical drawback of the DP Analysis is the following: either an 'empty determiner' is postulated ad hoc, in order to change into DPs the otherwise determinerless NPs with the same distribution (e.g. bare plurals), or the analysis misses a generalization, implying disjunctive $DP \vee NP$ subcategorization wherever a verb or other item traditionally subcategorizes for NP.[40] Netter (1994), who rejects empty determiners, has proposed a variant of the DP Analysis that avoids the weakening of subcategorization frames because the part of speech of a head that in traditional terms would play the specifier role ('functional head') is derived by token-identity with the part of speech of the complement, so that determiners and their 'DP' projections are actually nominal. However, his solution is in conflict with the intuitive linguistic notion of 'part of speech' as inherent (non-relational) lexical category information which one can rely on for the identification of heads:

> under the assumption that specifiers are heads, specifiers really have no inherent category at all, but instead are like wild cards that get their gross category assignments from the phrases they specify. But then there is clearly no basis for calling the specifiers heads.
>
> Pollard & Sag (1994: p. 370)

Moreover, in section 2.5 above we have argued for the existence of adjectival determiners that are specifiers or adjuncts depending on the syntactic context, while we expect the phenomenon to be accounted for without a duplication of lexical entries. As we will see in section 3.2, our HPSG system achieves the result in an optimally simple way, assuming that the lexical MARKER of the relevant functors is undetermined for the SPR value; so, their use as specifiers or adjuncts is dictated by the MARKED|SPR value (hence the number of bars) of the nominal projection they attach to. But a duplication of lexical entries would be unavoidable in case of a 'functional head' and a corresponding adjectival modifier in Netter's (1994) HPSG system, because of the irreducible

[40] This is just the simplest scenario (as taken into account by Netter 1994, for example). Radical versions of DP Analysis such as that of Abney (1987), treating adjective-nominal combinations along the same lines as determiner-nominal combinations, involve more extensive disjunctions in subcategorization frames and at the same time make use of empty elements. For a critical review, v. Sadler & Arnold (1994).

lexical differences between the two w.r.t. part-of-speech information as well as the feature for selection of the adjacent nominal. We can conclude that the DP Analysis, despite Netter's revision, is linguistically less appealing than a more standard HPSG analysis based on the non-head notion of specifiers. This does not prevent us from importing some interesting aspects of Netter's (1994) approach – as indeed we have done by making SPR boolean [41] – to the extent that they do not necessarily require a DP Analysis.

3.2 The Italian determination system

In the revision of HPSG we have proposed, there is no separate class of 'markers', neither as a DTRS/dependency primitive nor as a part of speech (pace Pollard & Sag 1994: p. 45). On the other hand, the property of marking instead of the head becomes potentially available to non-head functors in general. Here we want to show that this, beside being expedient for X-bar Theory formalization (as sketched in section 3.1 above), is also specifically motivated by empirical evidence concerning determination. A pertinent issue was already mentioned cursorily in section 2.5, namely the marking of an NP node to indicate whether it allows the adjunction of a qualifying adjectival modifier through a further NP projection, i.e. $[^{NP} AP\, [^{NP} ...]]$. E.g., data of Italian and other languages (v. Netter 1994 on German) show that in case of a bare plural the adjunction is possible, whereas it is impossible if the input NP arises from the attachment of some specifier. However, the distinction cannot be made in terms of SPR, as also bare plurals are marked [SPR+]. Our conclusion is that an additional dimension of marking is called for, allowing determiners that play the specifier role to mark the resulting NP node differently from bare plural heads.

Another problem to be considered concerns postdeterminers: they freely combine with each other (especially in Italian, as shown in section 2.4), but not when they are of the same variety in the sense of section 2.1, e.g. cardinals. When the same-variety items are individually distinct, as in * *the five three books*, it is tempting to appeal to an extra-grammatical explanation by semantic inconsistency, especially as far as numeral information is concerned, yet the solution does not apply to repetitions of the same item, as in * *the three three books*. Indeed, remind that the numerals in these examples work as 'intersective modifiers' in the sense explained in section 2.4. If T is the set of ternary sets (sets with cardinality 3) and B is the set of sets of books, then T∩B=I but also T∩I=I, i.e. the intersection with T can be freely iterated without changing the result, which is always the set of ternary sets of books (and the same line of reasoning holds in a mereological account, where T, B and I

[41] But cf. also section 3.3 below.

are sets of appropriate 'molecules'). A more restrictive solution would be one exploiting the semantic content of the grammatical selection applied through ARG-SLOT: e.g., a cardinal could enforce the ARG-SLOT condition that no element of *cardinal* sort [42] be contained by the RESTR set in the adjacent head's *nominal-object*. However, semantically based solutions, whether external or internal to the grammar, are hardly applicable to Italian possessives. It is clear that the abstract semantic relation possessive determiners express – grammatically, the *poss* sort (Pollard & Sag 1994: § 1.8) – is also expressed by possessive PPs (with the same options as regards its instantiation according to the pragmatic context: ownership, authorship, etc.); but this in Italian does not prevent the former items from co-occurring with the latter. Cf. the following data, where we assume that the first person be the owner and the third person the author [43] (to be identified with Moravia):

(23) a. i miei libri
('the my books')

b. i suoi libri
('the his books')

c. i libri di Moravia
('the books by Moravia')

d. * i miei suoi libri
('the my his books')

e. * i suoi miei libri
('the his my books')

f. i miei libri di Moravia
('the my books by Moravia')

The ungrammaticality of (23d) and (23e) must be explained by incompatibility of possessive determiners, not possessives tout court, otherwise one would

[42] With subsorts like *five*, v. example 10 of section 2.4.

[43] The assumption makes clear that what forbids the repetition is not a uniqueness constraint on the specific 'thematic role' the possessive can be claimed to play w.r.t. the nominal head. This is not meant to show that thematic uniqueness and, in general, thematic-role systems – like those applied in HPSG-style linguistics by Balari (1991), Dini (this vol.) and Sanfilippo (1990, this vol.) – are wrong. Simply, they are neither sufficient nor necessary to explain the impossible repetitions we are dealing with, as even more evident in the case of the cardinals, where no thematic role can be plausibly assigned.

discard (23f) as well.[44] In sum, the problem plausibly requires a syntactic solution, comparable with Pollard & Sag's (1994) way of avoiding repetitions of complementizers, e.g. * *that that* (ibid., p. 46).

We thus envisage that an appropriate, partly language-specific system of determination sorts be introduced to mark non-vacuously the mother node of a nominal phrase. It is worth noting that this holds for head nouns too, their lexically specified determination marking (which we will touch on afterwards) being transmitted to the mother in a head-complement construction; cf. note 39. Moreover, also non-head functors other than determiners are involved in determination marking, at least in the sense of preserving unaffected the MARKED value of the nominal they apply to. On the other hand, the ARG-SLOT feature of any non-head functor may imply or forbid that the nominal head it applies to be marked in a certain way. More generally, the compatibility between the two constituents will be entirely checked within the former, also in case of a specifier, by exploiting the information incorporated into its ARG-SLOT. Therefore, the expressive power of the SPR feature on the adjacent head can be legitimately reduced to a minimum as we have done.[45]

We will exemplify the approach w.r.t. a tentative marking system for (a fragment of standard) Italian, which we assume includes these partitions:

Partitions of *marking***:** *unmarked*, *marked*.

Partitions of *marked***:** *determination* (*det*), ...

Partitions of *det***:** *switch-det*, *source-det*.

Partitions of *switch-det***:** *outer-det*, *inner-det*.

Partitions of *source-det***:** *inner-det*, *baretype-det*.

[44]Of course, to revise a semantic approach accordingly, by introducing partitions like *poss-det* vs. *poss-pp*, inconsistent with the semantic status of the *poss* relation, would be simply a bad way to call into play the syntactic distinction one needs here. Another dubious attempt to by-pass our objections would imply that the scope of possessive determiners be always narrower than that of possessive PPs, in contrast with the most intuitive interpretation of an example like (23f), which can be elicited from *i miei libri di Moravia sono meno rovinati dei tuoi* ('the my books by Moravia are less spoiled than the your').

[45]For their treatment of German NPs, Pollard & Sag (1994: p. 372) assume that an adjectival modifier, according to its declension class, may select an $\overline{N}$ that in turn selects a determiner described by [SPR<[...]>] as belonging to a particular declension class. However, cf. Netter (1994) for an alternative treatment of the same data which does not resort to such a mutual selection, calls for specifiers by a binary feature (FCOMPL, already mentioned here in 3.1) and looks essentially compatible with our approach, modulo the necessary conversions. (In particular, since we reject a DP Analysis, DECL would be a marking feature for us.)

where *outer-det* (marking the [SPR+] nominals that disallow external modification by a qualifying adjective), *inner-det*[46] (marking [SPR–] nominals) and *baretype-det* (marking bare plurals and the other [SPR+] nominals that allow external modification by a qualifying adjective) are the maximal sorts of the determination system. Relevant feature declarations, which in the case of *det* (25) introduce three new attributes to be discussed presently, are the following:

(24) *marked*: $\left[\text{SPR } \textit{boolean}\right]$

(25) $$\textit{det}: \begin{bmatrix} \text{QUAMARK } \textit{boolean} \\ \text{ORDMARK } \textit{boolean} \\ \text{POSSPRO } \textit{list}\,(\textit{synsem}) \end{bmatrix}$$

(26) *outer-det*: $\left[\text{SPR } +\right]$

inner-det: $\left[\text{SPR } -\right]$

baretype-det: $\left[\text{SPR } +\right]$

We show hereafter the HEAD|MARKER value (a.) and the HEAD|ARG-SLOT| LOC|CAT|MARKED value (b.) to be lexically encoded in the category of Italian determiners of various kinds. Nothing will be said about the way determiners themselves are MARKED; suffice it to mention that the same basic mechanisms apply internally to phrasal determiners, modulo a specific dimension of the marking system, so as to control the attachment of 'adverbial dependents' in the sense of section 2.2 (cf. (**quasi*) *quasi ogni*).

(27) **Predeterminers**:

a. *outer-det* $\left[\text{QUAMARK } +, \text{ ORDMARK } \boxed{1}, \text{ POSSPRO } \boxed{2}\right]$

b. *outer-det* $\left[\text{QUAMARK } -, \text{ ORDMARK } \boxed{1}, \text{ POSSPRO } \boxed{2}\right]$

They are q-determiners typically adjoining to NPs with specifier[47], provided this is not a cardinal or q-determiner; as a consequence, the adjunction cannot be iterated. Note that in our system the feature QUAMARK is meant to capture generalizations over cardinals and q-determiners, irrespective of the varying distribution, part of speech and semantic properties of the latter.

[46] Common subsort of *switch-det* and *source-det* (cf. note 38).

[47] Or – in some cases – NPs consisting of a proper name or personal pronoun (cf. section 2.2 above), which therefore has to be lexically marked in a compatible way. E.g. *switch-det*, for proper names that can be introduced by a predeterminer or a specifier.

(28) **Articles and demonstratives**:

a. *outer-det* $\left[\text{QUAMARK} -, \text{ORDMARK } \boxed{1}, \text{POSSPRO } \boxed{2}\right]$

b. *inner-det* $\left[\text{ORDMARK } \boxed{1}, \text{POSSPRO } \boxed{2}\right]$

Typical central determiners, hence specifiers, they change a nominal projection seeking for a specifier into a 'functionally complete' one. Here the QUAMARK value in a. is not related to b., but set to *minus* in any case, thus allowing the resulting NP to be ajoined a predeterminer (27) even if some cardinal or q-determiner occurs after the specifier: cf. *tutti i venti libri* ('all the twenty books').

(29) **Central q-determiners**:

a. *outer-det* $\left[\text{QUAMARK} +, \text{ORDMARK } \boxed{1}, \text{POSSPRO } \boxed{2}\right]$

b. *inner-det* $\left[\text{QUAMARK} -, \text{ORDMARK } \boxed{1}, \text{POSSPRO } \boxed{2}\right]$

They are specifiers like the items (28), but differ in the QUAMARK feature because of the q-determiner status.[48]

(30) **Cardinals and quantificational postdeterminers**:

a. *switch-det* $\left[\text{QUAMARK} +, \text{ORDMARK } \boxed{1}, \text{POSSPRO } \boxed{2}\right]$

b. *inner-det* $\left[\text{QUAMARK} -, \text{ORDMARK } \boxed{1}, \text{POSSPRO } \boxed{2}\right]$

The non-maximal sort *switch-det*, being undetermined for the SPR value, makes their marking compatible with a specifier or ($\overline{N}$-level) adjunct function; v. also section 3.1 above. The maximal subsorts *outer-det* and *inner-det*, alternatively, will be inferred from a. according to the syntactic context. Note that an effect of the common QUAMARK restriction is that a cardinal and a quantificational postdeterminer cannot co-occur.[49]

(31) **Ordinals**:

[48] At first sight, examples like *ogni due giorni* ('every two days') would seem to call for a less restrictive b., so as to allow the central q-determiner *ogni* to precede a cardinal. However, the fact that the same examples become ungrammatical if the cardinal is omitted (as indeed there is a clash in grammatical number between *ogni* and the noun) suggests a treatment with the cardinal taken as specifier and *ogni* as its 'adverbial' dependent.

[49] There is at least one exception to the equivalent distribution of cardinals and quantificational postdeterminers in Italian, namely the fact that the latter, unlike the former, are always incompatible with a preceding qualifying adjective (as we mentioned in section 2.5). The phenomenon can be accounted for by some further refinement of the marking system or by assuming an appropriate semantic condition on the RESTR set within the ARG-SLOT of qualifying adjectives.

a. *source-det* $\left[\text{QUAMARK } \boxed{1}, \text{ ORDMARK } +, \text{ POSSPRO } \boxed{2}, \text{ SPR } \boxed{3}\right]$

b. *source-det* $\left[\text{QUAMARK } \boxed{1}, \text{ ORDMARK } -, \text{ POSSPRO } \boxed{2}, \text{ SPR } \boxed{3}\right]$

Typical case of postdeterminers that can only function as adjuncts, they preserve whichever SPR value marks the selected nominal – unlike the other determiners we have seen so far, but analogously to qualifying adjectives. However, a qualifying adjective would also leave unspecified the ORDMARK value and share it between a. and b.

(32) **Possessives**:

a. *source-det* $\left[\text{QUAMARK } \boxed{1}, \text{ ORDMARK } \boxed{2}, \text{ POSSPRO } <>, \text{ SPR } \boxed{3}\right]$

b. *source-det* $\left[\text{QUAMARK } \boxed{1}, \text{ ORDMARK } \boxed{2}, \text{ POSSPRO } < [...] >, \text{ SPR } \boxed{3}\right]$

Concerning a. and b. they show essentially the same kind of behaviour as the ordinals (31), mutatis mutandis. Here the re-setting of the POSSPRO value from a singleton list to an empty list ensures that possessive determiners cannot co-occur.

More has to be said about possessives, of course, in order to motivate the status of POSSPRO as a list-valued feature. A pertinent problem, due to the fact that we take SPR to be binary, therefore not a (list-valued) valence feature proper, is the impossibility of concatenating the SPR value with that of SUBJ and COMPS, to yield the SUBCAT list required for the purpose of Binding Theory (v. Pollard & Sag 1994: Ch. 6, Ch. 9). Nor SUBCAT can be claimed to concatenate just SUBJ and COMPS, because this appears to be in conflict with data of English, a language where possessive determiners are specifiers and at the same time relevant to Binding Theory:

(33) * [Kim and Sandy]$_j$ are [their]$_j$ greatest admirers

That is, in (33) the possessive would be 'locally o-commanded' by the co-indexed subject, hence ruled out by Principle B, assuming that both were on the SUBCAT list of "admirers" (Pollard & Sag 1994: pp. 375-376). But the exclusion of SPR's value from SUBCAT makes the possessive exempt from standard Binding Theory, leaving the ungrammaticality of the example unexplained. Nonetheless, we don't think this argument really falsifies our approach. Cf. below the Italian translation of (33):

(34) * [Kim e Sandy]$_j$ sono i [loro]$_j$ più grandi ammiratori

In (34), whereas the article "i" is the specifier, the possessive is an adjunct (as should be clear by now) and therefore, here and elsewhere, is exempt from Binding Theory irrespective of the assumptions about SPR's sort of values.

Still, in examples such as (34) the Italian possessive behaves like its English equivalent as far as the ungrammatical coreference is concerned. But since the decision of making SPR binary cannot affect Binding Theory properties of possessives in Italian, we believe the same conclusion should carry over to English, otherwise the parallel behaviour of (33) and (34) would be unexpected.

The solution we put forward exploits our new feature POSSPRO, whose value is concatenated with the SUBJ and COMPS values on the SUBCAT list in the lexical entries of nouns, in the same (intermediate) obliquity position that was assumed for the SPR value by Pollard & Sag (1994: p. 375). See (35) below, showing selection and marking properties of head nouns:[50]

(35)
$$\begin{bmatrix} \text{HEAD} \begin{bmatrix} \textit{noun} \\ \text{ARG-SLOT } \textit{none} \\ \text{MARKER } \textit{unmarked} \end{bmatrix} \\ \text{MARKED} \begin{bmatrix} \textit{det} \\ \text{QUAMARK } - \\ \text{ORDMARK } - \\ \text{POSSPRO } \boxed{2} \end{bmatrix} \\ \text{SUBJ } \boxed{1} \\ \text{COMPS } \boxed{3} \\ \text{SUBCAT } \boxed{1} \oplus \boxed{2} \oplus \boxed{3} \end{bmatrix}$$

Now, in case of occurrence of a possessive determiner as adjunct (in Italian) or specifier (in English), the POSSPRO value of the head noun – which is lexically unspecified – becomes instantiated as an effect of the Head-Functor Schema. Indeed, the lexical entry of the possessive is assumed to specify a suitable pronominal element [51] on the ARG-SLOT|LOC|CAT|MARKED| POSSPRO list, while discharging it modulo the empty MARKER|POSSPRO list (v. (32) above). On the other hand, the SUBJ / COMPS valences of the external heads that subcategorize for NP will require [POSSPRO $<>$], ensuring that also NPs without any possessive determiner get an empty list as POSSPRO value. No matter how the POSSPRO value is determined, it will be transmitted unchanged from the mother to the head daughter in each local nominal construction without a possessive determiner as non-head daughter (e.g. see the token-identity between the POSSPRO values of a. and b. in (27)-(31)). Finally, it should go without saying that no cyclic structure arises from our

[50] Alternative subsorts of *det* will be lexically specified depending on the type of noun (v. note 47 and the next section).

[51] A *personal-pronoun* or an *anaphor* (in the sense of Pollard & Sag 1994: Ch. 6), according to the possessive's properties relevant to Binding Theory. Note that these properties are in fact expressed via the POSSPRO feature only; thus, for example, the CONTENT of an Italian possessive adjective will be allowed to preserve the *npro* (*non-pronominal*) sort of the adjacent head's *nominal-object*.

use of POSSPRO, because the possessive selects the *synsem* object of the nominal head but the nominal head does not select the *synsem* object of the possessive, which in turn is not token-identical with the *synsem* object on the POSSPRO list (cf. note 51) although variously related to it.

3.3 On the syntax-semantics interface

3.3.1 Semantic types and flexible compositionality

In light of the approach developed in previous sections, the meta-grammatical statement of a model-theoretic interpretation for our linguistic descriptions includes the following type assignments to Italian determiners:

(a) predeterminers are $<NP, NP>$ functors

(b) central determiners are $<\overline{N}, NP>$ functors

(c) cardinal and quantificational postdeterminers are $<\overline{N}, N^k>$ functors

(d) possessive and ordinal postdeterminers are $<N^k, N^k>$ functors,

where k stands for 1 or 2 'bars', i.e. (c) and (d) involve templates from which specific types are obtained by alternative instantiations. Given the interpretation of NPs as generalized quantifiers [52] and $\overline{N}$s as their restrictions, the underspecified determiners get a specific semantic type depending on the number of bars of the nominal projection they attach to. The same holds for other functors such as qualifying adjectives, whose semantic type is characterized again by $< N^k, N^k >$.

Now, adapting an idea from Netter (1994), we would like to exploit lexical underspecification on the nominal head's side too. In languages with morphologically realized number distinctions for nouns, the singular and the plural of a count noun are encoded as distinct – though obviously related – lexical entries, according to the standard HPSG account of inflectional morphology (Pollard & Sag 1987). On the other hand, syntactically, the distinction between bare plural and plural calling for a specifier does not require any duplication of plural entries or corresponding disjunction of values (cf. section 2.5 above), if one leaves lexically undetermined the MARKED|SPR value to be shared by the plural noun with the immediately dominating phrasal node. It is up to the linguistic contexts of occurrence to instantiate the value on that node, thereby determining whether the phrase is a maximal or intermediate projection. [53]

[52] But cf. below for further discussion.

[53] The relevant SPR value is recoverable from the ARG-SLOT information of various non-head functors pertaining to NP structure (see section 3.2), or at least from the SUBJ / COMPS information of the external heads that subcategorize for NP.

So, in terms of the marking system we offered in section 3.2, a plural noun will be lexically marked *source-det*, allowing *baretype-det* (with [SPR+]) and *inner-det* (with [SPR–]) as alternatives.

In approaches of the kind, a problem (which Netter 1994 does not address) is how to avoid that the need to distinguish two semantic interpretations of the same plural noun – the bare plural interpretation and the specifier-related interpretation – brings about the very distinction of lexical entries that was dispensed with on syntactic grounds. Our solution is to obtain the two interpretations from the same lexical entry by virtue of the 'type ambiguity' of its category. To consider just the simplest case, if a lexical head without complements is taken to inherit the denotation of its mother node, a non-valent plural noun N in the lexicon is semantically of type N^k, i.e. $\overline{N}$ or NP. A similar indeterminism can be found with non-lexical categories as well, e.g. in the case of phrases acting as semantic functors characterized according to (c) and (d) above, hence type-ambiguous in isolation.

This scenario is in line with 'flexible' versions of compositionality proposed by Barbara Partee and others[54]:

> I will retain from Montague's approach the requirement of a systematic category-to-type correspondence, but allow each category to correspond to a family of types rather than just a single type. For an extensional sublanguage I propose basic NP types e ("referential"), $<e, t>$ ("predicative"), and $<<e, t>, t>$ ("quantificational").
>
> Partee (1987)[55]

We leave aside the tricky issue of providing an adequate semantic account of predicative NPs, but at any rate, exploiting the fact that categories in extended phrase structure frameworks display a rich array of features beside bar level and part of speech, a deterministic category-type correspondence would be restored in the predicative case by a characterization of the relevant category as including also [PRD+], as already proposed for adjective phrases by Gazdar et al. (1985: p. 192).[56] On the other hand, the alternative between e and $<<e, t>, t>$ appears to yield genuine indeterminism in the interpretation of a non-predicative NP.

[54]Cf. the use of 'multi-valued', 'non-deterministic' functions for semantic interpretation in Cooper (1983).

[55]Note that $<e, t>$ and $<<e, t>, t>$ (neglecting intension) are the complex types that Gazdar et al. (1985: Ch. 9) abbreviate as $\overline{N}$ and NP, respectively; e (i.e. 'individual entity') and t (i.e. 'truth value') are Montague's primitive types. (See Montague 1974, Dowty et al. 1981.)

[56]The resort to an extended notion of category is implicit in the correspondences (a)-(d) above, given the analytic account of informal labels such as "predeterminers", "central determiners", etc. that was offered in terms of HPSG features in section 3.2.

A standard motivation found in the literature (v. Partee 1987) concerns NPs consisting of a proper name, which are said to be ambiguous between a direct referential interpretation, adopted as the default option because of its ontological simplicity, and a quantificational interpretation [57], required e.g. in NP coordinations like "John and every woman". Here we would like to make clear that both semantic types are motivated also for (non-predicative) NPs projected by a common noun, including explicitly quantified ones, under certain HPSG assumptions about quantification. Indeed, so far in the article we have neglected the quantifier storage, inheritance and retrieval mechanisms originating from Cooper (1983) and employed by Pollard & Sag (1994: Ch. 8) to handle quantifier scope in HPSG. Their effect on the semantics of a relevant NP subcategorized for by some head is to distinguish between the NP's generalized quantifier, which is stored, and an interpretation as 'referential index' (i.e. e-type variable here), which fills an argumental slot in the semantic content of the selecting head (and becomes bound when the quantifier is retrieved with appropriate scope). Hence a puzzle for compositional model-theoretic semantics: the denotation this NP must be assigned in view of the functional application of a verb of type $<e, t>$, for instance, is not the denotation resulting from the NP's compositional interpretation and in fact required for the application of other types of functor (e.g. $< NP, NP >$ modifiers). Flexible compositionality offers a solution to the puzzle in that several denotations can be made available for the same NP, modulo some systematic way of deriving alternative interpretations from the more strictly compositional one.

Under a system of 'indirect' interpretation, whereby the linguistic descriptions generated by the grammar are translated as logical expressions (of appropriate semantic type) allowing a traditional, completely compositional and deterministic model-theoretic interpretation, it is up to a set-valued translation function T to accommodate the violations of compositionality. But in HPSG the logical translations generally come down to a notational rewriting of relevant feature values of the linguistic descriptions (and vice versa; cf. Pollard & Sag 1987: p. 94). So, the desired flexibility can be achieved as follows: some features of a given constituent α are identified as those with values recodable as logical expressions for semantic interpretation; among the resulting expressions, the ones whose semantic type is compatible with the category of the constituent make up the set $\mathrm{T}(\alpha)$ of its potential translations out of context; the appropriate translations of α qua daughter in the context of a local construction are those members of $\mathrm{T}(\alpha)$ that can combine – as functors or

[57] This implies that the referential way of treating proper names in HPSG (Pollard & Sag 1994: p. 27) be complemented by a version of the standard quantificational approach stemming from Montague (1974) and adapted to extensional GQT by Barwise & Cooper (1981), but we leave technical details aside in the present work.

arguments – with potential translations of the other daughters (if any). Taking for granted some meta-grammatical translation mechanism of the kind, in section 3.3.2 we will simply focus on the HPSG features to be assumed as input. Clearly, the *referential* / *e*-type interpretation of an NP corresponds to the INDEX feature of its *nominal-object* (i.e. CONTENT value). For NP-type interpretation, a possible candidate would be QSTORE, the feature used by Pollard & Sag (1994: p. 49) to pass up to the NP node the generalized quantifier associated with a determiner and embedding the relevant *nominal-object* qua restriction. However, as a result of the quantifier inheritance mechanism of HPSG, the QSTORE set on a mother node may collect several quantifiers from the daughters, whereas we will find it useful to have also a CONTENT-component feature to explicitly distinguish the quantifier received from the daughter acting as semantic functor in a nominal construction (the non-head functor, if any, or the nominal head otherwise).[58]

3.3.2 Quantification mechanisms in HPSG

We redefine the CONTENT values (i.e. the sort *content*) in such a way that they bring in the attributes LOGICAL-FORM (LF) and DISTINGUISHED-QUANTIFIER (DISQUANT). While the original CONTENT values generally become LF values (whose sort is *logical-form* with partitions *nominal-object* and *psoa*)[59], DISQUANT gets empty or singleton values of *set*(*quant*) sort. The DISQUANT value is shared between a mother and its semantic-functor daughter as an effect of how the Semantics Principle determines the CONTENT value of the former node from that of the latter (as we will see in formal detail afterwards). For example, if the noun "pictures" in bare plural NPs like "pictures of Mary" is a semantic functor of type $< e, NP >$, its DISQUANT set will contain the quantifier to be shared with the DISQUANT set on the NP node. However, in the 'underspecification approach' advocated in section 3.3.1 above, the $<e, NP>$ type of the plural is not distinct in the lexicon from the $< e, \overline{N} >$ type (e.g. when "pictures of Mary" is $\overline{N}$ in "the pictures of Mary"). This implies that we have to generalize DISQUANT with singleton value to all the elements that potentially could receive or pass up

[58]E.g., the mother node of the NP "every man who likes a rival", discussed by Pollard & Sag (1994: p. 332), stores both $\boldsymbol{(\forall x_1| \wedge \{man(x_1), likes(x_1, x_2)\})}$ and $\boldsymbol{(\exists x_2|rival(x_2))}$, in the wide scope reading of the latter, but the former is the quantifier received from the $<\overline{N}, NP>$ functor "every" in this case.

[59]We take the sort *psoa* to be grammatically defined as in Pollard & Sag (1994: Ch. 8), however – in accordance with our remarks in section 1 above – we do not feel committed to a situation-theoretic interpretation as 'parameterized state of affairs'. Note also that here there is no *quant* partition of *content* or *logical-form*, *quant* being an independent sort of linguistic objects (a partition of the *object* root of the sort hierarchy).

as NP interpretation the quantifier thus specified. Hence the following lexical features for non-predicative head readings of count nouns in both English and Italian: singular noun entries call for a specifier, i.e. [MARKED|SPR–] [60], and introduce no quantifier, i.e. [DISQUANT { }]; plural noun entries are lexically undetermined w.r.t. MARKED|SPR, as we mentioned in section 3.3.1, and introduce a quantifier by [DISQUANT { [...] }].

An empirically adequate treatment must assign plural nouns a generalized quantifier with restriction token-identical with the CONTENT|LF value of the noun and *semantic-determiner* operator of a sort appropriate for bare plurals in the language under consideration. E.g., as Diesing (1992) and other authors have noticed by elaborating critically on Carlson's (1977) original work, an existential and a generic/universal interpretation are potentially available for English bare plural subjects (i) when they are selected by a predicate expressing an activity or temporary state, whereas genericness alone is allowed (ii) when they are selected by a predicate expressing a permanent or tendentially stable state.[61] Italian bare plurals subjects, however, in the case (i) can be interpreted only existentially:

(36) a. Poliziotti sono disponibili in caso di bisogno
('Policemen [= some policemen] are available in case of need')

b. Formiche distruggono il mobilio
('Ants [= some ants] destroy the furniture')

and in the case (ii) sound inacceptable beside failing to convey genericness:[62]

(37) a. ?? Cavoletti di Bruxelles sono immangiabili
('Brussels sprouts are unsuitable for eating')

b. ?? Cantanti d'opera sanno l'italiano
('Opera singers know Italian')

The semantic difference between Italian and English w.r.t. bare plurals is simply accounted for by assuming that the DET value of the *quant* object associated with the plural is *exists* in Italian and the disjunction of *exists* and *gen* (or

[60] In Italian, a possible exception is due to a particular use of singular nouns referred to relatives, such as *padre* ('father'), *mamma* ('mother'), *cugino* ('cousin'), etc., which can occur without article or other specifier when they are modified by a possessive adjective (for discussion of additional conditions, v. Renzi 1988: Ch. 7). A simple treatment will achieve the result by a lexical rule deriving a reading of these nouns with the MARKED value set so as to impose [SPR+] and [POSSPRO< [...] >], inter alia.

[61] More precisely, the genericness constraint on (ii) holds for those surface subjects that are also 'deep subjects', i.e. do not correspond to 'deep objects' of passives and the like.

[62] The non-genericness of Italian bare plurals is also confirmed for those (exceptional) cases in object position that would be interpreted as generic in English: cf. *She hates chocolate cookies* vs. ?? *Lei odia biscotti al cioccolato.*

a corresponding supersort of the two[63]) in English. Here *exists* and *gen* stand respectively for $\exists$ and some appropriate logical operator reflecting the generic interpretation of bare plurals.[64] The fact that DISQUANT is a (CONTENT) feature of 'synsems', hence accessible to subcategorization, allows English and Italian to account lexically for constraints like the one implying that a bare plural NP associated with an existential generalized quantifier is inacceptable as subject of some predicates (basically permanent-state predicates or similar, but v. also notes 61 and 62). As a first approximation, the lexical entry of a pertinent verb or other predicate can be annotated with a 'relational dependency'[65] between the [MARKED $\boxed{1}$] and [DET $\boxed{2}$] features of the element on its SUBJ list, say: **if** ($\boxed{1}$ *baretype-det*, $\boxed{2}\neg$ *exists*).

In order to be eventually incorporated into the CONTENT|LF value of a relevant clause, the quantifier introduced by a plural noun has to be stored, inherited and retrieved like any other.[66] The treatment follows (modulo the Semantics Principle) if lexically the DISQUANT value is token-identical with the QSTORE value, an assumption that in the present work is expected to hold for all lexical entries.[67]

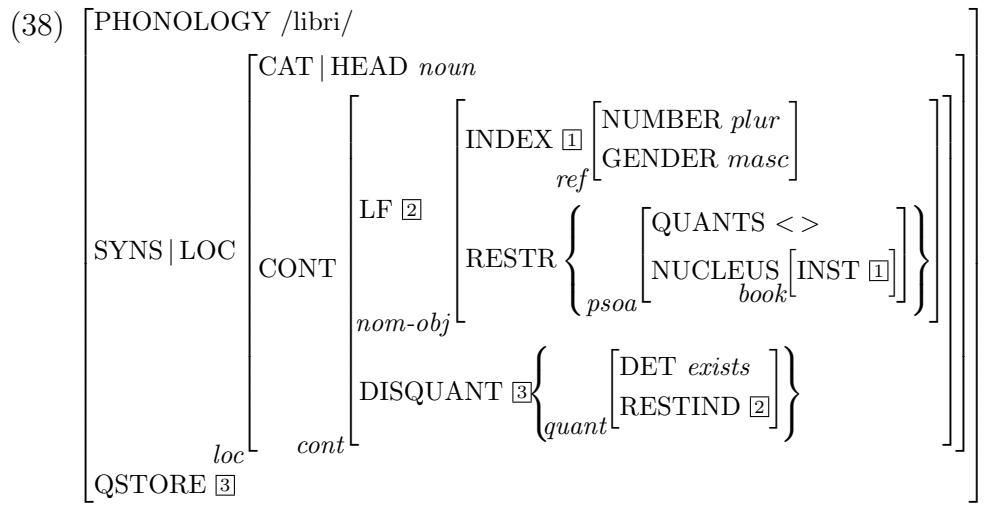
[63]This would be a more compact – hence preferable – solution, yet in the present article we will use the disjunction for notational perspicuity.

[64]Cf. Diesing (1992: p. 16): "there is an abstract generic operator *Gen* that binds a variable to produce a generic reading". For related discussion on the modal interpretation of generic (universal) quantification, Heim (1982) and Gerstner-Link & Krifka (1993).

[65]In the sense of Richard Cooper (1990: § 5.6).

[66]A possible objection is that existentially interpreted bare plurals do not show the scope ambiguities typical of explicitly quantified existential NPs. Hence Carlson's (1977) proposal to treat bare plurals not quantificationally but rather as referential terms that denote 'kinds': thus it would be up to the semantics of the selecting predicate to determine whether the predication can be about the individuals qua representatives of a kind (generic) or their spatio-temporally limited 'stages' (existential). However, such an approach does not account adequately for the Italian data exemplified in (36)-(37), because Italian predicates would mysteriously lack a predication option compatible with their semantics and in fact available to the corresponding English predicates. On the other hand, it is well known that wide scope is not equally possible with all quantified NPs, as these can be classified along a preference scale according to their determiners' tendency towards wide or narrow scope; therefore, after Diesing (1992: p. 64), one can simply extend the scale by classifying implicitly quantified plural NPs as tending towards narrower scope (in both English and Italian). See also Chierchia (1982), Gerstner-Link & Krifka (1993), among others, for more discussion of alternatives to Carlson's original treatment.

[67]This generalized assumption, inter alia, could require revision in view of the treatment of nonlocal dependencies. (E.g., consider the uncertain quantificational status of lexical entries representing 'traces'.)

(38)


See (38) above for a sample lexical entry of Italian plural noun; its English counterpart ("books") would differ in quantificational properties because of [DET *exists* ∨ *gen*], while the singular in both languages would take the empty set as DISQUANT / QSTORE value. (It is also worth noting that in (38) we have removed a simplification adopted so far for convenience in our diagrams: indeed, following Pollard & Sag 1994: Ch. 8, the elements in the RESTR set are not just 'predicate-argument formulae' – henceforth NUCLEUS values – but include also a possibly empty list of quantifiers, QUANTS, for quantifier retrieval.)

Let us now consider how the semantic content of nominal heads is operated on within a *head-functor-structure* (in the sense of section 3.1). In all cases, by application of ARG-SLOT in the Head-Functor Schema, the functor picks up the nominal head's SYNSEM|LOC|CONTENT|LF value, a *nom-obj* which we indicate as 1[INDEX 2, RESTR 3]. Being ARG-SLOT a HEAD feature, the information thus made available can be always referred to in the lexical entry of the functor. More precisely, the functor's lexical LF is specified as token-identical to 1 in case of a non-substantive determiner (e.g. an article), but consists of [INDEX 2, RESTR{…}∪3], a co-INDEXed *nom-obj* incorporating the nominal head's RESTR value by set union, in case of a determinative or (extensional) qualifying adjective. We have exemplified the adjectival-type LF for a cardinal accordingly in (10), section 2.4, and the same approach can be extended to other determiners, e.g. $\boldsymbol{x_1|} \wedge \boldsymbol{\{poss(x_2^{speaker}, x_1), \varphi\}}$ represents the LF of the Italian possessive adjective *mio* in schematic logical notation (where $\boldsymbol{\varphi}$ stands for the formula translating the value to be incorporated from the nominal head).[68] Furthermore, on a par with plural nouns, all potential

[68]Cf. Pollard & Sag (1994: § 1.8) for the 'contextual index' conventionally represented here by *speaker*, the superscript of the variable filling the 'possessor' argument slot of the

NP-level adjuncts or specifiers are lexically provided with some non-empty DISQUANT – and, therefore, QSTORE – set, whose element is a quantifier with RESTIND value token-identical to the LF value of the functor itself. The quantifier's DET value (corresponding to an operator such as $\forall$, $\exists$, etc.) indeed expresses the only original semantic contribution of non-substantive determiners insofar as they preserve unaffected the *nom-obj* from the adjacent head [69]; on the other hand, in case of substantive functors that can modify a bare plural (e.g. qualifying adjectives), the DET feature is lexically specified so as to preserve the corresponding information of the plural nominal head, *exists* in Italian.

At any rate, the intended quantificational result of the application of a non-head functor to some nominal whose mother node is associated with a distinguished quantifier is to replace this with another quantifier, which somehow 'updates' the former. The process is exemplified in (39) below, where all the three nominals can occur as independent NPs – their NP-type interpretation being represented by the associated quantifier [70] – but (39a) and (39b) can occur embedded as $\overline{N}$ constituents too.

(39) a. $[^{N^k}$ libri $] \rightsquigarrow (\exists \boldsymbol{x_1}| \wedge \{\boldsymbol{books}(\boldsymbol{x_1})\})$

b. $[^{N^k}$ due $[^{\overline{N}}$ libri $]] \rightsquigarrow (\exists \boldsymbol{x_1}| \wedge \{\boldsymbol{two}(\boldsymbol{x_1}), \boldsymbol{books}(\boldsymbol{x_1})\})$

c. $[^{NP}$ i $[^{\overline{N}}$ due libri $]] \rightsquigarrow (\boldsymbol{the}\, \boldsymbol{x_1}| \wedge \{\boldsymbol{two}(\boldsymbol{x_1}), \boldsymbol{books}(\boldsymbol{x_1})\})$

Clearly, for the correct functioning of the mechanism we must ensure that each distinguished quantifier to be replaced because of an intervening non-head functor is also subtracted from the inheritance of stored quantifiers. The

abstract *poss* relation. We assume that free variables like this be implicitly existential and pragmatically restricted according to the discourse / context model, roughly as done in File Change Semantics. (See note 19 for references.)

[69] However, there are exceptions like the English possessive determiners, which show non-substantive syntactic behaviour (v. section 2.3 above) but semantically require that their quantifier be further restricted through the *poss* relation (cf. Pollard & Sag 1994: p. 52). By contrast, in areas other than NP determination, there are non-substantive functors semantically vacuous in all respects, e.g. most complementizers, which preserve unaffected the whole CONTENT value from the head they apply to.

[70] The picture is simplified inasmuch as we show only the existential NP-type interpretation of (39b), whereas "numeral-noun combinations may have a generic reading, just like ordinary bare plurals" (Hoeksema 1983; cf. also Link 1987). However, it is worth noting that in Italian the generic interpretation clearly arises from the cardinal alone, since Italian bare plural nouns lack it, as mentioned. Moreover, in both languages the NPs introduced by cardinals are exempt from the constraint ruling out the existential interpretation of bare plural subjects with permanent-state predicates (e.g. "Two opera singers know Italian" can be – and preferably is – interpreted existentially, unlike "Opera singers know Italian"). Therefore we don't think that the availability of a generic interpretation undermines our assumption that cardinals can be specifiers rather than adjuncts to bare plurals (cf. section 2.5).

Semantics Principle by Pollard & Sag (1994: pp. 323, 401-402) has indeed to be revised so as to comply with our approach in this connection. As a prerequisite, we define a function **compute-content** which basically reflects the two cases they envisage for the computation of the CONTENT value of a phrase (ibid., p. 323), but takes into account our DISQUANT and LF features:

$$\text{compute-content}\ (<>, \boxed{j}\begin{bmatrix}\text{LF}\ \neg\ psoa\end{bmatrix}) = \boxed{j}$$

$$\text{compute-content}\,(\boxed{i}, \begin{bmatrix}\text{DISQUANT}\ \boxed{h}\{\,\} \\ \text{LF}\ psoa\begin{bmatrix}\text{QUANTS}\ \boxed{k} \\ \text{NUCLEUS}\ \boxed{l}\end{bmatrix}\end{bmatrix}) = \begin{bmatrix}\text{DISQUANT}\ \boxed{h} \\ \text{LF}\ psoa\begin{bmatrix}\text{QUANTS}\ \boxed{i} \oplus \boxed{k} \\ \text{NUCLEUS}\ \boxed{l}\end{bmatrix}\end{bmatrix}$$

Then we use **compute-content** and other operations [71] in a formalized version of the principle, expressed as the following implicational constraint:

(40) **Semantics Principle**

$$phrase\begin{bmatrix}\text{DTRS}\ head\text{-}struc\end{bmatrix} \Longrightarrow$$

$$\begin{bmatrix}
\text{SYNSEM|LOC} & \begin{bmatrix}\text{CONTENT compute-content}\,(\boxed{1},\boxed{2})\end{bmatrix} \\
\text{RETRIEVED}\ \boxed{1} & \\
\text{QSTORE}\ \boxed{3} & \\
\text{DTRS} & \begin{bmatrix}
head\text{-}arg\text{-}struc & \begin{bmatrix}\text{HEAD-DTR}\ \begin{bmatrix}\text{SYNSEM|LOC|CONTENT}\ \boxed{2} \\ \text{QSTORE}\ \boxed{4}\end{bmatrix} \\ \text{SUBJ-DTR}\ \boxed{5} \\ \text{COMP-DTRS}\ \boxed{6}\end{bmatrix} \\
 & \text{where: set-of}\,(\boxed{1}) \cup \boxed{3} = \boxed{4} \cup \text{union-QST}\,(\boxed{5}) \cup \text{union-QST}\,(\boxed{6}) \\
 & \bigvee \\
head\text{-}fun\text{-}struc & \begin{bmatrix}\text{HEAD-DTR}\ \begin{bmatrix}\text{SYNSEM|LOC|CONTENT|DISQUANT}\ \boxed{8} \\ \text{QSTORE}\ \boxed{4}\end{bmatrix} \\ \text{FUN-DTR}\ \begin{bmatrix}\text{SYNSEM|LOC|CONTENT}\ \boxed{2} \\ \text{QSTORE}\ \boxed{9}\end{bmatrix}\end{bmatrix} \\
 & \text{where: set-of}\,(\boxed{1}) \cup \boxed{3} = (\boxed{4} - \boxed{8}) \cup \boxed{9}
\end{bmatrix}
\end{bmatrix}$$

where: set-of $(\boxed{1}) \cap \boxed{3} = \{\,\}$

We can do with only two disjuncts – spelling out formally our character-

[71] In particular, beside standard set-theoretic operations, the functions **set-of**, which yields the set of elements of a list, and **union-QST**, which yields the union of the QSTORE values of the elements of a list of signs (thus being formally similar to the function that in the Valence Principle yields the concatenation of the SYNSEM values of the elements of a list of signs).

ization of the semantic functor[72] as the FUN-DTR if any, the HEAD-DTR otherwise – because FUN-DTR allows us to dispense with Pollard and Sag's original distinction between ADJ-DTR, MARK-DTR and SPR-DTR.[73] The remaining alternation between two cases of DTRS structure in our principle is independently motivated by a corresponding variation in quantifier inheritance, that is, only in a *head-fun-struc* the quantifier possibly specified on a nominal head by DISQUANT is subtracted from the head's QSTORE (v. 4 – 8 in (40) above) when this has to be unioned with the other daughters' QSTOREs. The quantifier subtraction is an additional operation (which the standard Semantics Principle indeed did not envisage), but an ameliorative one, being required for a treatment of 'type ambiguities' that avoids to enlarge considerably the size of the lexicon.

4 Conclusion

In the lexically based version of X-bar Theory proposed by Pollard & Sag (1994: Ch. 9), hierarchical bar levels and related dependency notions are not characterized in a fully configurational manner within (ID) phrase structure schemata, but arise from the interaction between these schemata and the information conveyed by lexical heads. For our study of Italian NP structure and determination we have enhanced the lexicalist, non-configurational orientation of such an approach to phrase structure. According to our revised HPSG, the bar level of a nominal construction with some determiner qua nonhead daughter and, concomitantly, the specifier or adjunct role of that daughter, instead of being constrained by the ID schema the construction instantiates, follow from lexically based determination values transmitted between the determiner and the nominal mother node. We have shown how an HPSG system of the kind reduces the repertory of ID schemata and ancillary syntactic principles/constraints and, moreover, allows to adapt ideas from Netter (1994) in order to treat head-specifier dependencies without resorting to cyclic feature structures and disjunctive subcategorization frames. Finally, we have explored the quantificational import of determiners but also of other relevant constituents of nominal constructions, extending/revising the 'quantifier storage' technique of HPSG consistently with a treatment of bare plurals that does not resort to empty determiners, nor requires the introduction of additional lexical readings.

[72] Which Pollard and Sag would call "semantic head" (cf. our note 34), whereas we prefer to restrict the head notion to syntactic heads.

[73] Also 'fillers' should be considered, in both their version and ours, but cf. note 31.

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