# Chapter 1

# Unifying modifiers, classifiers and demonstratives

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We argue that the distributional properties of modifiers, classifiers and demonstratives with respect to nouns in Mandarin Chinese motivate a head-functor approach (Van Eynde 2006), where NUM(eral)-CL(assifier)-N(oun) sequences are analyzed as left branching structures with N as the head. This approach explains the distributional similarities between all prenominal categories by unifying their combinatorial properties under a single phrasal schema while also accounting for their differences by means of selectional constraints and a hierarchy of MARKING values. We also analyze classifiers themselves as special kinds of noun. All in all, our analysis entails that nominal complexes in Mandarin Chinese are fundamentally different from those found in languages with dedicated specifiers (e.g. determiners in a language like English), suggesting a two-way typology that is parallel to the NP/DP parameter proposed in the minimalist tradition (Bošković 2007, i.a.).

## 1 Introduction

The structure of Mandarin Chinese nominal complexes (CNCs) is subject to extensive research, mostly centering on their implications for the NP/DP debate and right and left-branching analyses (Cheng & Sybesma 1999, Bošković et al. 2013, Her & Tsai 2020, Jiang et al. 2022).[1] However, there has been little work on

[1]We employ the term *nominal complex* in order to not beg the question of the categorial status of these structures. The following abbreviations are also used: N(P) = noun (phrase), D(P) = determiner (phrase), NUM = numeral, CL(P) = classifier (phrase), DEM = demonstrative, V = verb, ADJ = adjective, MOD = modifier, PERF = perfective, SG = singular, $CL_m$ = measure

CNCs in the tradition of HPSG (Pollard & Sag 1994). In this paper, we attempt to bridge this gap by focusing on the combination of prenominal elements (DEM, MOD, CL) with the head N. (1) illustrates the kind of structure we will deal with.

(1) na da de san ben guanyu yuyanxue de shu
DEM big DE three CL about linguistics DE book
'those three big books about linguistics'

As we will see when we examine other examples, the combinatorial properties of prenominal elements in CNCs pose several puzzles for both traditional NP accounts as well as for DP-based theories of nominal complexes.

We argue that the distributional properties of MODs and DEMs with respect to Ns and CLs motivate a head-functor approach (HFA) (Van Eynde 2006), where NUM-CL-N sequences are analyzed as left-branching NPs, with NUM-CL forming a CLP that acts as a functor over the noun. The notion of functor replaces the more specific grammatical relations of specifier and modifier, which are prevalent in NP approaches to the nominal domain. It also stands in contrast to DP analyses, which treat prenominal elements as heads of extended nominal projections.[2] The HFA allows us to unify the combinatorial properties of CLs, MODs and DEMs, thus explaining their similarities in Mandarin Chinese, while also accounting for their differences by means of selectional constraints and a hierarchy of MARKING values. Our treatment also entails that CNCs are fundamentally different from nominal structures in languages with dedicated specifiers, suggesting a two-way typology of languages (head-specifier or head-functor) that is parallel to the NP/DP parameter proposed in the minimalist tradition (Bošković 2007, Bošković & Gajewski 2011, Despić 2011, Phan & Lander 2015, i.a.).

In Section 2, we briefly review two standard theories of nominal complexes: the head-specifier NP approach and the head-complement DP approach. In Section 3 we discuss the puzzles CNCs pose for both of these approaches. In Section 4, we summarize the HFA alternative and propose an analysis of the CNC data. Lastly, Section 5 summarizes our approach and situates it in the context of a broader typological hypothesis about nominal complexes across languages.

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classifier, $CL_s$ = sortal classifier, DeP = arguments/modifiers of N marked with *de*. We also use following abbreviations for HPSG analyses: SYNSEM = SYNTAX-SEMANTICS, DTRS = DAUGHTERS, CAT = CATEGORY, SPR = SPECIFIER, SPEC = SPECIFIED, COMPS = COMPLEMENTS, SUBJ = SUBJECT, PHON = PHONOLOGY, CONT = CONTENT, LOC = LOCAL, LEX = LEXICAL, MOD = MODIFIED.

[2]The term *functor* comes from categorial grammar, where it refers to any selecting category, i.e. heads, modifiers and specifiers (Bouma 1988: 23). We use the term here in the more restricted way to refer only to non-head daughters that impose selectional requirements on their sisters.

## 2 Standard views about Nominal Complexes

In this section, we summarize two main approaches to the combinatorics of nominal complexes (NCs): a standard NP approach, which posits that NCs are headed by nouns that take determiners and other functional prenominal elements as their specifiers; and a DP approach, which assumes that NCs are headed by determiners that take nouns as their complement. For the sake of commensurability with our own theory, we focus on simple HPSG variants of these approaches, but most of what we say here is independent of choice of formalism.

Let us start with the standard NP approach, which is rooted in classic X′ theory (Chomsky 1970, Jackendoff 1977) and found its way to HPSG through works like Pollard & Sag (1987: 139–143), Ginzburg & Sag (2000: 34), Sag et al. (2003: 102) and Levine (2017: 84). Its defining assumption is the idea that NCs are formed by first combining a nominal head with all of its complements/modifiers and subsequently by adding a specifier which closes off the nominal projection to further combinations and allows it to serve as an argument to other heads. Specifiers of N typically belong to the functional category D, which encompasses definite articles (*the*), demonstratives (*this*), genitives (*the queen's*), quantifiers (*some*, *each*), and measure phrases (*a lot of*). Some examples are given in (2).[3]

(2) a. { The / These / The queen's / Some / A lot of } books are bad.

b. { The / This / The queen's / Some / Each } book is bad.

In HPSG, combinations of these functional prenominal elements with N are licensed by the schema in (3) as structures of the type *head-specifier phrase*.

(3) *head-specifier-phrase* ⇒
$$\begin{bmatrix} \textit{headed-phrase} \\ \textsc{synsem|loc|cat|spr}\ \langle\rangle \\ \textsc{head-dtr|synsem|loc|cat}\ \begin{bmatrix} \textsc{spr}\ \langle \boxed{1} \rangle \\ \textsc{comps}\ \langle\rangle \end{bmatrix} \\ \textsc{non-head-dtrs}\ \langle [\textsc{synsem}\ \boxed{1}] \rangle \end{bmatrix}$$

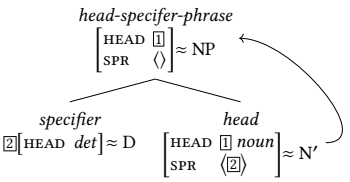
The schema requires the head daughter to have the *synsem* of the non-head daughter in its SPR list and the mother to have an empty SPR, blocking the combination with further specifiers. The head daughter is also constrained to have an

[3] Semantically, it is generally assumed that specifiers are functions that map the property meaning of N (of type $\langle e, t \rangle$) into a semantic type that can be combined with the property expressed by the VP (Heim & Kratzer 1998). This can be either an entity or a generalized quantifier (of type $\langle \langle e, t \rangle, t \rangle$). In this paper, we focus mostly the syntactic combinatorics of CNCs, leaving an account of their semantic composition for future work (see Krifka (1995) for a proposal).

empty COMPS list, to ensure that a noun can only combine with its specifier after its complements. Furthermore, heads that select NCs require their N arguments to have empty SPR lists, so a specifier will always be necessary to integrate Ns in a larger phrasal structure. This ensures, for instance, that a verb selecting a noun can only combine with the noun after it has already been saturated by a specifier.[4] Since head-specifier structures are required to be of type *headed-phrase*, they also have to abide by the Head-Feature Principle, given in (4) (Pollard & Sag 1994: 34). A schematic depiction of the effects of (3)–(4) is shown in (5).

(4) $\textit{headed-phrase} \Rightarrow \begin{bmatrix} \textit{headed-phrase} \\ \text{SYNSEM|LOC|CAT|HEAD } \boxed{1} \\ \text{HEAD-DTR|SYNSEM|LOC|CAT|HEAD } \boxed{1} \end{bmatrix}$

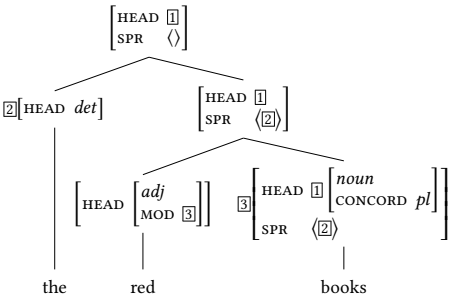
(5)




Crucially, modifiers of N are introduced by the separate combinatorial schema in (6), which defines a distinct phrasal type *head-adjunct-phrase* (Pollard & Sag 1994: 56). According to this schema, modifiers select their heads by means of their MOD feature, which is structure-shared with the head's *synsem*. The combination with a modifier has no effect over the categorial properties of the phrasal head. A simplified example of a structure satisfying these schemas is given in (7).

(6) $\textit{head-adjunct-phrase} \Rightarrow \begin{bmatrix} \textit{headed-phrase} \\ \text{HEAD-DTR|SYNSEM } \boxed{1} \\ \text{NON-HEAD-DTRS } \left\langle \left[ \text{SYNSEM|LOC|CAT } \left[ \text{HEAD|MOD } \boxed{1} \right] \right] \right\rangle \end{bmatrix}$

(7)




[4] So structures like **Amy read book* are predicted to be ungrammatical. For bare plurals and mass nouns (which can combine with other heads without an overt determiner) it is necessary to assume either an empty determiner that only combines with Ns of the appropriate type or a unary rule that identifies this exact class of Ns and removes the determiner from their SPR list. Similar provisions are necessary under DP analyses, which make exactly the same predictions.

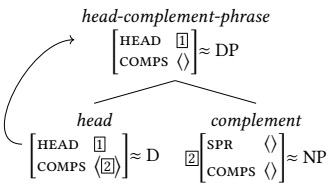
On this analysis the NC is headed by the noun, which, therefore, determines both the internal combinatorics of the phrase (e.g. which kinds of arguments can be introduced in the NC) as well as its distribution when combining with other heads. This seems to be intuitively correct if we look back at (2), where we see that, for at least some of the specifiers (e.g. *the*, *some*), the inflection on V seems to depend only on the number value of N. Strikingly, in (2a), the measure phrase specifier *a lot of* is singular, but V must be plural, in conformity with the number value of *books*. This makes sense under an NP approach, where many of the categorial properties of NCs (all of the HEAD features, including the agreement values under HEAD|CONCORD) are inherited from N due to (4).

The opposite holds on the DP approach, proposed in HPSG by Netter (1994) on the basis of GB work by Abney (1987). Under this analysis, the combination of prenominal elements like D with nominal projections is viewed as a *head-complement-phrase*. The principle constraining structures of this sort is (8).

(8) $$\textit{head-complement-phrase} \Rightarrow \begin{bmatrix} \textit{headed-phrase} \\ \text{SYNSEM|LOC|CAT|COMPS } \boxed{1} \\ \text{HEAD-DTR|SYNSEM|LOC|CAT|COMPS } \langle \boxed{2} \rangle \oplus \boxed{1} \\ \text{NON-HEAD-DTRS } \langle [\text{SYNSEM } \boxed{2}] \rangle \end{bmatrix}$$

According to (8), the prenominal element selects a nominal projection via its valence feature COMPS. After both combine, the resulting phrase no longer has an NP in its COMPS list. Non D-heads always select Ds with empty COMPS lists (i.e. DPs), ensuring that D is obligatory to integrate NCs in larger structures, which rules out bare N arguments **boy sings*. The requirement that D be fully saturated for it to be selected by other heads rules out structures like **a sings*, where a verb combines directly with a N-less determiner. A NC licensed by (4) and (8) is shown in (9). Modifiers of N are assumed to be introduced by (6), as in the NP analysis.

(9)




On this approach, D determines the internal structure and the distributional properties of the NC as a whole. As we saw, this seems counterintuitive in light of some of the English data in (2), where the agreement information seems to flow from N alone. However, it is a natural assumption if one considers constructions like (10) in German, where the inflection on V appears to to be coming from D alone, given that the person values on D and N do not coincide (Netter 1994: 301).

(10) Du Idiot {hast / *hat} das Brot vergessen.
you.2.SG idiot.3.SG have.2.SG have.3.SG the bread forgotten
'You idiot forgot the bread.'

Both (10) and (2) can be accommodated to NP and DP approaches by appealing to underspecification. For instance, in the case of (10), a proponent of the standard NP treatment could say that German Ns are underspecified for a PERSON value and simply inherit it from the PERSON value of the D in their SPR list.[5]

Overall, the main difference between the NP and DP theories concerns locality of selection (Sag 2010). Assuming a head can only select the properties of its sister, each approach makes different predictions about what features should be accessible for selection after an N is combined with a prenominal element. Treating NCs as instances of *head-specifier-phrase* implies that the properties of the prenominal element (e.g. D) are not accessible after it is removed from SPR. Treating NCs as objects of the sort *head-complement phrase* implies, in turn, that the properties of N are not accessible after NP is removed from COMPS.

In spite of these differences, the standard NP and DP analyses outlined above share many assumptions about the structure of NCs. Both approaches assume that there is a unique element – typically, a determiner – that has to be combined in the right order to complete NCs, turning them into suitable arguments for other selecting categories. Once this special element is combined, the NC is closed off to further prenominal elements and its combinatorial history is no longer accessible to other selectors. Consider the examples in (11)–(14).

(11) Amy bought [this (big) bed]
(12) * Amy bought [(big) bed]
(13) * Amy bought [this my big bed]
(14) * Amy bought [big this bed]

The standard NP and DP analyses outlined above are all unanimous in licensing (11) and ruling out (12)–(14). However, as we will see in Section 3, analogues of these structures are all acceptable in Mandarin Chinese.

[5] Pollard & Sag (1994: 47–51) propose a modified NP approach that combines aspects of the NP and DP analyses by incorporating a mechanism of mutual selection between the specifier and N. On their theory, N selects its specifier via SPR and the specifier also selects its N head through a dedicated SPEC feature. Pollard & Sag (1994: 371–373) motivate this NP analysis on the basis of facts abut declension classes and adjectival inflection in German (see also Machicao y Priemer & Müller 2021). Since nothing here hinges on the difference between this and the more standard NP approach outlined above, we assume the latter for ease of exposition.

## 3 Puzzles

In Section 2, we provided a review of the standard theories on NCs (as proposed within HPSG). When taking Mandarin Chinese into account, the empirical data appears to not perfectly align with either of the proposals. In this section, we summarize the puzzles that arise when applying these theories to CNCs.

### 3.1 Challenges for the standard DP approach

As it is well known (see Chierchia 1998, a.o.), Mandarin Chinese lacks articles and NCs can appear in argument positions with or without DEM or CL(P).[6] That is, bare Ns, CLP-N, DEM-N and DEM-CLP-N are all grammatical combinations, cf. (15). In other words, DEM and CL, traditionally analyzed as D-heads in DP analyses, are not obligatory in CNCs. The optionality of D is a problem for the DP approach, which requires D to project a DP.[7] This leads to the first puzzle: an adequate analysis of CNCs needs to make both, bare and complex NCs, selectable by a verb.

(15) a. wo mai-le *shu* (bare NP)
1.SG buy-PERF book
'I bought {a book / the book / ∅ boks / the books}.'

b. wo mai-le *san ben shu* (CLP-N)
1.SG buy-PERF three CL book
'I bought three books.'

c. wo mai-le *na shu* (DEM-N)
1.SG buy-PERF DEM book
'I bought that book.'

d. wo mai-le *na san ben shu* (DEM-CLP-N)
1.SG buy-PERF DEM three CL book
'I bought those three books.'

[6] At this point of our argument, we are using CLP as a mere descriptive convenience to refer to NUM-CL sequences. We will see in example (22) and Section 4.2, there is good evidence for a left-branching structure where CL and NUM build a constituent headed by CL – i.e. a CLP (Bale et al. 2019, Her & Tsai 2020, Wągiel & Caha 2020, 2021).

[7] Optionality is even more problematic in theories like Cheng & Sybesma (1999) and Cinque (2005, 2023), which decompose D into multiple heads ($NUM^0$, $DEM^0$, $CL^0$). Either all of them would have to have phonetically empty variants (which arguably generates unwanted readings for cases like (15a)), or the COMPS lists of each of them would have to be disjunctively specified: e.g. $DEM^0$ can select a ModP, or a CLP, or an NP, etc.

Furthermore, the various possible positions for MODs[8] within CNCs represent a further challenge for the DP analysis, cf. (16). For instance (16a) and (16b) show that the order of CLPs and MODs can be reversed without affecting the meaning of the NC. This suggests that the syntactic relation of the CLP w.r.t. N is similar to MODs, i.e. more like an adjunct than a D head. Even more challenging is the possibility to realize MODs preceding a DEM, cf. (16c). In a standard DP approach, N is not accessible after NP is removed from the COMPS list of D; but to enable *da de* 'big' to modify the N *shu* 'book' locally in (16c) the information of N needs to be projected above DEM. This leads us to the second puzzle: an adequate analysis of CNCs needs to account for the different attested positions of MODs.

(16) a. na san ben *da de* shu
DEM three CL big DE book
'those three big books.'

b. na *da de* san ben shu
DEM big DE three CL book
'those three big books.'

c. *da de* na san ben shu
big DE DEM three CL book
'those three big books.'

Cases like (16c) also seem to be at odds with Greenberg's (1963) Universal 20, which says that, in pre-N position, DEM has to precede ADJ. DP theories like Cinque's (2005), which hardwire Universal 20 in the form of a rigid sequence of functional heads, have to say that MOD can only appear before DEM if it undergoes movement. However, we will see that this generates unwanted readings.

A further challenge arises from the behavior of CL. As proposed in the literature (Cheng & Sybesma 1999, Her 2012a,b, Li 2013, a.o.), the class of CL can be further subcategorized into sortal and measure CL ($CL_s$, $CL_m$), where $CL_m$ has extra lexical meaning (e.g. 'box' in (18)) allowing modification, and $CL_s$ is purely functional, hence not allowing modification, as shown with (17)–(18), adapted

[8] In this paper, we limit ourselves to phrasal *de*-marked MODs like *bai de* 'white *de*' in *bai de zhi* 'white paper' (cf. Paul 2005, Sun 2015, Xu 2018, i.a.). For the sake of clarity, we only refer to adjectives in this paper, but the *de*-marker can attach to different types of nominal modifiers, such as relative clauses, possessives, PPs, etc. Furthermore, we assume that non-*de*-marked MODs, e.g. *bai* in *bai-zhi* 'white paper' or 'blank paper' , are introduced morphologically through a compounding rule that forms a new lexeme out of two lexemes, hence, being outside the scope of our investigation.

from Zhang (2011: 7).[9] For instance, in (17), since 'triangular' and 'square' both have to modify 'chips', its intended reading runs into a contradiction – the chips being triangular and square at the same time. In contrast, with a $CL_m$ in (18), one modifier can take scope over $CL_m$ – yielding 'square box', and the other over the noun, yielding 'triangular chips'.

(17) # *sanjiaoxing de* na fangfangzhengzheng de *san pian* shupian
triangular DE DEM square DE three $CL_s$ chips
Intended: 'those triangular square chips.'

(18) *sanjiaoxing de* na fangfangzhengzheng de *san xiang* shupian
triangular DE DEM square DE three $CL_{m \approx \text{'box'}}$ chips
'those three square boxes of triangular chips.'

The modifiability of (some) classifiers makes them more similar to Ns than Ds, blurring the distinction between functional and lexical categories. It also implies that the scope of MODs preceding $CL_m$ can be both CL or N. This is shown in (19), where the MOD preceding $CL_m$ leads to an ambiguity.

(19) *haokan de* yi xiang shu
nice DE one $CL_{m \approx \text{'box'}}$ book
'a nice box of books' or 'a box of nice books'

Assuming locality (cf. Machicao y Priemer & Müller 2021: 8), these facts suggest two possible attachment positions for MODs preceding $CL_m$: (i) adjunction inside CLP and (ii) adjunction to the N projection, cf. (22). This structure predicts the acceptability of (20) ruling out (21) (with the intended reading). However, (20) and (21), adapted from Zhang (2011: 7), pose a problem for the DP approach since $MOD_1$ in (22) should not be able to locally modify N.

One could try to derive pre-CL MODs with scope over N (e.g. *chao haochi de* in (20)) by moving them to the left-periphery over the CL and reconstructing their interpretation at their original N-adjacent position. However, if this kind of movement/reconstruction is allowed for MODs, it becomes a mystery why MODs with CL scope cannot be at the leftmost position inside NCs. E.g. (21) could be licensed by generating and interpreting *dada de* in a CL-adjacent position and subsequently moving it to the left edge of the NC. Thus, in the absence of

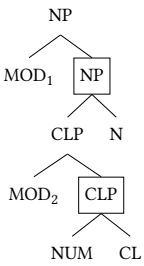
[9] In HPSG terms, we can say that a $CL_m$ is able to introduce its own INDEX, which can appear as an argument to elementary predications introduced by MODs; while a $CL_s$ always inherits the INDEX of its corresponding N, akin to the analysis of parasitic heads in Levine (2010); see also Bender & Siegel (2004) for a similar approach to Japanese classifiers.

a restrictive theory of which MODs can move and reconstruct, this movement alternative would overgenerate.

(20) chao haochi de dada de yi wan chao xiao de yingtao
very delicious DE big DE one $CL_m \approx$ 'bowl' very small DE cherry
Intended: 'a big bowl of very delicious small cherries'

(21) # dada de chao haochi de yi wan chao xiao de yingtao
big DE very delicious DE one $CL_m \approx$ 'bowl' very small DE cherry
Intended: 'a big bowl of very delicious small cherries'

(22)




Furthermore, since $CL_m$ can be modified, then specification by DEM is also possible. This $CL_m$P-internal DEM is further supported by the observation that DEMs can act as semantic functors over $CL_m$ meanings. For instance, assume that three books are placed respectively in a box and in a basket. In case of contrast, the CL can be contrastively emphasized: *na XIANG shu, haishi na LAN shu* 'that box of books or that basket of books'. Hence, DEMs appearing before $CL_m$P are also structurally ambiguous, cf. (23).

(23) *na* san xiang shu
DEM three $CL_m \approx$ 'box' book
'those three boxes of books' or 'three boxes of those books'

Therefore, the next puzzle: an analysis of CNCs needs to account for the modifiability of $CL_m$ (vs. $CL_s$) and the ambiguity of MODs and DEMs preceding CLPs.

### 3.2 Challenges for the standard NP approach

Compared to the DP analysis, the NP (head-specifier) approach faces less difficulties w.r.t. the data, but there are still issues to be considered. For instance, taking (24) into account, there are at least two candidates for specifiers in CNCs: DEM and CLP, which have to be realized in a specific order DEM-CLP, cf. (24a)

vs. (24b).[10] Similar to "standard" specifiers, neither DEM nor CLP can be iterated, as (25a)–(25b) show. Crucially, the impossibility of iterating DEMs applies even when DEMs have different scopes, with one applying to N and the other to $CL_m$, as in (25b). This is problematic for DP and NP approaches, since any left-peripheral DEM which scopes over N would need to look into the CLP that it c-commands to see whether there is any other DEM contained in it – a clear violation of locality.

(24) a. *na san ben* guanyu yuyanxue de shu
DEM three CL about linguistics DE book
'those three books about linguistics'

b. * *san ben na* guanyu yuyanxue de shu
three CL DEM about linguistics DE book
'those three books about linguistics'

(25) a. * yi *xiang* yi *ben* shu
one $CL_{m \approx \text{'box'}}$ one CL book

b. * [$_{NP}$ *na* [$_{CLP}$ *zhe* liang xiang] shu]
DEM DEM two $CL_{m \approx \text{'box'}}$ book
Intended: 'these two boxes of those books'

A specific problem for the standard NP approach concerns the valency of the SPR feature. On the one hand, it is possible to combine two different specifiers (DEM and CL) with N, cf. (25a). That is, more than one "specifier" can be selected by N, contrary to (3). On the other hand it is also possible for N to not select either DEM nor CL (15a), or to select only one of them (15b)–(15c). That is, the standard NP approach would require either disjunctive lists as the value of SPR (with DEM, with DEM and CL, with CL, without DEM and CL) or it would require lexical rules adding/removing SPR elements. This suggests that DEMs and CLs diverge from the properties of specifiers and behave more like MODs.[11] If DEMs and CLs are

[10] Examples like (i) are also possible. But in this case, CL-DEM-N can only be interpreted as *this kind of book* (singular). Here, we limit ourselves to $CL_s$ and $CL_m$, excluding *kind* CL, cf. Liao & Wang (2011) for iteration of CLPs. Beyond these cases, DEM always precedes CL.

(i) san ben zhe (zhong) shu
three CL DEM CL book
'three books of this kind'

[11] Note that a restriction on the iteration of DEMs and CLs as in (25) also applies to MODs of the same type (e.g. **the book about linguistics about psychology*) and is not specific to specifiers.

treated as MODs, some information about the presence of these pre-N elements needs to be projected locally to higher projections in order to rule out multiple DEMs (25b) or combinations like CL-DEM (24b), cf. Section 4.2.

That brings us to the puzzle related to the NP approach: an adequate analysis of CNCs needs to account, on the one hand, for the similar behavior between DEMs, CLs, and MODs, and, on the other hand, it needs to explain the different possible syntactic configurations with and without DEM and CL.

### 3.3 Singular demonstrative paradox

There is a further puzzle for DP and NP approaches that is related to the number interpretation of NCs. When an overt CLP is present, the number interpretation of DEM-CLP-N comes from the cardinal relation encoded by the NUM inside the CLP, as in (26a). Without an overt CLP, bare Ns have number-neutral interpretation, i.e. both singular or plural readings are possible (26b). A combination of DEM-MOD-N in (26c) is also underspecified for number, since neither DEM nor MOD express number information. However, the paradox emerges when DEM is directly combined with a bare N, as in (26d). In that case, the NC can only be interpreted as singular. This raises the question: what is it about the presence of MOD in (26c) that allows the NC to retain the number-neutral interpretation lexically associated with bare Ns? Why should the absence of MOD have any influence over the absence of a plural interpretation in (26d), given that MOD does not encode plurality, as the singular reading of (26c) shows?

(26) a. wo mai-le na san ben shu
1.SG buy-PERF DEM three CL book
'I bought those three books.'

b. wo mai-le shu
1.SG buy-PERF book
'I bought {a book / the book / ∅ books / the books}.'

c. wo mai-le na da de shu
1.SG buy-PERF DEM big DE book
'I bought {that big book / those big books}.'

d. wo mai-le na shu
1.SG buy-PERF DEM book
'I bought that book.'

# 4 The Head-Functor Approach in Mandarin Chinese

In this section, we introduce the Head Functor Approach (HFA) to NCs (Allegranza 1998, 2007, Van Eynde 2006, 2020, 2021) and propose a solution to the puzzles outlined in Section 3 based on this theory.

## 4.1 The Head-Functor Approach

The HFA can be defined by its rejection of two distinctions that are basic to NP and DP theories: the distinction between lexical and functional categories and, most importantly, the distinction between specifiers and modifiers.

The first of these contentions is motivated by the observation that the notion of a determiner does not correspond to a morphosyntactically uniform functional category. Expressions that typically fall under the class of determiners share characteristics with lexical parts of speech, such as N and ADJ. An example of the former is CL in Mandarin Chinese, which, as we saw in (18), can be modified like an ordinary N. The structural parallelism between functional and lexical categories (e.g. CLP and NP in Mandarin Chinese) is especially problematic for the DP theory, whose defining feature is precisely the idea that NCs are the combinatorial yield of selectional properties of a dedicated functional element (D), which takes a lexical N as its complement. If such Ds do not exist as a category distinct from N, then neither do DPs, by definition (Van Eynde 2006: 157).[12]

The elimination of the specifier-modifier distinction, in turn, is motivated by the fact that bearers of these grammatical relations share more syntactic properties than either DP or NP theories typically ascribe to them. First, both specifiers and modifiers can occupy prenominal position. Second, both add information to the NC that must be projected for the purposes of semantic interpretation and selection by other heads.[13] For Mandarin Chinese, as we saw in (25), the information about whether a head has previously combined with a DEM or a CL at some point is relevant for selection because DEM/CL cannot be iterated. Third, specifiers of different types can be stacked, much like modifiers (e.g. *the* ***big red*** *book*).

[12] Another example of N-like Ds are adnominal pronoun constructions like *du Idiot* in (10), where the prenominal position is filled by a pronoun. Conversely, definite determiners in German (*der*, *die*, *das*) can function as pronouns without an accompanying N (Postal 1969, Wiltschko 1998). This can also be taken to suggest an N status, though something has to be said to explain the contrast in the dative plural (*den* vs. *denen*), see Wiltschko (1998: 155). Other putative determiners seem to function more like ADJs, like possessives in Mandarin Chinese.

[13] In the case of specifiers, this can be information about the cardinality of the plurality denoted by N (e.g. *two books*) or about definiteness (e.g. {*the* / *a*} *book*). In the case of MODs, the information is more diverse. It can be an expression of size (e.g. *big books*), color (e.g. *red books*), quality (e.g. *good books*), as well as cardinality (e.g. {*single* / *unique* / *numerous* / *various*} *books*).

We saw this in the case of CL and DEM in Mandarin Chinese in (24a).[14] Fourth, specifiers like modifiers can be omitted, as bare singular Ns in Mandarin Chinese (15a) show. This is unusual if specifiers (or modifiers) are treated as heads.

The projectability of prenominals is especially problematic for the standard NP theory because, after the specifier is combined with the head, only the properties of the latter project. The only residue of the presence of a specifier inside a NC is an empty SPR list. Stackability and omissibility are properties that the classic DP and NP theories both take to be exclusive to modifiers. Therefore, the fact that elements taken to be specifiers/Ds exhibit these properties cannot be expressed under either of these accounts without special stipulations. For instance, in order to derive omissibility (i.e. bare Ns), the DP approach would have to appeal to an empty D head, while the NP approach would need to posit an empty specifier or a unary rule that eliminates the element in the SPR list of the head.

Crucially, the HFA strives to capture all of the properties of specifiers and modifiers while preserving locality of selection and endocentricity within NCs (Chomsky 2007, Chomsky et al. 2019, Bruening 2009, 2020, Machicao y Priemer & Müller 2021). This leads the HFA to view N as the heads of NCs and prenominal elements previously analyzed as specifiers, modifiers or Ds as functors over N.

Following the rejection of the distinction between specifiers and modifiers, the selection features SPR, MOD and SPEC are replaced by a single feature SELECT. It is through this feature that functors (ADJs, DEMs, CLPs, possessives, etc.) impose selectional constraints on the *synsem* of their corresponding N-heads.

The HFA assumes with previous theories the Head Feature Principle in (4) as a constraint on objects of the sort *headed-phrase*. Corresponding to the abandonment of SPR, MOD and SPEC, the schemas for *head-specifier-phrase* (3), and *head-adjunct-phrase* (6) are replaced by the more general Selector Principle in (27) (based on Van Eynde 2006: 164), which constraints objects of sort *head-functor-phrase*. This allows the (non-head) functor to select the head daughter.[15]

(27) $$\textit{head-functor-phrase} \Rightarrow \begin{bmatrix} \textit{headed-phrase} \\ \text{HEAD-DTR}|\text{SYNSEM}\ \boxed{1} \\ \text{NON-HD-DTR}\ \left\langle \begin{bmatrix} \text{SYNSEM}|\text{LOC}|\text{CAT} \begin{bmatrix} \text{HEAD}|\text{SELECT}\ \boxed{1} \\ \text{COMPS}\ \langle\rangle \end{bmatrix} \end{bmatrix} \right\rangle \end{bmatrix}$$

[14] Similar examples may also exist in English, depending on how one analyzes sequences like ***all these three*** *books*. Though Van Eynde (2006) assumes the HFA approach is necessary for English, we believe that languages like Mandarin Chinese provide much stronger support for it. In spite of that, we cite some data from English and German to facilitate the exposition.

[15] In comparison to Van Eynde's Selector Principle, we enforce the necessity of the functor's COMPS list to be empty. This parallels the constraints generally imposed on *head-specifier-phrase* and *head-adjunct-phrase* (cf. Müller & Machicao y Priemer 2019: 333 & 335). This constraint is necessary to ensure that CL (without NUM) cannot be a functor of N, cf. (34).

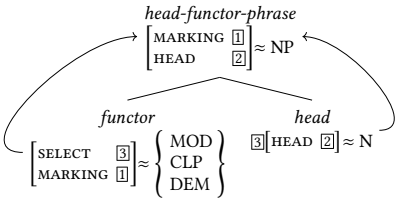
To register the effects of prenominal elements on N the MARKING feature proposed by Pollard & Sag (1994: 46) is used. MARKING values can be used to state selectional constraints of functors or heads over NCs. We propose a MARKING value *weak* (for bare N and CL) and *strong* (for DEM). These values play a similar role to SPR lists, however, as we will see in the next section, MARKING gives the HFA more flexibility than the distinction between empty and non-empty SPR, since different subsorts of *weak* and *strong* can be postulated (e.g. *n(oun)-marked*) with the purpose of modeling more fine-grained selectional constraints on NCs. E.g. some functor or V might be constrained in such a way that it can only select for NCs that have a specific subsorts of *weak* (e.g. *n-marked*) as its value.

The projection of MARKING is governed by the Generalized Marking Principle in (28), which ensures that the MARKING values of a head-functor phrase come from its functor (Van Eynde 2006: 166).

(28) $$\textit{head-functor-phrase} \Rightarrow \begin{bmatrix} \textit{headed-phrase} \\ \text{SYNSEM|LOC|CAT|MARKING } \boxed{1} \\ \text{NON-HD-DTR} \left\langle \left[ \text{SYNSEM|LOC|CAT|MARKING } \boxed{1} \right] \right\rangle \end{bmatrix}$$

Taken collectively, the Head-Feature Principle in (4), the Selector Principle (27) and the Generalized Marking Principle (28) yield the following kind of structure:

(29)




The structures licensed by the HFA combine aspects of both NP and DP theories. On the one hand, the HFA is unequivocally an NP approach, since the category D is not assumed and N functions as the head of NCs. On the other hand, however, the HFA departs from most NP analyses in two crucial respects: (i) it rejects the notion that N imposes selectional requirements on its prenominal dependents; and (ii) a nominal projection can, through its MARKING value, encode fine-grained categorial information about its prenominal daughters, providing a local record of its "combinatorial history", much like a DP encodes information about D. As David Adger (p.c.) points out to us, the idea that a phrase may simultaneously inherit categorial properties of its lexical head and its non-head daughter makes the HFA essentially a version of Grimshaw's (1991) theory of extended projections encoded in the formalism of typed feature structures.

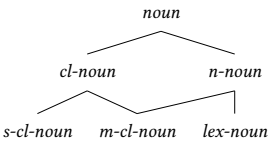
### 4.2 Accounting for the Mandarin Chinese puzzles

In the case of Mandarin Chinese, we want the HFA to account especially for the following properties, which lie at the heart of the puzzles discussed in Section 3: (i) the modifiability of $CL_m$; (ii) the similar prenominal distribution of CL, DEM, and MOD; (iii) the differences between MOD, CL and DEM with respect to iteration; (iv) the optionality of CL and DEM; (v) the singular DEM paradox.

Though each of these puzzles taken individually could be solved by adding some stipulation to standard NP or DP approaches, we are not aware of any version of these theories that could address all four of them simultaneously. We will show that the HFA is essential to provide a unified and coherent solution to all of these problems, while also raising interesting typological hypotheses.

The first ingredient of our theory is a hierarchy of nominal HEAD values. Due to the different positions and interpretations MODs and DEMs can have inside NCs according to the subtypes of CL ($CL_s$ and $CL_m$), we assume that N and CL constitute a natural class of type *noun*, which is divided in different subtypes, with measure classifiers (*m-cl-noun*) being at the same time subtypes of *n(ouny)-noun*, like lexical nouns (*lex-noun*), and of *cl(assifier)-noun*, like sortal-classifiers (*s-cl-noun*).[16] Prototypical Ns like *shu* 'book' have HEAD values of type *lex-noun*.

(30) Hierarchy of nominal HEAD values




We posit that modifiers (i.e. DePs) and DEMs can attach only to elements of type *n-noun*. For this to work, we also need to assume a left-branching analysis, where NUM and CL combine to form a CLP before combining with the head N. This account explains why DePs and DEMs have a similar distribution and, moreover, why measure classifier phrases can be modified by DeP and DEMs just like ordinary lexical Ns.[17] Since any DeP or DEMs can in principle combine as a functor with $CL_m$ or N, cases where DeP (19) and DEMs (23) precede NUM-$CL_m$-N sequences are predicted to be structurally ambiguous. No such ambiguity

[16] Further evidence for this hierarchy comes from the historical development of classifiers out of nouns, see Huang (1964). On this picture, we can understand this diachronic development as a grammaticalization of elements of type *lex-noun* as *m-cl-noun* and, subsequently as *s-cl-noun*.

[17] As a reviewer notes, the class of *m-cl-noun* is not semantically homogeneous, given that some of its members can have both counting and measuring readings, as in (i) adapted from Li (2013: 135):

should exist for sortal classifiers, because they are not a subsort of *n-noun*. That is, our account derives the range of positions in Figures 1-2 for DePs and DEM in NCs with measure classifiers and for NCs with sortal classifiers.

This proposal correctly predicts non-spurious structural ambiguities in (31).

(31) wo mai-le da de na san xiang shu
1.SG buy-PERF big DE DEM three $CL_{m \approx \text{'box'}}$ book
'I bought those three big boxes of books' or
'I bought those three boxes of big books' or
'I bought three boxes of those big books'

The interpretation 'three big boxes of those books' is ruled out by the structure in Fig. 1 because, if *da de* 'big' is predicated of *xiang* 'boxes', then so must be the DEM to its right appearing before the $CL_m$ – i.e. given their position, these functors have to be the topmost DePs and DEMs inside the CLP in Figure 1. An approach that allows DeP to raise over DEM (as we suggested above in connection to Cinque (2005)) would have trouble capturing this restriction, since there could be a lower copy of *da de* 'big' inside the $CL_mP$ that is chosen for reconstruction, while DEM is directly attached high to the NP, above the $CL_mP$.

(i) a. wo ling-le *liang ping* *hongjiu* (counting reading)
1.SG lift-PFV two $CL_{m \approx \text{'bottle'}}$ red.wine
'I carried two bottles of red wine.'

b. ta-de jiuliang shi *liang ping* *hongjiu* (measuring reading)
3.SG-DE drinking.capacity BE two $CL_{m \approx \text{'bottle'}}$ red.wine
'The most he can drink (i.e. his 'drinking capacity') is two bottles of red wine.'

Li & Rothstein (2012) and Li (2013) attribute these two readings to different syntactic structures. This is not necessary under our analysis. Making use of the flexible syntax-semantics interface of HPSG, we can distinguish the two readings purely at the level of CONTENT. In the counting reading, *ping* conveys a nominal semantic relation *bottle-rel*, which is the semantic head of the whole NP, taking the relation expressed by N as an argument and the relation expressed NUM as essentially a modifier. In the measuring reading, *ping* conveys a measure function *bottle-measure-rel*, which relates the INDEX of the head N to the number expressed by NUM (see Krifka 1995: 400 for a similar idea). The two readings are depicted in (ii).

(ii) a. $\begin{bmatrix} \text{INDEX } \boxed{1} \\ \text{RELS } \langle \textit{bottle-rel}(\boxed{1}, \boxed{2}), \textit{card-rel}(\boxed{1}, 2), \textit{wine-rel}(\boxed{2}) \rangle \end{bmatrix}$ (counting reading)

b. $\begin{bmatrix} \text{INDEX } \boxed{1} \\ \text{RELS } \langle \textit{bottle-measure-rel}(\boxed{1}, 2), \textit{wine-rel}(\boxed{1}) \rangle \end{bmatrix}$ (measuring reading)

The idea would be that the CONTENT value of *ping* is lexically underspecified w.r.t. whether it encodes *bottle-rel* or *bottle-measure-rel*. The advantage of this treatment is that the uniform syntactic structure is preserved while the different readings are resolved at the semantic level. We leave a more explicit formalization of the semantics of CLPs for future work.

The structures in Figures 1-2 model quite well the distribution of DEM, DeP, and CLP observed in Section 3. In particular, the structural ambiguity of DePs and DEMs preceding NUM–$CL_m$ is derived because DePs and DEMs can combine either with $CL_m$P or higher up with NP. CLPs are also similar to DePs and DEMs in the sense that they are prenominal and optional. Overall, DePs, DEMs, and CLPs in Mandarin Chinese have similar collocational properties, which is a natural consequence of the unification of modifiers and specifiers in the HFA.

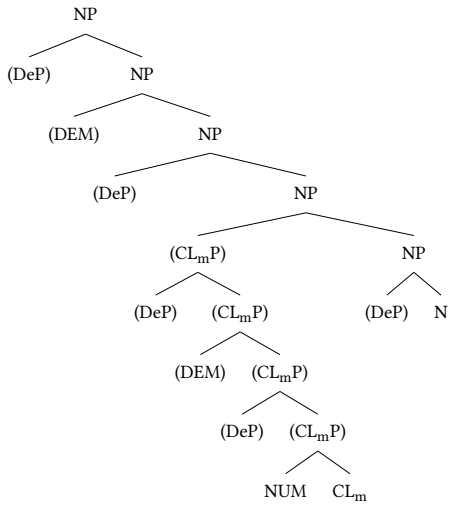



Figure 1: NP structure with $CL_m$

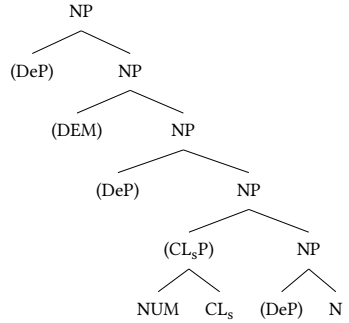


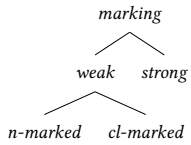

Figure 2: NP structure with $CL_s$

There is, however, a difference between DEMs, CLPs, and DePs that we also observed in Section 3, namely, the fact that DePs can be indefinitely iterated and CLPs and DEMs can only appear once per NP – in the case of DEMs, regardless of whether they combine inside the $CL_m$P or directly with the NP.

To explain why multiple DEMs/CLPs cannot appear at the same time and DePs can, we need to invoke another ingredient of the HFA. Elements in the NC carry different MARKING values, only some of which can be selected by CL and DEM. We propose that objects of sort *marking* are arranged as the hierarchy (32), where *n-marked* is the MARKING value of N and *cl-marked* is the MARKING value of CL.[18]

[18]We believe that the hierarchy in (32) provides a more natural encoding for the Mandarin Chinese data than the one in Van Eynde (2006: 167), which is motivated for European languages. That said, for ease of exposition, one can think of *n-marked* as being equivalent to Van Eynde's *bare*, and *weak* and *strong* as being parallel to his *unmarked* and *marked* sorts, respectively.

(32) Hierarchy of MARKING values




Recall that, in virtue of the Generalized Marking Principle in (28), the MARKING value of the combination between a functor and a head is the MARKING value of the functor. To explain why DeP functors like the adjectival *haokan de* ('nice') can be freely iterated and combined with either N or $CL_m$ in any order, we propose the general structure in (33). We assume that DePs are head-complement phrases, with the dependent-marking particle *de* serving as the head daughter. What *de* effectively does, according to (33), is take a predicate of some sort (an adjective, in that case) and map it into a functor that selects an N.

(33) Sample **DeP** (for adjectives)

$$\begin{bmatrix} \textit{head-complement-phrase} \\ \textsc{phon} & \langle \textit{haokan,de} \rangle \\ \textsc{synsem|loc|cat} & \begin{bmatrix} \textsc{head} & \boxed{2} \begin{bmatrix} \textit{de} \\ \textsc{select} & \begin{bmatrix} \textsc{head} & \textit{n-noun} \\ \textsc{comps} & \langle\rangle \\ \textsc{marking} & \boxed{1} \end{bmatrix} \end{bmatrix} \\ \textsc{comps} & \langle\rangle \\ \textsc{marking} & \boxed{1} \end{bmatrix} \\ \textsc{hd-dtr|synsem|loc|cat} & \begin{bmatrix} \textsc{head} & \boxed{2} \\ \textsc{comps} & \langle \boxed{3} \rangle \\ \textsc{marking} & \boxed{1} \end{bmatrix} \\ \textsc{non-head-dtrs} & \left\langle \boxed{3} \begin{bmatrix} \textsc{synsem|loc|cat} & \begin{bmatrix} \textsc{head} & \textit{adj} \\ \textsc{comps} & \langle\rangle \end{bmatrix} \end{bmatrix} \right\rangle \end{bmatrix}$$

Crucially, DeP does not impose any requirement on the MARKING value of the head – it inherits its own MARKING value from the *n-noun* (N or $CL_m$) it selects. This MARKING value is, by virtue of (28), projected the mother of DeP.

The non-iterability of CLPs is due to the constraints on the MARKING values of the heads they select. We treat CLPs as signs of type *num-cl-phrase*, a subtype of *head-complement-phrase*, subject to (8). What defines this specific type of head-complement structure is the fact that it is headed by a non-phrasal CL with a non-phrasal NUM as its complement. The non-phrasal status of the CL and NUM daughters of CLP is represented by a positive specification for the boolean LEX feature (Pollard & Sag 1987: 72–73).[19] This ensures that no modifiers can be

[19]The fact that the daughters of these structures have to be non-phrasal likens *num-cl-phrase* to

inserted between NUM and the CL head – i.e. it rules out structures like **san da de xiang shu* 'three big DE box book'. Crucially, all CLP functors select a *n-marked* head of type *lex-noun* (in virtue of their CL head) and have the MARKING value *cl-marked*, which (28) ensures is transmitted to their mother. (34) exemplifies.

(34) Sample structure for **Classifier Phrase**

$$\left[\begin{array}{ll} \textit{num-cl-phrase} & \\ \text{SYNSEM|LOC|CAT} & \left[\begin{array}{ll} \text{HEAD} & \boxed{2}\left[\begin{array}{ll} \textit{cl-noun} & \\ \text{SELECT} & \left[\begin{array}{ll} \text{HEAD} & \textit{lex-noun} \\ \text{MARKING} & \textit{n-marked} \end{array}\right] \end{array}\right] \\ \text{COMPS} & \langle\rangle \\ \text{LEX} & - \\ \text{MARKING} & \boxed{1}\ \textit{cl-marked} \end{array}\right] \\ \text{HD-DTR|SYNSEM|LOC|CAT} & \left[\begin{array}{ll} \text{HEAD} & \boxed{2} \\ \text{COMPS} & \langle\boxed{3}\rangle \\ \text{LEX} & + \\ \text{MARKING} & \boxed{1} \end{array}\right] \\ \text{NON-HEAD-DTRS} & \left\langle \boxed{3}\left[\text{SYNSEM|LOC|CAT}\left[\begin{array}{ll} \text{HEAD} & \textit{num} \\ \text{LEX} & + \end{array}\right]\right]\right\rangle \end{array}\right]$$

Since *cl-marked* is not a subtype of *n-marked*, a second CLP cannot be added to a NC after a CLP has already marked the nominal projection – even if there is an intervening DeP between them, as Figure 3 illustrates (the offending phrases are signaled with an asterisk, the remainder of the structure is well-formed).

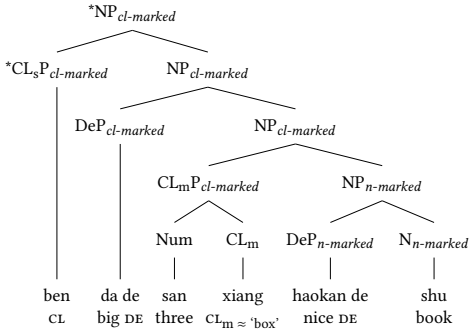



Figure 3: Ill-formed NP structure with two CLPs

DEMs in Mandarin Chinese have minimally the structure in (35). What is essential is that DEMs select a phrasal *n-noun* head with a *weak* MARKING value. This predicts that DEM can precede a CLP (24a), because the MARKING value of

compounds. Unlike compounds, however, the output of the combination is LEX – (this allows DEMs to select CLPs, cf. (35)). We assume that, due to constraints on the sort *phrase*, the result of any phrasal combination (*head-complement*, *head-functor*, etc.) is always LEX –. The fact that the PHON of the complement of CL (i.e. NUM) precedes that of CL follows from a general linear precedence rule for all nominal head-complement structures in Mandarin Chinese.

the latter is *cl-marked*, i.e. a subsort of *weak* – the value selected by DEM. Therefore, we effectively solve one of the puzzles that Mandarin Chinese NCs posed for *head-specifier* approaches (and to some extent also DP theories): the fact that the same structure can have multiple D-like elements.

(35) Minimal structure for **demonstratives**

$$\left[\begin{array}{l}\textsc{cat}\left[\begin{array}{ll}\textsc{head} & \left[\begin{array}{ll}\textit{demonstrative} & \\ \textsc{select} & \left[\begin{array}{ll}\textsc{head} & \textit{n-noun}\\ \textsc{marking} & \textit{weak}\\ \textsc{lex} & -\end{array}\right]\end{array}\right]\\ \textsc{marking} & \textit{strong}\end{array}\right]\end{array}\right]$$

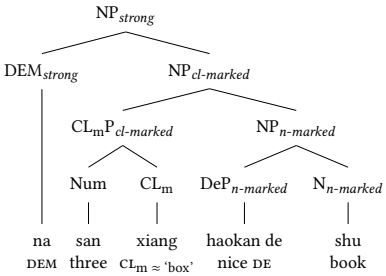



Figure 4: NP structure with DEM and CLP

After a DEM functor combines with $CL_m$ or N, the resulting phrase inherits the *strong* MARKING of DEM. An NP marked with *strong* has no problem being selected by a DeP, assuming the latter has a structure like (33). This allows us to solve the puzzle for the DP approach pointed out in connection to (16c) – namely, the fact that DePs can precede DEMs, as Figure 5 illustrates.[20]

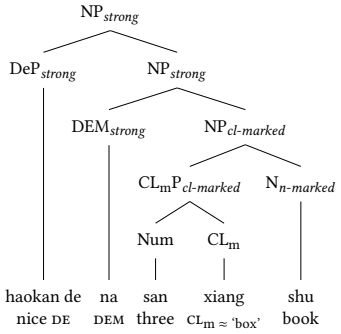



Figure 5: NP structure with DeP preceding DEM

[20]The fact prenominal DeP can appear both before and after DEM, apparently contradicting Greenberg's (1963) Universal 20, arguably follows from the fact that both DEMs and DeP in Mandarin Chinese are subsumed under the general category of functors. We can hypothesize that Universal 20 only applies to languages where DEMs function as specifiers.

The iteration of DEMs is ruled out because DEM is *strong*-marked but selects *weak*-marked elements. Note that *strong* marking projects regardless whether the most embedded DEM is attached to N or $CL_m$. In the latter case, the MARKING value *cl-marked* that is lexically associated with $CL_m$ is overwritten by *strong* as soon as DEM is merged. This becomes the MARKING value of $CL_mP$, so no further DEM can be added to N to the left of the $CL_mP$, as Figure 6 shows.

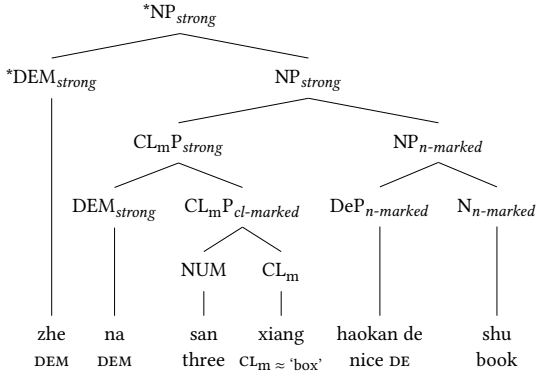



Figure 6: Ill-formed NP structure with two DEMs

As we hinted at in Section 3, in the absence of a MARKING feature, it would not be possible to capture this effect without somehow relaxing locality of selection. On a DP theory, one would have to say that DEM can probe inside the non-immediate daughters of its complement to make sure that no other DEM was combined inside of them. On standard NP theories, one would have to first allow N to have two optional specifiers (see for instance Ng (1997)) and then impose a constraint to ensure that, if the second specifier contains DEM somewhere among its non-head daughters, DEM cannot appear as the first specifier.

This account also explains why CLPs cannot precede DEMs within the NP, as we saw in (24b). Given (35), any NP mother of DEM will have *strong* MARKING value. This is incompatible with the selectional requirements imposed by CLPs (34), which require *n-marked* NPs as their sisters, as Figure 7 illustrates.

With these ingredients, we can also envision a solution to the two of the remaining puzzles: the optionality of CL and DEM (Section 3.1) and the singular demonstrative paradox (Section 3.3). The optionality of prenominal elements like CL and DEM can be explained by positing that verbs and other heads that can take NP as their valents in Mandarin Chinese simply do not care about the MARKING values on NP [21]. That is, the MARKING values of NP valents are underspecified, as illustrated by the partial entry for *mai* 'buy' in (36).

[21]Verbs in Mandarin Chinese do impose requirements on their valents beyond what we formalize

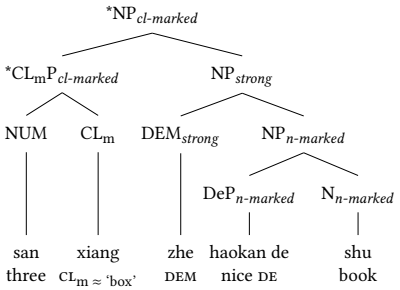



Figure 7: Ill-formed structure with CLP preceding DEM

(36)
$$\begin{bmatrix} \textsc{phon} & \langle mai \rangle \\ \textsc{synsem|loc|cat} & \begin{bmatrix} \textsc{head} & verb \\ \textsc{subj} & \langle \text{NP}_{marking} \rangle \\ \textsc{comps} & \langle \text{NP}_{marking} \rangle \end{bmatrix} \end{bmatrix}$$

We can also solve the singular demonstrative paradox in (26) – i.e. the observation that the combination of a DEM and a bare N can only be interpreted as singular, while the combination of a DEM with a modified N can be singular or plural. The key to solving this puzzle lies in the requirement that DEM select an element of type *n-noun* with the LEX value − (35).[22] A bare N is of type *lex-noun* (i.e. a subtype of *n-noun*, along with *m-cl-noun*) and has the LEX value +, as in (37). But after combining with a DeP, the resulting phrase becomes LEX −. The number neutrality of the resulting phrase follows from the fact that N and DeP are both underspecified for number.

(37) Minimal structure for *lex-noun*s (a subtype of *n-noun*)
$$\begin{bmatrix} \textsc{synsem|loc|cat} & \begin{bmatrix} \textsc{head} & lex\text{-}noun \\ \textsc{marking} & n\text{-}marked \\ \textsc{lex} & + \end{bmatrix} \end{bmatrix}$$

A consequence of (37) is that DEM cannot directly combine with a bare N.[23] We propose that when DEM combines with a seemingly bare N, there is actually a covert singular $CL_sP$. We must posit, therefore, a phonologically empty NUM expressing a singular cardinality relation and a null $CL_s$ selecting this singular NUM via *head-complement-phrase*, giving rise to a structure like Figure 8.

in (36), depending on the grammatical function of arguments (Huang et al. 2009). Subjects, for instance, can only be definite NPs, whereas some combinations like CLP-N (with a null NUM proform meaning *one*, see below) are only possible as objects. These semantic restrictions can be encoded as constraints on the CONTENT values of the elements in the SUBJ or COMPS of verbs.

[22] With respect to the LEX feature, see Pollard & Sag (1987) and Arnold & Sadler (1992).

[23] This also predicts that DEM cannot combine directly with a $CL_m$ head (a subtype of *n-noun*), before $CL_m$ combines with its NUM complement giving rise to a phrasal structure like (34).

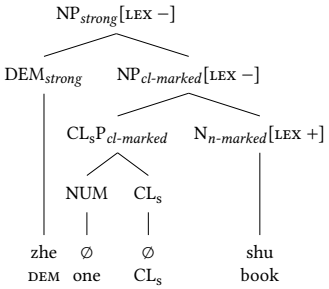



Figure 8: NP structure with covert singular $CL_sP$

There is independent evidence for a null proform for 'one' in Mandarin Chinese. Phrases where NUM does not overtly occur can only be interpreted as singular (e.g. *na ben shu* 'that CL book'), indicating the presence of a covert singular NUM (see Her et al. 2015 and Zhang 2019: 183–187 for more discussion).[24]

Our theory can, thus, derive these seemingly paradoxical facts from independently motivated assumptions, without attributing contradictory properties to DEM (singular number in DEM-N, number neutrality in DEM-DeP-N sequences).

## 5 Conclusion and typological hypothesis

In this study we proposed a Head-Functor Analysis (HFA) for NCs in Mandarin Chinese. This is motivated by the observation that, as opposed to what we see in languages with dedicated determiners, in Mandarin Chinese bare Ns can appear as arguments in all contexts and typical modifiers (e.g. APs) and specifiers (DEMs) can be freely interweaved and co-occur. The structural ambiguity of elements that appear before NUM also supports this approach and provides evidence for a left-branching [[NUM CL] N] structure headed by N.

All in all, the HFA allows us to solve the puzzles that NCs in Chinese pose for standard NP and DP theories. Bare and complex NCs are licensed as full NPs, without the need to posit empty specifiers or Ds. DEM, CL, and MODs can be

[24] Similarly, the existence of a null $CL_s$ can be supported by structures where $CL_s$ is optional, like *wuqian (ge) ren* '5000 (CL) person' (Her 2012a: 1669). In some northern Chinese dialects and formal registers, NUM-N sequences are even more productive and can occur with other kinds of Ns (Her et al. 2015). The fact that the null $CL_s$ has a more widespread distribution in some forms of speech follows from variation in its selectional properties. We can speculate that, unlike in standard Mandarin Chinese, the null $CL_s$ in these varieties does not require the element in its COMPS list to be the null NUM proform. For approaches dealing with register-driven morphosyntactic variation, see Machicao y Priemer et al. (2022) and Varaschin et al. (Under Review).

unified under the category of functors which select and mark N-heads, which explains their prenominal status and optionality. Constraints on the MARKING values of the heads selected by each of these functors account for the distributional differences between them, e.g. for the fact that DEM can precede CLP (but not vice versa), and that MODs can be iterated but DEM and CLP cannot. We also proposed that $CL_m$ and $CL_s$ have different structures and that DEM and MOD can attach only to elements of type *n-noun*, i.e. $CL_m$ or lexical Ns. The singular demonstrative paradox is solved by postulating a lexicon containing only one phonologically empty $CL_s$ and an independently motivated a singular NUM.

The behavior of prenominal elements in Mandarin Chinese is very different from what we see in languages like German or English, both of which have dedicated determiners (Pollard & Sag 1994, Machicao y Priemer & Müller 2021). In our view, both types of languages favor an NP account, but require different combinatorial mechanisms: in German and English, prenominal elements fall more naturally into two different categories (specifiers vs. modifiers) while in Mandarin Chinese, all prenominal elements seem to behave similarly and preserving the modifier/specifier distinction seems unworkable.

This general outlook suggests a typology of languages which is parallel to the NP/DP parameter proposed in the minimalist tradition, from which many properties have been argued to follow (Cheng & Sybesma 1999, Bošković 2007, Bošković et al. 2013). Rather than interpreting this in terms of the presence of DPs, these properties could be due to the presence of structures of the sort *specifier-head-phrase* or *head-functor-phrase* in each language. D-less languages like Mandarin Chinese, Polish and Turkish would only have the latter, while English and German would only have the former. It remains to be seen the extent to which Mandarin Chinese conforms to these generalizations and how they can be derived from the differences between *head-functor* and *specifier-head* phrases.

## Acknowledgements

We would like to thank the audiences at the GLiF Seminars (Formal Linguistics Research Group at the Universitat Pompeu Fabra in Barcelona), the Berlin-BrnoVienna Workshop (Masaryk University in Brno), the Kolloquium Syntax und Semantik (Humboldt-Universität zu Berlin), the CSSP 2023 (Ecole Normale Supérieure in Paris), and at the Constraining Linearization workshop at the DGfS 2024 conference (Ruhr Universität Bochum) for their helpful feedback. We profited from useful conversations with Anne Abeillé, David Adger, Sascha Alexeyenko, Zehui Guo, One-Soon Her, Zi Huang, Jean-Pierre Koenig, Xuping Li,

Jialing Liang, Yanru Lu, Stefan Müller, Louise McNally, Adam Przepiórkowski, Viola Schmitt, Marcin Wągiel and Martina Wiltschko. We are very grateful to three anonymous reviewers for their detailed and constructive comments, which have led to substantial improvements. Of course, all remaining errors are our responsibility. The research reported here was partially funded by a Ph.D. scholarship from the Chinese Scholarship Council and Deutsche Forschungsgemeinschaft (DFG) – SFB 1412, Project A04, ID 416591334.

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