MORPHOLOGY OF DIRECT MODIFICATION

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The distinction between direct and indirect modification has been widely discussed from semantic and syntactic viewpoints; however, this paper focuses on its morphological aspects. The core empirical observation is that morphologically complex adjectives are attributive-only when they have phrasal semantics. It will be argued that phrasal indirect modifiers alternate with non-projecting direct modifiers such as three-foot-long (pole), cellular (structure), and preadverbial (expression) because of the syntax of direct modification. This morphological alternation, which involves various incorporating patterns, is akin to inflection in its syntactic motivation. The close relationship between direct modification and attributive compounding, on the other hand, will be shown to be diachronic.*

Keywords: attributive modification, morphophonology, morphosyntax, paradigm, lexicalization

1. Introduction

Since Sproat and Shih (1988), the distinction between direct and indirect modification has been widely assumed in the literature on adjectival modification (e.g. Alexiadou and Wilder (1998), Baker (2003), Cinque (2010a), to name but a few). Direct modification is a type of attributive modification in which the modifier enters the structure directly via base-generation. In-

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direct modification, on the other hand, is a type of attributive modification transformationally derived from a predicational structure, specifically via relative clause reduction. Sproat and Shih (1988) argue that this syntactic distinction underlies the semantic and distributional properties of adjectives: direct modification adjectives are open to intersective and non-intersective interpretations and subject to an ordering restriction, whereas indirect modification adjectives are limited to intersective interpretations and are ordered freely. Thus, although adjectives can be semantically ambiguous in the attributive use (e.g. the old director), the non-intersective reading disappears in the predicative use (e.g., the director is old) (Bolinger (1967: 4)); crucially, the non-intersective reading is available only in the attributive use. The two-source hypothesis of attributive modification is also supported by the existence of adjectives that cannot be used predicatively, such as main, former, and alleged.

The aim of this paper is to examine the two-source hypothesis from a morphological point of view: how do direct and indirect modifiers differ morphologically? This question concerns both inflectional and derivational morphology. First, if direct and indirect modification is a valid syntactic distinction, a possibility arises from a general theory of inflectional morphology that modifiers take different forms in these two contexts. Cinque (2010a: 95–111) shows that this is indeed the case in inflectional languages. In Bosnian/Croatian/Serbian, direct modification adjectives occur in the long-form, whereas indirect modification adjectives take the short-form. In Maltese, Romanian, and Greek, indirect modification adjectives can carry an article, whereas direct modification adjectives always occur in an article-less, bare form. Although English does not have overt inflection as rich as these languages, it remains possible to ask whether the supposed syntactic differences between direct and indirect modification can trigger any morphological difference in this language as well.

Derivational morphology can also make a difference between indirect and direct modification. The two-source hypothesis has been entertained exclusively for simplex adjective modifiers, but Rubin’s (2003) observation that modifiers come from various syntactic categories raises the question of whether or in what way the direct vs. indirect distinction is relevant to modifiers based on non-adjectival categories. If direct modification is a property of category A (Croft (2001: 88), Baker (2003: sec. 4.2)), non-adjectives need their categories shifted to A to function as direct modifiers. Because the primary linguistic means of changing syntactic categories is provided by derivational morphology, there should be cases in which modifiers based on
non-adjuncts take different forms in direct and indirect modification.

These considerations shed a new light on formally complex attributive modifiers such as:

1. **a cellular** structure, a **wooden** box, a **red-roofed** house, the **Korean** economy
2. **preadverbial** expressions, **subatomic** particles, **anti-tank** gun, **between-class** break
3. a **ten-year-old** girl, a **three-foot-long** pole, a **three-child** buggy, a **two-second** pause
4. **degree-conferring** institution, **London-based** company, the **Balkan-weary** troops
5. **public-private** partnership, **Swedish-Irish** trade, **phrasal/lexical** distinction, **dinosaur-bird** link

The italicized elements occur only attributively, like **former** and **main**.

The modifier-noun combinations as a whole are not compounds, as indicated by their end-stress and syntagmatic non-fixity. These types of modifiers can be stacked, as in the **first major machine-readable, corpus-based lexical project** and **Iranian, 16th-century, brass, boat-shaped vessel** (Feist (2012)).

We will argue that these modifiers are direct modifiers whose forms depend on the syntactic properties of direct modification. Their formal complexity belongs to derivation (1a, b) and compounding (1c–e), but the morphological change itself is closer to inflection in that it is triggered by the syntactic context.

Argumentation will proceed as follows. First, section 2 will show that syntactic conditions of direct modification as proposed by Baker (2003) corroboratively impose a certain morphological condition on this type of
modification, which accounts for compound modifiers (1c–e). Based on this syntax-morphology interaction, section 3 will show that derived modifiers (1a, b) are morphological consequences of PPs used as direct modifiers. The close relationship between direct modification and attributive compounding will be analyzed diachronically in section 4. Section 5 will extend the direct modification analysis to the so-called phrasal compounding. The last section will summarize the findings of this paper and discuss their theoretical implications from a cross-linguistic viewpoint.

As a framework for morphological analysis, we will adopt two fundamental hypotheses of Beard’s (1995) Lexeme-Morpheme Base Morphology (LMBM): (i) the distinction between lexemes (members of the lexical categories, i.e. nouns, verbs, and adjectives/adverbs (Aronoff (1994: 10), Baker (2003))) and grammatical morphemes, with the latter governed by the separation hypothesis, and (ii) the separate but parallel working of supralexical syntax and lexeme-internal syntax (see Beard and Volpe (2005) for a succinct introduction of LMBM). LMBM constitutes one of the cornerstones of contemporary morphological inquiry. The first hypothesis is widely adopted in theories whose main focus is on the relation between morphosyntactic representations and morphophonological realizations (e.g. Aronoff (1994), Stump (2001)). Ideas similar to the second hypothesis, which concerns the nature of morphosyntactic representations, are found in the literature dealing with the word-phrase distinction (e.g. Ackema and Neeleman (2004), Di Sciullo (2005)).

2. Syntax of Direct Modification and Its Morphological Consequence

2.1. Syntactic Properties of Direct Modification

This section elucidates the syntactic properties of direct modification based on Baker (2003) and Emonds (2012). The first concerns the syntactic category: adjectives alone can be direct modifiers (Baker (2003: 191)). According to Baker’s definition, nouns are bearers of a referential index, verbs are theta-role assigners, and adjectives are neither of these. Baker (2003: sec. 4.2.2) argues that this character as an elsewhere category enables adjectives to occur in the structure where the modifier merges directly with the head noun, with no functional structure mediating the relation (as an in-

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4 The hypotheses in (i) and (ii) are not mutually exclusive; see Aronoff (1994: sec. 1.3).

5 See Hofherr (2010: sec. 3.1) for the survey of relevant previous studies.
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stance of Bare Phrase Structure):

(2)  \[ \text{DP} \ a \ [\text{NP} \ [a \text{ smart}] \ [\text{N} \text{ woman}]] \]

Nouns and verbs cannot be used as modifiers (*a genius woman, *a shine coin (Baker (2003: 191))) because it would leave the referential index of a noun and the theta-role of a verb unlicensed.

Implicit in (2), the second syntactic property of direct modification is the structural smallness of the modifier (Sadler and Arnold (1994: sec. 5)). Baker (2003: 274) states that a direct modifier is similar to an incorporated head in that they are “both very small pieces of syntax, typically consisting of only a single X0.” Thus, a direct modifier cannot appear with a full-fledged degree system (*the too/so proud parent) and cannot take complements (*the proud of Mary parent) (Baker (2003: 196)) (see Ticio (2010: sec. 4.2) for Spanish data; cf. Escribano (2004), Cinque (2010a: sec. 4.1.2)).

Thirdly, Baker (2003: 210–211 and fn. 15) suggests that overt or covert agreement between an adjective and a noun (in gender, number, and case) is necessary to the existence of direct modification, functioning as a sort of glue to join the modifier and modified. Given this condition, “if adjectives could not bear agreement (not even covert agreement) in a particular language, they would be barred from attributive constructions in that language. They could only show up in predicative environments, where the ‘glue’ of agreement is not so necessary” (Baker (2003: 211, fn. 15)). This, Baker says, accounts for the observation that some languages lack direct modification entirely. As for the mechanism of adjectival agreement, Baker (2003: 208, fn. 13) proposes a c-command-based view, according to which “an adjective assumes the phi-features (e.g. gender, number, case) of the closest nominal that c-commands it” (see also Note 11).

Direct modification also exhibits a peculiar word-order property: it allows or requires head-final word order even in parametrically head-initial languages (Emonds (2012: 173)). As discussed in Cinque (2010a), a direct modifier precedes a head noun, always in Germanic languages and in certain cases in Romance languages, despite the general head-initial word order of

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6 See Baker (2003: 196, fn. 5) for the modification of direct modifier adjectives by adverbs.

7 Opinions differ as to the status of Japanese in this respect; see Shimoyama (2011: sec. 2) and the literature cited therein. Yamakido (2000) argues for the possibility of direct modification in Japanese; crucially, she analyzes the suffix -i in Japanese adjectival forms as the realization of Case agreement.
these language groups. The surface ordering of DP-internal constituents in each group may be succinctly stated as follows:  

(3)  
a. Germanic languages:  
   \[ D > \text{direct modifier} > N > \text{indirect modifier} \]  
b. Romance languages:  
   \[ D > \text{direct modifier} > N > \text{direct modifier} > \text{indirect modifier} \]  

Both synchronic and diachronic considerations are necessary to understand the above surface orders (e.g. Cinque (2010a), Perridon and Sleeman (2011)), but what is important here is that direct modification allows the violation of unmarked word order. Notice that a similar ordering property is found internal to the direct modifier itself. As an instance of its structural smallness, we have seen the Head Final Filter effect. Crucially, this is exhibited by prenominal direct modifiers, as Escribano (2004: 5) defines Head Final Filter as follows: “Base-generated pre-modifiers must be head-final.” This means that prenominal direct modification is head-final and the modifier therein is also head-final.

2.2. A Morphological Condition for Direct Modification

The next question is the relationship between the four syntactic properties identified in the previous section. Because Baker (2003: 210–211 and fn. 15) suggests that agreement is the syntactic condition for direct modification, the other syntactic properties should be treated as epiphenomena of that condition. Such an analysis is not only possible but brings to light a morphological condition for direct modification: direct modifiers should take a form that is fit for agreement with the noun.

A hint of correlation lies in the fact that the structural peculiarity of direct modifiers, their structural smallness, is observed in the prenominal position in head-initial languages, i.e. a parametrically marked position. Let us suppose that direct modification allows the violation of unmarked word order because it is supported by the glue of agreement.  

We can then make sense of the above observation by further supposing that the small or X\(^0\)-level structure is a consequence of the agreement condition; that is, a direct modifier is non-projecting because a full projection would hinder the direct

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8 In Cinque’s (2010a) analysis, an indirect modifier appears also between D and a direct modifier in Germanic languages.

9 One piece of evidence for this view is the fact that adjectives in Dutch and German overtly agree with modified nouns if and only if they violate parametric word order (Emonds (2012: 173)).
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If correct, this speculation is tantamount to saying that the agreement condition imposes a morphological condition on direct modifiers, because the non-projecting status requires a specific morphological realization, an incorporated form. This morphological requirement of direct modifiers is not noticeable as long as we are dealing with simplex adjectives, but it becomes visible when we look at compound premodifiers that take a phrasal form in postmodification:

\[(4)\]
\[
\begin{align*}
\text{a. a \{ten-year-old/*ten-years-old\} girl} \\
& \quad \text{(a girl who is \{ten years old/*ten-year-old\})} \\
& \quad \text{a \{three-foot-long/*three-feet-long\} pole} \\
& \quad \text{(a pole that is \{three feet long/*three-foot-long\})} \\
\text{b. a \{three-foot/*three-feet\} pole} \\
& \quad \text{(a pole that is \{three feet long/*three-foot\})}
\end{align*}
\]

\[(5)\]
\[
\begin{align*}
\text{a. degree-conferring institution} \\
& \quad \text{(institution that \{confers degrees/*is degree-conferring\})} \\
& \quad \text{suspicious-looking packages} \\
& \quad \text{(packages that \{look suspicious/*are suspicious-looking\})} \\
& \quad \text{British-based company} \\
& \quad \text{(company that is \{based in Britain/*British-based\})} \\
\text{b. the Balkan-weary troops} \\
& \quad \text{(the troops that are \{weary of the Balkans/*Balkan-weary\})}
\end{align*}
\]

\[(6)\]
\[
\begin{align*}
\text{a. doctor-patient dialogue} \\
& \quad \text{(dialogue \{between a doctor and his or her patient/*between doctor-patient(s)/*that is doctor-patient\})} \\
& \quad \text{Tennessee-Arkansas game} \\
& \quad \text{(game \{between Tennessee and Arkansas/*between Tennessee-Arkansas/*that is Tennessee-Arkansas\})}
\end{align*}
\]

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10 As will be discussed later, Watanabe (2010) argues that a measure phrase takes a compound form in an attributive position because of the requirement of “Uniformity of Feature Distribution in Attributive Modification”: attributive adjectives assume the same set of features as the modified noun.

11 The connection between these syntactic properties is suggested by the fact that both are observed to be subject to certain variability among languages. Thus, Baker (2003: ch. 4) observes that “the basic facts about adjectival agreement seem to be quite language-particular” in fn. 13 (p. 208). In fn. 12 (p. 205), he suggests the same for Head Final Filter (see also Cinque (2010a: 46–47)). Although much must be left for future research, our analysis allows for the possibility that the structural property of direct modifiers varies depending on the adjectival agreement pattern adopted in each language.
b. *public-private* partnership
(parternship{between public and private institutions/*that is public-private})*

cognitive-corpus analysis (subtitle of Hamawand (2007))
(analysi {by cognitive and corpus linguistics/*by cognitive-corpus/*that is cognitive-corpus})*

The direct modifier status of the italicized expressions is confirmed by their distribution; the compounds in (5) primarily and those in (4) and (6) always occur as attributive modifiers.

Measure phrases show a clear formal alternation between attributive and predicative contexts, as illustrated in (4). In the attributive context, the measure noun always takes a singular form (Sadler and Arnold (1994: 217–218), Escribano (2004: 4)).\(^{12}\) Watanabe (2010) explains this fact as a result of the agreement condition of direct modification; because a singular form of a measure noun, a default word-form, does not have a specific Number feature, it does not interfere with the agreement between the modifier as a whole (*ten-year-old*) and the modified (*girl*) (see also Note 10).\(^{13}\) Although Watanabe focuses on the singular/plural distinction of a measure noun, his analysis could be rephrased as follows: a measure phrase takes a compound form in the attributive context to satisfy the agreement condition. In compounds, lexemes generally take a default word-form. Being incorporated into a complex head, a measure noun becomes syntactically indistinctive, which enables the modifier as a whole to assume feature specifications identical to the head noun.

A similar analysis can be applied to the formal alternations in (5) and (6): direct modifiers take an incorporated adjectival form for the agreement condition. As discussed in Yumoto (2009), compounds in (5) are synthetic compounds in which the head adjective (deverbal in (5a) and simplex in (5b)) satisfies its argument structure through the non-head position. Thus, the predicative counterparts of the modifiers in (5) are VPs (Verb + Object) or APs (Adjective + Prepositional object). Postmodification with VPs and APs alternates with compound premodifiers. This is a clear instance of the

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\(^{12}\) Forms with and without adjectives in (4a, b) can both be regarded as compound adjectives (Huddleston and Pullum (2002: 1660)), though they can differ semantically (Schwarzschild (2006)).

\(^{13}\) Watanabe (2010) considers English to be one of those languages that have adjectival agreement in attributive but not in predicative constructions (e.g. Dutch).
formal alternation between indirect and direct modification. The relation between this phrase-compound alternation and the agreement condition is confirmed by co-occurring formal changes of internal constituents: the involvement of adjectival suffixes, the dropping of a plural ending (e.g. weary of the Balkans / Balkan-weary), and the paradigmatic alternation between nouns and adjectives (e.g. based in Britain / British-based) (Booij (2010: sec. 2.2); see also section 6).

Modifiers in (6) are representative coordinate compounds in English (Olsen (2001), Bauer (2008)), which alternate with indirect modifiers based on phrasal coordination. Unlike coordinate compounds in Japanese (e.g. oya-ko ‘lit. parent-child; parent and child’), English instances always modify a relational noun (in a broad sense) (Olsen (2001: 299)) and semantically function as arguments of that noun. Thus, the compounds in (6a) cannot be used as nouns, and those in (6b) cannot be used predicatively; they are attributive-only adjectives. Apparent counterexamples to this show semantic difference; dinosaur-bird in (1e) and doctor-patient in (6a), for instance, can be used independently only as right-headed appositional compounds (e.g. singer-songwriter) (Olsen (2001: 301), Plag (2003: 146–147), Bauer (2008: 4)). In this type of modifier, too, the overall phrase-compound formal alternation can lead to formal changes of constituents; compare, for example, Swedish-Irish trade in (1e) and a trade between Sweden and Ireland.

In summary, section 2 has shown that the syntactic properties of direct modification force a direct modifier to be formally realized as an incorporated form.

3. Prepositions in Indirect and Direct Modification

In Baker’s theory, P is a category-shifting functional category, “the syntactic equivalent of a derivational morpheme” (Baker (2003: 324)), which selects an NP and turns it into an AP. If PP is a type of AP, the discussion in section 2 predicts that it can be used as an indirect modifier but not as a direct modifier; PP should formally alternate with an $A^0$ form in direct modification. This section will verify this prediction by showing that PPs alternate with derived adjectives such as (1a, b).

3.1. The Distinction between Lexemes and Grammatical Morphemes

The most important contribution of LMBM to modern morphological investigation lies in its serious examination of the separation hypothesis, or the question of how (far) the side of morphology that addresses sound and
the sides that address syntax and semantics can be separated. LMBM’s hypoth-
thesis is that lexemes and grammatical (or functional) morphemes should be
distinguished in this respect; lexemes are linguistic signs, but grammatic-
ical morphemes represent phonological realizations of universally available
grammatical functions. Thus, according to LMBM, deviations from one-
to-one form-meaning mapping such as cumulative expression, zero expres-
sion, empty expression, and multiple exponentence (Haselmath (2002: sec.
2.6), Spencer (2004: sec. 4.2.2)) signal non-lexeme status. Lexemes and
grammatical morphemes are also distinguished by semantics and members-
ship in an open/closed class (Beard and Volpe (2005: 189)). For example,
category-shifting suffixes are bound grammatical morphemes because they
allow empty expression (e.g. the adjectival suffix -al in dramat-ic-al and
syntact-ic-al) and zero expression (e.g. Agent-function realization in (a) cook
vs. reader, standee, correspondent, recordist). In addition, they belong to a
closed class and refer to grammatical functions rather than real-world refer-
ences.

Significantly, both prepositions and prefixes are observed to be problem-
atic to the lexical/grammatical distinction in that their members seem to
spread over both camps. The idea that prepositions come in two types,
functional and lexical, is shared by many researchers (e.g. Miller (1993),
Beard (1995: ch. 10), Abob (2010), Terzi (2010), Moyna (2011); see Cinque
(2010b: sec. 1) for a survey). Being present to mark Case functions, prepo-
ositions such as of, at, with, to, and by lack semantic content (Beard (1995:
309)), which can be observed from the fact that they do not come in pairs
of opposites and do not accept degree phrases (Miller (1993)). They mar-
ginally allow zero expression (Beard (1995: sec. 10.3.1)). Prepositions of
this type cannot be newly formed (Beard (1995: sec. 10.3.2), Baker (2003:
304–305)). On the other hand, prepositions such as behind, inside, under,
and in front of do have semantic content; thus, they often come in pairs of
opposites and accept degree phrases (Miller (1993)). They do not allow
zero expression. Prepositions of this type can increase in number, mainly
by grammaticalization (Abob (2010)).

When Baker says that P is a functional category, he means prepositions
of the former type, namely functional prepositions; he views the latter type,
lexical prepositions, as location-denoting relational nouns conflated into a
covert functional preposition (Baker (2003: 304–305, fn. 1)). Thus, at the
table and under the table each have the following syntactic structures:

(7) a. $\text{[PP [P at [DP the table]]]}$
    b. $\text{[PP [P AT [DP UNDER [DP the table]]]]}$
The structure of a lexical preposition in (7b) is a specification of the structure of a functional preposition in (7a); $P$ selects a DP complement, which can be composed of a relational noun (RN henceforth) such as UNDER and FRONT and its complement. The lexical preposition under results from the RN UNDER conflating into the covert $P$ (represented as AT in (7b)). If conflation does not occur, (7b) gives rise to periphrastic lexical prepositions, such as in front of (cf. Svenonius (2006)),\(^\text{14}\) Aboh (2010: sec. 4), Terzi (2010: sec. 4). Lexical prepositions are often complex in form (e.g. beside, inside) because they embody the composite of $P$ and RN (cf. Noonan (2010: sec. 2)). Below, we will call PPs of the structure (7a) simple PPs and PPs of the structure (7b) composite PPs.\(^\text{15}\)

Prefixes also consist of two types, lexical and grammatical bound elements. It is traditionally recognized that prefixes constitute a conundrum for the lexeme-affix distinction (Marchand (1967, 1969), Bauer (2003, 2005), Montermini (2006), Kastovsky (2011)); compared to suffixes, prefixes are less prototypical affixes.\(^\text{16}\) English prefixes are divided into five semantic groups: (i) evaluative prefixes (e.g. mal-, pseudo-, super-), (ii) spatio-temporal prefixes (e.g. circum-, inter-, pre-), (iii) quantitative prefixes (e.g. bi-, multi-, semi-), (iv) negative prefixes (e.g. de-, non-, un-), and (v) aspectual prefixes (e.g. be-, en-, re-) (Plag (2003: sec. 4.5), Lieber (2005: sec. 3.1)). Crucially, LMBM’s criteria dictate that the latter two groups can be seen as grammatical morphemes, but the former three groups are lexemes. Types (i), (ii), and (iii) have clear semantic content, never occur covertly, and allow the addition of new members; in fact, most of their members are borrowed morphemes. Types (iv) and (v), on the other hand, form closed classes and express grammatical meanings. The possibility of zero expression in these types is indicated by doublets such as to {friend/befriend} and to {bone/debone} the fish.

The lexeme status of the prefixes in (i)–(iii) can be corroborated by behaviors that go against the Lexical Integrity Principle (LIP). Thus, they allow coordinate reduction (Kenesei (2007)) (e.g. sub- and super-human

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\(^\text{14}\) I am grateful to Yoshiki Ogawa for informing me of this study.

\(^\text{15}\) Baker (2003: 304–305, fn. 1) analyzes the lexical component of the lexical preposition as a relational noun; however, in studies on spatial PPs that posit more fine-grained structures than (7a, b), RN is analyzed as Axial Part (Svenonius (2006)) or a modifier of the unpronounced noun PLACE (Noonan (2010), Terzi (2010)).

\(^\text{16}\) More recently, Williams (2011: ch. 2) argues that prefixes are projective, not realizational.
(Bauer (2005: 101)), cf. *Mary un- and re-tied her laces (Sadler and Arnold (1994: 208)). Some of them also allow ellipsis (e.g., I am more interested in pre- than I am in post-World War II (Sadler and Arnold (1994: 208, fn. 27)). These prefixes can take semantic scope over phrases (e.g. [post [di-
gestive disorder]] complication, my ex-car (Lieber and Scalise (2006: 18)) and allow word-internal anaphora (e.g., Anti-Reagan forces believe him to be a threat (Lieber (1992: 129))). As noted by Montermini (2006: sec. 4), examples such as anti-Reagan (forces) can be seen as phrasal prefixation because their proper-name bases remain referential entities. These anti-LIP behaviors, absent from derivatives by suffixes and negative/aspectual prefix-
es, make sense if prefixations by the prefixes in (i)–(iii) are not derivatives but combinations of lexemes. In general, the LIP violation occurs in com-
pounding, which is often analyzed as lexeme-internal syntax (Aronoff (1994: 16)).

3.2. Complementary Distribution of PPs and Derived Adjectives

Baker’s definition of P as a category-shifting functional category is based on the observation that the distribution of PPs is similar to that of APs (Baker (2003: 311–325); see also Beard (1995: 282–290)). For example, similar to APs, PPs can be restrictive modifiers in the postnominal position:

(8) a. a book yellow with age a’. a book on the shelf
   b. a book full of pictures b’. a book about flowers
(9) a. *a yellow with age book a’. *an on the shelf book
   b. *a full of pictures book b’. *an about flowers book

(Beard (1995: 283))

In section 2.2, we showed that APs are indirect modifiers and alternate with direct modifiers in incorporated form (e.g. (5b)) because of the morpho-
logical condition imposed on direct modification. If this analysis is correct, PPs should also be able to occur prenominally if they turn into adjectival heads by incorporating their complement into their head P, a category-shift-
ing functional category.

This prediction is verified by the existence of attributive-only derived ad-
jectives such as (1a, b), which are X^0 categories and have an overt or covert
category-shifting suffix in the head position. If (1a, b) are direct modifica-
tion alternants of PPs, we can account for the fact that they are semantically paraphrased as PPs and occur only in the prenominal position; they are in the complementary distribution with PPs. Specifically, simplex PPs alternate with suffixed adjectives, and composite PPs alternate with parasynthetic adjectives, i.e. suffixed adjectives with spatio-temporal prefixes:
(10)  
a.  *presidential* plane/election/lie  
b.  *cellular* structure  
c.  *dental* disease  
d.  *bearded* man  
e.  *southern* exposure  
f.  *Belgian* law  

a’.  plane/election/lie *of the president*  
b’.  structure of cells  
c’.  disease of teeth  
d’.  man with beard  
e’.  exposure to the south  
f’.  law of Belgium  

(11)  
a.  *preadverbial* expression  
b.  *postnominal* adjective  
c.  *intra-organismal* and *inter-organismal* struggle  
d.  *sub-Saharan* Africa  
e.  *suprasegmental* phonemes  
f.  a *trans-global* expedition  

a’.  expression in front of an adverb  
b’.  adjective after a noun  
c’.  struggle within and between organisms  
d’.  Africa below the Sahara  
e’.  phonemes above segments  
f’.  expedition across the globe  

pre-Chaucerian literature  

literature before Chaucer  

postnominal adjective  

adjective after a noun  

intra-organismal and inter-organismal struggle  

struggle within and between organisms  

sub-Saharan Africa  

Africa below the Sahara  

suprasegmental phonemes  

phonemes above segments  

trans-global expedition  

expedition across the globe  

In the A⁰ forms on the left, P is realized by the underlined N-to-A suffix. In addition to this, those in (11a–f) have a spatio-temporal prefix. This is because composite PPs consist of P and a location-denoting RN; spatio-temporal prefixes are bound forms of the latter lexemic component.

Because category-shifting derivation (or transposition in LMBM) is often expressed covertly in English, P in the A⁰ form can also be expressed covertly, as in:

(12)  
a.  steel bridge, corduroy suit, duck soup, gold medal, iron rod, rubber boots, wood floor  
b.  autumn leaves, September morning, summer palace, Arab policies/philosophy, garage door, library curtains, the New Zealand economy, Tiffany lamp, US ambassador  

(13)  
a.  pre-Easter season, pre-railroad world, post-lunch coffee, anti-tank gun, anti-trade wind, cross-border traffic, inter-island steamer, interstate affairs, pro-tariff reform, sub-bottom echo, subsurface waters, superstandard risk, trans-earth orbit, trans-world airline  
b.  after-dinner mint, before-tax book profits, between-class break, off-campus extension courses, on-base military club, on-board modem, an underground passage  

The modifiers in (12) are direct modifier alternants of simple PP; they denote material (12a) or time or location (12b) with respect to the head noun, semantic relations marked by *of*-PP in indirect modification (e.g.
suit {of corduroy/*that is corduroy}, economy {of New Zealand/*that is New Zealand}). The combinations in (12) are not N-N compounds because they exhibit end-stress (Liberman and Sproat (1992: 157)) and allow one-replacement under coordination (e.g. a wooden bridge and a steel one (Watanabe (2010: 7))). The modifiers in (13) also have PP-like interpretations and occur only prenominally (e.g. season {before Easter/*that is pre-Easter}). The parallelism between (13a) and (13b) shows that the prefixes in (13a) are suppletive bound forms of RNs in lexical prepositions; those in (13b) are their regular bound forms.

In summary, the alternation between non-projecting premodifiers and phrasal postmodifiers in (4)–(6) and (10)–(13) is the one between direct and indirect modification. This view accounts for the occurrence of morphologically complex attributive-only adjectives with regular phrasal semantics. The following table summarizes the distribution of modifiers of various syntactic sizes:17

Table 1. English modifier types and their distribution

| Types                  | Predicative-only | Predicative/Attributive | Attributive-only |
|------------------------|------------------|-------------------------|------------------|
|                         | I-i              | I-ii                    | II-i             | II-ii | III-i | III-ii |
| Indirect modifier      | XP               | A⁰                      | AP/VP/PP         | A⁰    |       |       |
| Direct modifier        |                  | A⁰ of complex form       |                  |
| Modifier in compound   |                  |                         |                  |

As the default pattern, English non-projecting adjectives (A⁰) can be used both predicatively and attributively, as shown in (II-ii), but there also exist predicative-only ones (I-ii) and attributive-only ones (III-i), as mentioned in section 1. Phrases (XP) cannot be used as prenominal modifiers (I-i), while the first element of a compound noun (X) can function as a modifier (III-ii). Morphologically, non-projecting adjectives in (I-ii), (II-ii), and (III-i) and compound elements in (III-ii) can be simplex (e.g. present ‘being in the place’ in (I-ii), nice in (II-ii), late ‘dead’ in (III-i), red wine/key word in (III-ii)), derived (e.g. asleep in (I-ii), boyish/criminal ‘wrong’ /friendly/ prehistoric ‘very old’ in (II-ii), alleged in (III-i), southernwood in (III-ii)), or compounded (e.g. good-looking in (II-ii)). What we have identified is the existence of the type (II-i), where AP/VP/PP postmodifiers alternate with

17 The EL reviewers’ comments and questions were particularly helpful in improving my analysis on this issue, which is presented in this paragraph and the last two paragraphs of section 4.
morphologically complex nonprojecting premodifiers (e.g. ten-year-old, degree-conferring, criminal ‘of a crime,’ postadverbial, prehistoric ‘of prehistory’). A full discussion of the intricate relationships between premodifiers in (II-i), (II-ii) and (III-ii) needs a separate paper (see, for example, Beard (1993, 1995: 187–191, ch. 9), Nikolaeva and Spencer (n.d.), and the papers in Word Structure 2:2 (2009)), but at least it seems safe to say that the type (II-i) can lexicalize into the types (II-ii) and (III-ii), as indicated by the arrows (see section 4 for details). Thus, complex premodifiers in (II-ii) and (III-ii) have two sources, synchronic word-formation and diachronic lexicalization from the type (II-i).

### 3.3. Morphosyntactic Representation and Morphophonological Realization

#### 3.3.1. Morphosyntactic Representation

This section discusses how to derive direct modifiers in (1a, b). Under the two hypotheses discussed in section 1, LMBM allows for the possibility that the same structural representation, which is called base structure (Beard (1995: ch. 14)), is phonologically realized either in a phrasal unit (by free grammatical morphemes) or in a lexical unit (by bound grammatical morphemes). This possibility is developed by Ackema and Neeleman (2004: ch. 3) as a theory of competition between phrasal syntax and word syntax, according to which a phrase and a word that represent an identical syntactico-semantic relation compete with each other. A phrasal realization is preferred in languages that aim to minimize morphological complexity (e.g. English, French), whereas a lexical realization is chosen in languages that aim to minimize syntactic complexity (e.g. polysynthetic languages). For example, Ackema and Neeleman claim that the compound verb to truck-drive is blocked by the VP to drive trucks except in a certain morphosyntactic context (e.g. truck driver). Then, in the case at hand, we could say that PPs compete with and block derived adjective forms, which, however, take precedence in a context that requires a lexical realization, i.e. direct modification.

We observed that PPs are realizations of syntactic structures such as (7a) [pp [p at [dp the table]]] and (7b) [pp [p AT [dp UNDER [dp the table]]]]. Lexical realization of parallel structures is made possible by two strategies: conflation and incorporation (see Baker (2003: sec. 2.9, 167–169) for the distinction). First, suppose that word syntax projects structures like (14a, b) as parallels to (7a, b), respectively:

\[(14)\]

\[
\begin{align*}
\text{a. } & [P \text{ Comp } N] & \quad & \text{a’. } [N_i+ P \text{ } [t_i]] \\
\text{b. } & [P \text{ Comp RN } [\text{Comp } N]] & \quad & \text{b’. } [[RN-N]_{i+} P \text{ } [t_i]]
\end{align*}
\]
Because a complement can be conflated into its head (Hale and Keyser (1993)), N in (14a) and the compound of RN and N in (14b) can be conflated into P, resulting in structures like (14a’, b’). We view the merger of RN and N in (14b) as compounding rather than conflation because they are both lexemes. (The following discussion does not hinge on this point, though; conflation could give rise to (14b’), especially if we follow Terzi (2010: sec. 4) on the articulated structure of a composite PP.) The structure derived by conflation has only one X^0 node (Baker (2003: 168)); [N+P] and [[RN-N]+P] in (14a’, b’) constitute A^0 nodes because the head P is a category-shifting functional category.

Another potential strategy for A^0-form realization is incorporation in PP realizations. Applying noun incorporation to PPs in (7a, b) would give rise to the following structures:

(15)  a. [PP [P at-tablei [DP t_i]]]
     b. *[PP [P under-tablei [DP t_j [DP t_i]]]]

The incorporation in composite PPs as depicted in (15b) is, however, ruled out by an independent syntactic reason, Head Movement Constraint (Baker (2003: 49)); the head of the deeply embedded DP has to skip over the intervening DP to incorporate into P. On the other hand, the incorporation in simple PPs as depicted in (15a) is syntactically legitimate, yet the resulting A^0 head (e.g. at-table) is not fit for direct modification in English, where direct modifiers always occur prenominally with a head-final structure (section 2.1). Section 3.4 will show that direct modifiers of the type (15a) are attested in Romance languages, where direct modifiers can occur post-nominally (see (3b)).

3.3.2. Paradigm-Based Mapping

English, then, has to use the conflated structures in (14a’, b’) in the context of direct modification. The next question is how to map these structures to phonological realizations. According to Aronoff (1994: ch. 1), this mapping or “the complex process by which abstract morphosyntactic representations are realized morphophonologically” (p. 9) is the primary concern of morphology. LMBM can address this issue also, by using the concept of the paradigm as “a means of mapping one linguistic level, that of grammatical functions, to another, the phonological (P-)level” (Beard (1995: 254)).

Let us start with the representation in (14a’), [N+P]. P comprises conceptual subtypes such as P_{Relation} (syntactically realized by of in English), P_{Possession} (with), and P_{Direction} (to) (see Beard (1995: 391–395) for a list of the subtypes). As the separation hypothesis predicts, morphophonological
means for realizing [N+P] are diverse; for example, [NOUN+ PRelation] is realized by processes such as:

(16) a. suffixation
   [CELL+ PRelation]: cellular (10b), [TOOTH+ PRelation]: dental (10c)
   b. conversion
   [STEEL+ PRelation]: steel (12a), [NEW ZEALAND+ PRelation]: New Zealand (12b)
   c. deletion
   [LINGUISTICS+ PRelation]: linguistic, [ECONOMICS+ PRelation]: economic

Suffixes corresponding to PRelation are also diverse, as indicated by the following non-exhaustive list:

(17) a. -al: additional, regimental, pastoral
    b. -ar: lunar, molecular, nuclear, polar
    c. -ary: budgetary, cautionary, dietary
    d. -en: earthen, wooden, woolen
    e. -ic: anemic, atomic, genetic, parasitic
    f. -ical: biological, electrical, theatrical
    g. -istic: autistic, cannibalistic, euphemistic
    h. -an/-ian: Belgian, Saharan, Freudian
    i. -ese: Chinese, Maltese, Viennese
    j. -ish: Danish, Polish, Scottish

Conversely, many of these formal means are used for realizing representations other than [NOUN+ PRelation]; thus, -al is used for [VERB+ Nominalization] in arrival and refusal. [NOUN+ Possession] is realized by -ed (e.g. (10d)) or -y (e.g. thorny (branch), yeasty (bread) (Hamawand (2007: 72))), but -ed also realizes past, perfect, and passive verbal forms, as in (be/have) knocked (Aronoff (1994: sec. 1.5)).

Such many-to-many mapping constitutes a challenge for both lexeme-based and morpheme-based morphological theories (see Aronoff (1994: sec. 1.2) and Spencer (2004) for the distinction), but the former type of theory, including LMBM, can capture one generalization that the latter type cannot: N in [N+P] determines how [N+P] is realized. For example, Latinate nouns ending in (sometimes non-morphemic) ion, ment, or or choose -al realizations for [NOUN+ PRelation] (Plag (1999: 87–88), Huddleston and Pullum (2002: 1708)), as in (17a), whereas certain Latinate nouns employ

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18 See also Plag’s (1999) substantial arguments for a “base-driven” approach to affixation.
a suppletive stem for the realization, as in *dental* in (16a) and *lunar* in (17b). Proper nouns, whether Latinate or not, use -an/-ian, -ese, -ish (17h–j), conversion ((12b) *Tiffany, New Zealand*), or other suffixes (Huddleston and Pullum (2002: 1691–1696)). A few Germanic nouns have -en realizations, as in (17d). The nouns that do not have any specification for the [NOUN+ P] realization opt for conversion, as in (12) (Bauer (1997: 253)).

Stump (2001: sec. 8.2.2) argues that a lexeme projects inflectional and derivational paradigms, the latter consisting of cells defined by syntacticosemantic categories such as Personal Noun and Privative Adjective. According to this view, a noun’s derivational paradigm includes cells for Relational Adjective ([NOUN+ P_{Relation}]) and Possessional Adjective ([NOUN+ P_{Possession}]) (Beard (1995: 187–191), Nikolaeva and Spencer (n.d.)); thus, it is possible to specify realization forms lexeme-by-lexeme except for the default conversion cases. Moreover, because paradigms are organized by deductive logic (Beard (1995: sec. 11.2), Stump (2001: ch. 1), Spencer (2004: sec. 4.3)), this approach can capture subregularities in the mapping as paradigm-based rules.

Empirical support for the paradigm-based approach for the realization of [N+P] comes from cases in which (i) N is a toponym, personal name, or belief/ideology name, and (ii) N is a complex noun. The first case presents a clear example of cross-referencing within the nominal derivational paradigm, which can be dealt with by rules of referral (Stump (2001: 36–37), Haspelmath (2002: sec. 7.6.4)) in the paradigm-based approach:

Table 2. Partial paradigms of toponyms, personal names, and belief names

| Noun | Person Related to Noun | Relational Adjective ‘Related to Place’ |
|------|------------------------|----------------------------------------|
| (I) Place | Inhabitant | | |
| a. Belgium | Belgian | Belgian ‘of/from Belgium’ |
| b. China | Chinese | Chinese ‘of/from China’ |
| c. Iraq | Iraqi, Iraqi | Iraqi, Iraqi |
| d. Greece | Greek | Greek |
| e. Denmark | Dane | Danish |

| (II) Person | Belief | Believer/Follower | Adjective ‘Related to Person/Belief’ |
|-------------|--------|-------------------|--------------------------------------|
| a. Chomsky | | Chomskian | Chomskian (linguistics) |
| Aronoff | | Aronovian | Aronovian (word-formation rules) |
| b. Marx | Marxism | Marxist/Marxian | Marxist/Marxian (beliefs) |
| Buddha | Buddhism | Buddhist | Buddhist, Buddhistic, Buddistical |
| c. minimalist | minimalist | | minimalist, minimalistic |
| lexicalism | lexicalist | | lexicalist, lexicalistic |
| atheism | atheist | | atheist, atheistic, atheistical |
| sexism | sexist | | sexist (jokes) |
| cf. language | linguistics | | linguistic ‘of language/linguistics’ |
Toponymic adjectives are representative direct modifiers (Alexiadou and Wilder’s (1998) “ethnic adjectives,” Cinque’s (2010a) “adjectives of provenance/nationality”). The paradigm-based nature of their realization is indicated by the data in (I), which show that they are derived not from semantically (most logically) related toponyms but from paradigmatically related inhabitant names. Inhabitants and adjectives in (Ia–d) are formally identical, but the direction of dependency is clear from the affixation pattern in (Ie); the semantic base of Danish (in e.g. Danish history/economy) is Denmark, but its formal base is Dane.\(^{19,20}\)

Similarly, the data in (II) show that relational adjectives from personal names and belief names refer to believer/follower names. The believer cell uses an -(i)an form in the paradigm of the personal name, as in (IIa), and an -ist form in the paradigm of the belief name, as in (IIC). The relational adjective cell of each paradigm inherits these forms, either directly, without any formal modification, or with an additional suffix (-ic, -ical) attached. When a personal name has a corresponding belief noun, as in (IIb), the believer cell has two distinct forms, -ian and -ist; and so does the relational adjective cell. Significantly, the relation between the believer and relational-adjective cells is purely formal (or “morphemic” according to Aronoff (1994)); relational adjectives in (II) semantically depend on the person or belief cell. Thus, Aronovian word-formation rules are word-formation rules proposed by Aronoff rather than by his followers (or Aronovians), and the strongest minimalist theory (Rubin (2003: 664)) is a theory embodying minimalism most strictly.\(^{21}\) The paradigm-based approach can capture the purely formal connection by using rules of referral, to the effect that the relational adjective cell is filled with a form identical to or based on the form of the believer cell.

Next, let us consider the realization of the representation [N+P] in which N is a complex noun, i.e. [(X-\(N_1\)]\(_N\) + P] (where X is a lexeme or grammatical morpheme). In this case, cross-referencing across nominal paradigms is necessary in that the realization of [(X-\(N_1\)]\(_N\) + P] depends on the realization

\(^{19}\) Dutch toponymic adjectives uniformly have the form [inhabitant N+suffix] (Booij (1997: sec. 4.3)).

\(^{20}\) In addition to the purely relational meaning, toponymic adjectives may have a meaning referring to inhabitants, in which case they are not necessarily attributive-only (cf. section 4).

\(^{21}\) As with relational adjectives in general, adjectives in (II) may allow predicative use once established and given a qualitative reading; e.g., This hypothesis is strongly minimalist. See section 4.
of \([N_1 + P]\); the relational adjective of \(X-N_1\) refers to that of \(N_1\):

(18)

\[
\begin{array}{ll}
\text{X-N lexeme: } [\text{[X-N]}+P_{\text{Relation}}\text{]} \text{ cell} & \text{N lexeme: } [\text{[N}+P_{\text{Relation}}\text{]} \text{ cell} \\
a. \text{METALANGUAGE: metalinguistic} & a'. \text{LANGUAGE: linguistic (Table2 (IIcf.))} \\
b. \text{SOCIOLINGUISTICS: sociolinguistic} & b'. \text{LINGUISTICS: linguistic (Table 2 (IIcf.))} \\
c. \text{MINIMALIST THEORY: minimalist theoretic} & c'. \text{THEORY: theoretic} \\
d. \text{NETWORK MORPHOLOGY: network morphological (analysis)} & d'. \text{MORPHOLOGY: morphological} \\
e. \text{STRONG LEXICALISM: strong lexicalist (view)} & e'. \text{LEXICALISM: lexicalist (Table 2 (IIc))} \\
f. \text{AUSTRALIAN ABORIGINE: Australian Aboriginal (English)} & f'. \text{ABORIGINE: aboriginal} \\
g. \text{EAST ASIA: East Asian (affairs)} & g'. \text{ASIA: Asian} \\
h. \text{SOFT STEEL: soft steel (wire)} & h'. \text{STEEL: steel (bridge) (16b)} \\
\end{array}
\]

The data in (18) instantiate the phenomenon called head-marking (Stump (2001: ch. 4, sec. 8.2.1), Stewart and Stump (2007: sec. 12.7.2)). Any formalization of this phenomenon “must refer to the realization of a paradigm’s cells independently of the particular morphological operations by which their realization is defined” (Stewart and Stump (2007: 408)); in (18), an identical inter-paradigmatic dependency holds between the relational adjective cells whether their realization uses suppletion (18a), deletion (18b), affixation (18c–g), or conversion (18h). See Spencer (1991: ch. 10) for a thorough discussion of the difficulty of morpheme-based approaches to this phenomenon.

We have observed two pieces of evidence for the paradigm-based realization of the representation \([N+P]\) in (14a'). Because the morphosyntactic representation in (14b'), \([\text{[RN-N]}+P]\), is a type of \([\text{[X-N]}+P]\), the present approach predicts that its realization exhibits the same inter-paradigmatic dependency as we saw in (18). The following data speaks for this prediction:

(19)

\[
\begin{array}{ll}
\text{RN-N lexeme: } [\text{[RN-N]}+P_{\text{Relation}}\text{]} \text{ cell} & \text{N lexeme: } [\text{[N}+P_{\text{Relation}}\text{]} \text{ cell} \\
a. \text{ACROSS-LANGUAGE: cross-linguistic (issue)} & a'. \text{LANGUAGE: linguistic (18a')} \\
b. \text{OUTSIDE-LANGUAGE: extra-linguistic (issue)} & \\
c. \text{FRONT-ADVERB: pre-adverbia}l (11a) & b'. \text{ADVERB: adverbia}l \\
d. \text{BEFORE-CANCER: pre-cancerous (symptom)} & c'. \text{CANCER: cancerous} \\
e. \text{AFTER-NOUN: postnominal (11b)} & d'. \text{NOUN: nominal} \\
f. \text{BETWEEN-ORGANISM: inter-organisma}l (11c) & e'. \text{ORGANISM: organisma}l \\
g. \text{BELOW-SAHARA: sub-Sahara}n (11d) & f'. \text{SAHARA: Sahara}n (17h) \\
\end{array}
\]
Lexical prepositions have a lexemic component RN (section 3.1), which in word syntax first undergoes compounding with its complement N and then conflates into P, as in (14b/b'). (19) shows not only the paradigm-based realization of the N and P_{Relation} of \([\text{RN-N}]+P_{Relation}\) but also the free-bound stem allomorphy of RN; in (19a–k), the underlined RN is realized with a suppletive bound stem, while in (19l–n), it takes a regular bound stem. The double-lined bound stems of RN are among the spatio-temporal prefixes, one of the three prefix classes with lexeme status (section 3.1). Prepositions and prefixes show the parallel lexical/grammatical dichotomy because lexical prepositions and spatio-temporal prefixes constitute free and bound stems of the same RN lexemes.

A stem is a sound form that a lexeme takes when a morphosyntactic representation it forms is realized morphophonologically (Aronoff (1994: 29–41), Beard (1995: 48)); in Aronoff’s (1994: 39) words, it is “the phonological domain of a realization rule: that sound form to which a given affix is attached or upon which a given nonaffixational realization rule operates.” Therefore, a lexeme may have more than one stem. For example, certain nouns (e.g. WIFE) exhibit distinct free and bound stems in Number inflection (e.g. wife, wive-); additionally, non-native lexemes often show different free and bound stems in word-formation processes (Booij (2010: 250–252)) (e.g. DRAMA in drama-less, drama-performer, dramatic, dramatize).

Our analysis is that RNs also have free and bound stems, which are formally identical in some cases (e.g. OFF: off and off-) but are suppletively related in other cases (e.g. OUTSIDE: outside and extra-).\(^{22}\) This analysis is strongly supported by the fact, noted in section 3.1, that most of the spatio-temporal prefixes (and evaluative and quantitative prefixes also) were borrowed from Romance languages. Traditionally, language contact

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\(^{22}\) A similar analysis is applicable to combining forms (e.g. socio- in (18b)) (Amiot and Dal (2007)).
has been considered to provide the primary ground for the emergence of suppletion (Dressler (1985), Mel’čuk (2000)) because it causes the contact of synonyms. Thus, Maiden (2004) argues that the genesis of suppletion is largely driven by the principle of synonomy avoidance; when native speakers perceive lexical synonymy, as in the case of borrowing, synonyms coalesce into a suppletive relation, i.e. into stems of one lexeme, so that they are given distinct intraparadigmatic meanings. Then, it is possible that borrowed spatio-temporal elements have been integrated into the paradigms of pre-existing synonyms, location-denoting RNs of lexical prepositions, as their bound stems, which must have originally (i.e. in the pre-borrowing stage) been formally identical to their free stems. As predicted from this analysis, a polysemous RN has acquired more than one suppletive bound stem (e.g. (19a, g)), whereas RNs sharing a meaning have acquired the same bound stem (e.g. (19b, c)). The fact that a few RNs (BETWEEN and AFTER, in particular) have both regular and suppletive bound stems (e.g. (19e, n)) may be attributed to the gradual nature of the diachronic emergence of suppletion.

Lastly, a brief comment is in order on the RN-N lexemes in (19). Although they are not existing words, the possibility of this type of compounding is confirmed by the fact that the spatio-temporal prefixes yield right-headed nouns such as premodifier, post-genitive, and interlanguage.

3.3.3. Nature of Derivational Paradigms

This section aims to confirm our paradigm-based approach to the mapping of [N+P] by showing that it exhibits at least two of the general properties of derivational paradigms (see van Marle (1985), Bauer (1997), Booij (1997), Stump (2001: sec. 8.2.2), Rainer (2012), among others). The first one is that the more transpositional a derivational process is, the more profitably the notion of paradigm can be employed for its mapping aspect (Bauer (1997: sec. 4.2)). The derivation of a [N+P] form is purely transpositional because P, a category-shifting functional category, adds no semantic substance to N.

Secondly, it has been generally recognized since Aronoff (1976) that derivational paradigms do not necessarily follow the elsewhere condition in that the application of the default realization pattern is not blocked by

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23 I am grateful to the EL reviewers for the data and questions which prompted me to add this section.
a less general pattern or a listed form. Thus, -ness suffixation is the default pattern in the A-to-N derivation, but it is not necessarily blocked by -ity suffixation or listed forms (e.g. grammatical/grammaticalness, glory/gloriousness). In the N-to-V derivation, the default conversion can apply even to nouns that are within the application domains of -ize/-ify/-ate suffixation (Plag (1999: chs. 6 and 7)); for example, the location/locatum/goal-verb cells of iambic or monosyllabic Latinate nouns are realized by -ify, but this does not block the use of conversion for the same cells (e.g. tubify/to tube, zincify/to zinc). The same applies to the V-to-N derivation, where the default of action noun realization is -ing suffixation and that of agent noun realization is -er suffixation (e.g. her careful {arrangement/arranging} of the flowers, applicant/applier (Shimamura (1990: 41, 85)).

The default pattern for the realization of [N+P] is conversion (16b); realizations by various suffixes (17) or by deletion (16c) are either captured by less general, domain-specific rules (e.g. (17a) -al suffixation to -ion/-ment/-or nouns, (17g) -ic suffixation to -ist nouns) or listed in the relational adjective cell of the base noun. As predicated, the realization of [N+P_{Relation}] allows the use of conversion for those cells with specifications, producing doublets such as golden/gold medal, wooden/wood furniture, southern/south island, and atomic/atom/nuclear bomb. See also the relational adjective cells in Table 2 (IIb, c), where the default pattern of conversion is used in the face of the domain-specific -ic/-al rules. One might want to know what factors, if any, determine the exact distribution of the default realization pattern or the choice between doublets in the same cell (cf. Stump (2001: 256)). We do not go into these questions because they are more fruitfully addressed in psycholinguistic studies, where one can develop the discussion based on notions such as the relationship between frequency and productivity and the relationship between rule-based production and memory storage. What is more significant for us is the fact that synonyms in the same relational adjective cell always involve one member by conversion; there seems to be no doublet whose members are all suffixed with distinct suffixes. This fact clearly shows that the realization of [N+P] is governed by a derivational paradigm, where the most general pattern is exempt from competition.

3.4. Direct Modification in Romance Languages

We have seen that English uses conflation (14) to accommodate PP structures to direct modification. An incorporated structure such as (15a) is unavailable because its head-first structure conflicts with the head-finalness of
prenominal direct modification (see section 2.1). As we observed in (3a), direct modifiers in English and other Germanic languages occur only prenominally.

In Romance languages, on the other hand, direct modifiers occur not only prenominally but also postnominally, as in (3b). Therefore, these languages can use not only conflation but also incorporation in P-related direct modification; the italicized derived adjectives in (20) and (21) below are realizations of the conflated structures of the types (14a′, b′), respectively, but there are also incorporated direct modifiers such as (22), which correspond to the representation in (15a).

(20)  

a. French: tuberculose ossee ‘bone tuberculosis’ (cf. ?*sa tuberculose est ossee ‘his tuberculosis is (a) bone tuberculosis’), palais présidentiel ‘presidential palace,’ carte routière ‘road map,’ autorités villageoises ‘authorities ruling villages’ (Fradin (2008: 2–7)), la morphologie lexémétique classique ‘classic lexeme-based morphology’ (Fradin (2003: 79)), les critères structuraux valides ‘the valid structural criteria’ (Fradin (2003: 16))

b. Italian: un vaso cinese ‘a Chinese vase,’ un ingegnere elettronico ‘an electrical engineer’ (Cinque (2010a: 71–72)), scatola cranica ‘cranial box,’ sforzo muscolare ‘muscle effort,’ cellula nervosa ‘nerve cell,’ scienza atomica ‘atomic science’ (Bisetto (2010: 65–68, 82))

c. Spanish: una zona industrial ‘an industrial zone,’ una revista americana ‘a journal of things related to America,’ el agua mineral ‘the mineral water,’ tren eléctrico ‘electric train,’ central eléctrica ‘power plant’ (Ticio (2010: sec. 4.2))

(21)  

a. French: les lacs sous-glacaires ‘the lakes located under the glaciers,’ une vigne préphylloxérique ‘a vineyard that existed before the epidemic of phylloxera,’ Association Transfrontalière de Protection des Chauves Souris ‘cross-border association for bat protection’ (Fradin (2008: 10–11)), les moyens extragrammaticaux ‘the extragrammatical methods’ (Fradin (2003: 206)), organization intergouvernementale ‘intergovernmental organization’ (Shogakukan Robert Grand Dictionnaire Français-Japonais)

b. Italian: la ginnastica post-parto ‘post-partum gymnastics,’ questo rimedio anti-zanzare ‘this anti-mosquito product,’ un’azione anti-Opec ‘an anti-Opec action,’ Russia post-Urss
post-USSR Russia,’ il prodotto antirughe ‘an anti-wrinkle product’ (Montermeni (2006))
c. Spanish: escudo antimisil ‘anti-missile shield,’ crema antiarugas ‘anti-wrinkle cream,’ chalecos antibalas ‘bullet-proof vest,’ interclubes ‘among clubs,’ carrera contrareloj ‘timed race,’ político sinvergüenza ‘shameless politician’ (Kornfeld (2009: 440–450))

(22) a. French: heure de pointe ‘rush hour,’ course de côte ‘hill climb,’ fil de fer ‘iron wire,’ avion à réaction ‘jet plane,’ moulin à vent ‘windmill,’ brosse à dents ‘toothbrush’ (Fradin (2003: 199)), serpent à sonnettes ‘rattlesnake,’ chambre d’hôtes ‘guest room’ (Fradin (2009: 419))
b. Italian: casa di cura ‘nursing home,’ camera a gas ‘gas chamber,’ ferro da stiro ‘iron,’ carta di credito ‘credit card,’ abito da sera ‘evening dress,’ barca a vela ‘sailing boat,’ orologio da polso ‘wristwatch,’ elaboratore di testi ‘word processor’ (Masini (2009: sec. 3))
c. Spanish: barco de vapor ‘steamboat,’ bicicleta de montaña ‘mountain bike,’ botas de lluvia ‘rubber boots,’ caja de música ‘music box,’ casa de campo ‘country house,’ diente de leche ‘milk tooth,’ torre de marfil ‘ivory tower’ (Kornfeld (2009: 442))

The N+preposition+N constructions in (22), a widely discussed syntax-morphology interface problem, can be seen as direct modification with a direct modifier of the type (15a); the italicized modifiers in (22) are formed from corresponding PPs by incorporating the head noun of their complement into the governing preposition. First, the italicized modifiers in (22), like those in (20) and (21), cannot be used predicatively, having a non-intersective semantic relation to the head noun. Second, the constructions in (22) as a whole, however, are not compounds but phrases (Rainer and Varela (1992: 120), Booij (2010: 173), Moyna (2011: sec. 1.5.4)), as is evidenced by their very high productivity (Kornfeld (2009: 443), Masini (2009: 258), Booij (2010: 172)) and their lack of lexical integrity (e.g. diente de leche from (22c) > dientes permanentes y de leche ‘lit. teeth permanent and of milk, permanent and milk teeth’ (Kornfeld (2009: 447))).

According to Moyna (2011: 40–41), Italian-speaking aphasics make mistakes in preposition selection in the N+preposition+N construction at rates comparable to errors...
the modifiers exhibit many of the defining characteristics of incorporating patterns (Dahl (2004: ch. 10): i) they cannot be expanded by adding a modifier to the incorporated element, ii) they denote unitary concepts, or stereotypical or permanent properties, and iii) the incorporated element may be wholly or partially deprived of the morphological marking that would be expected in similar syntactic constructions. Thus, unlike the complement of a PP, the post-prepositional nouns in (22) lack Number inflection and determiner (Masini (2009: 260)), though a few instances in (22a) retain the former. Fourth, the prepositions in (22) are functional prepositions; de (French and Spanish)/di (Italian) ‘of’ and a (Spanish, Italian)/à (French) ‘to’ are representative Romance functional prepositions (Kornfeld (2009: 442, fn. 7), Aboh (2010: sec. 4), Noonan (2010), Moyna (2011: sec. 1.2.4.1); for the Italian da ‘from,’ see Cinque (2010b: sec. 1)). As discussed in section 3.1, incorporation from composite PPs as in (15b) is impossible for a grammatical reason.

Derived adjectives in (20) and (21) are Romance equivalents of English derived adjectives (1a, b), direct modifiers by conflation. Because Romance languages have overt adjectival agreement (both in attributive and predicative contexts), their data provide a clearer piece of evidence for the agreement condition governing the formal alternation between direct and indirect modification; the suffixes realizing P cumulatively express agreement information. Thus, osseuse, présidentiel, and intergouvernementale in (20a, 21a) alternate with osseux/osseuses, présidentielle, présidentiel, présidentielles, and intergouvernemental/intergouvernementaux, respectively, depending on the gender and number of the modified noun. The underlined suffixes cannot be consistently divided into P marking and agreement marking; it seems more appropriate to state that P suffixes function also as agreement suffixes. This morphological cumulation is a logical one if P is realized by a suffixal form to satisfy the agreement condition of direct modification.

with non-lexicalized phrases. She argues that this is because the construction is formed syntactically each time.

25 On the other hand, composite but not simple PPs allow NP forms such as Under the elm is a nice place for a picnic and I prefer under the elm (Baker (2003: 305, fn. 1)). In Baker’s view, these NPs arise when the RN UNDER fails to conflate with P in (7b).

26 Several studies on Germanic languages with overt adjectival agreement (Bauer (2009: 403–404), Don (2009: 374), Neef (2009: 388), Booij (2010: 176)) independently make the same, apparently puzzling generalization that derived adjectives do not form A+N compounds. This makes sense if, as we are claiming, derived adjectives are forms for direct modification and as such exhibit adjectival agreement morphology. In fact,
Due to the borrowing from Greek and Latin, Romance languages also have prefixes as suppletive stems of RNs (e.g. \textit{anti-}, \textit{post-} in (21)), but many of their spatio-temporal prefixes (e.g. \textit{contre-}, \textit{sous-}, \textit{sur-} in French) are formally identical to lexical prepositions (Amiot (2005), Kornfeld (2009: 447–451), Moyna (2011: 25–26)); many of their RNs have formally identical free and bound stems.\footnote{According to Kornfeld (2009: 440), composite PPs in Spanish have a corresponding “P+N compound,” and both forms show a similar adjectival distribution, as in (a) \textit{político [\textit{pp sin} [vergüenza]]} ‘politician without shame’ and (b) \textit{político sinvergüenza} ‘shameless politician’ (=\textit{(21c)}). In our terms, the PP in (a) is an indirect modifier in which the free stem of the RN is used, whereas the P+N compound in (b) is a direct modifier realizing the RN with its bound stem.} The paradigmatic pressure from this may be one reason why some Romance suppletive prefixes allow a prepositional use in which they introduce phrasal complements (e.g. Italian: \textit{[marcia [anti [moschea di Lodi]]]} ‘anti Lodi mosque demonstration’; [\textit{periodo [post [caduta del muro di Berlino]]}] ‘post Berlin wall fall period’ (Montermini (2006: 142))).

In summary, in Romance languages, indirect modifier PPs formally alternate with derived adjectives or incorporated P-N forms in direct modification. They both occur postnominally and are in a paradigmatic relation to each other as distinct realizations of the same grammatical function (cf. the morphological and periphrastic realizations of the comparative function in English).\footnote{We do not go into the issue of what system, if any, governs the choice between the two realizations. Rainer (2012) suggests that it is lexically determined by the modified noun.}

4. Direct Modification and Attributive Compounding: Diachronic Relation

Section 3 has shown that indirect and direct modifiers alternate synchronically, and this relationship is similar to inflection, contextual inflection in particular (Booij (2002: 19–20)), in that it is forced by syntactic contexts. This section argues that direct modification and attributive compounding are in a diachronic relationship in such a way that the former feeds the latter through lexicalization.

Baker (2003: 271–275) claims that direct modification can be clearly distinguished from morphological compounding by criteria such as stress pat-
terns and agreement morphology. However, compared to indirect modification, direct modification has a structure and semantics that are much closer to word-level concatenation; structural smallness and nonintersective semantics are reminiscent of compounding. Such synchronic affinity can lead to the higher susceptibility of direct modification to the diachronic process of lexicalization where phrases become words and complex words become simplex words (Brinton and Traugott (2005: 96), Trousdale (2008)). If this is correct, the gradual nature of diachronic lexicalization predicts that there must be a grey or transitional area between direct modification and its lexicalized counterpart. We will show that this prediction is empirically correct; instances of direct modification can become close to compounds, but this alternation is gradual.

The first evidence for the prediction comes from the fact that attribute-head combinations (e.g. short story, origami bird) and complement-head combinations (e.g. watch maker) behave differently with respect to a set of criteria of lexical integrity (see Bauer (1998: sec. 2), Lieber and Scalise (2006), Kageyama (2009: sec. 28.2), Haspelmath (2011)). Whereas the latter uniformly behave as words across the criteria, the former exhibit conflicting behaviors in and between their tokens: some behave as words, others behave as phrases, and yet others show mixed behaviors with respect to the word-phrase distinction.\textsuperscript{29} For example, Giegerich (2004) shows that whereas complement-head combinations always exhibit fore-stress, attribute-head combinations exhibit end-stress as the norm but may also exhibit fore-stress.\textsuperscript{30} Bauer (1998) and Giegerich (2009) further show that phonological, semantic, and syntactic criteria yield conflicting results for the word-phrase distinction of attribute-head combinations. Thus, the bracketed constituents in [small car] driver and [fresh fish] shop are phrase-like in their stress and semantics but are word-like in being embedded in compounds (Shimamura (2007)). As Giegerich claims, the clear contrast between complement-head and attribute-head combinations can be explained if the former are formed by compounding and the latter are formed by syntactic attributive modification, the output of which may undergo lexicalization.

Facts about agreement morphology also speak for the gradual working of lexicalization. According to Booij (2002: sec. 2.3, 2010: ch. 7) and

\textsuperscript{29} Schäfer (2009) shows the same for three types of A-N combinations in Mandarin Chinese.

\textsuperscript{30} Liberman and Sproat (1992) and Olsen (2001: sec. 4.4) also show that noun-noun combinations deviate from fore-stress when they are not of complement-head type.
Hüning (2010), in Dutch, some adjective-noun combinations with the adjectival agreement -e (e.g. *mobiele telefoon ‘mobile phone,’ *volle maan ‘full moon,’ *zure regen ‘acid rain’) exhibit phrasal stress (end-stress) but semantically function as names rather than descriptions and undergo further word-formation (e.g. *volle-maans-gezicht ‘lit. full moon face, moonface,’ *zwarte-band-er ‘lit. black belt-er, judoka with a black belt’). The agreeing adjectives in such instances do not allow modification by a degree adverb (e.g. *erg rode kool ‘very red cabbage’) nor can they be followed by another (agreeing) adjective (e.g. *vieze rode kool ‘filthy red cabbage’ vs. *rode vieze kool). Other name-like adjective-noun combinations show the optionality of the adjectival agreement -e (e.g. *het oudheidkundig(e) museum ‘the archaeological museum,’ *het koninklijk(e) paleis ‘the royal palace’), yet they always place the main stress on the noun. In yet other name-like combinations, the agreement -e is always absent (e.g. *een/de geheim agent ‘a/the secret agent,’ *een/de taalkundig onderzoeker ‘a/the linguistic investigator’), but the stress is on the noun. Baker (2003: 274) claims that the agreement suffix -os of the attributive adjective in Greek clearly distinguishes A+N phrases from A+N compounds, but Ralli and Stavrou (1998) show that certain adjective-noun combinations with -os (e.g. *ekdhotik-os ikos ‘publishing house,’ *psixr-os polemos ‘cold war,’ *trit-os kozmos ‘third world’) behave as words semantically and syntactically. When embedded in a larger word, these combinations take an uninflected, compound form (e.g. *psixr-o-polem-ikos ‘lit. cold-linking vowel-war-like, cold-war-like’ < *psixr-os polemos ‘cold war’).

The same analysis applies to the diachronic alternation between N₁+preposition+N₂ constructions (22) and left-headed N₁+N₂ compounds in Romance languages. Moyna (2011: sec. 1.5.4) notes that the former construction in Spanish can be a compound precursor, historically changing into the latter construction. Thus, tela de araña ‘lit. cloth spider, spider web’ evolved from tela de araña ‘lit. cloth of spider, spider web.’ Because the N+preposition+N construction is a type of direct modification (section 3.4), this historical change can also be viewed as lexicalization. Similar to the attribute-noun combinations in English, Dutch, and Greek discussed above, this construction also exhibits transitional behaviors, including the optionality of de, which is obligatory in cepillo *(de) dientes ‘lit. brush of teeth; toothbrush’ but optional in ducha (de) teléfono ‘lit. shower (of) telephone; hand shower’ (Moyna 2011: 41)).

The ambivalent status of attribute-head combinations has given birth to linguistic units intermediate between word and phrase, such as construct (Ralli and Stavrou (1998)), W⁺ (Shimamura (2007), Kageyama (2009: sec.
28.2.1.1), phrasal lexeme (Masini (2009)), and phrasal name (Booij (2010: ch. 7)). However, these units can be dispensed with only by acknowledging the susceptibility of direct modification to lexicalization. Undergoing this diachronic process, direct modifier-noun (or noun-direct modifier) combinations gradually acquire word-like properties, ultimately becoming indistinguishable from attributive compounds. This view accounts not only for the variously mixed behaviors of attribute-noun combinations, but for the fact that adjective-noun compounding itself is not so productive in languages with a good stock of adjective-noun words (Marchand (1969: 64) for English, Sohn (1999: 245–247) for Korean, Bauer (2009: 408) for Danish, Don (2009: 374) for Dutch).

We have discussed how direct modification alternates with attributive compounding diachronically. Given the summary of English modifier types in Table 1 (p. 124), this finding means that premodifiers of the type (II) can diachronically feed the type (III-ii). Let us suppose that the semantic ambiguity found in certain suffixed adjectives between relational and qualitative interpretations (e.g. *criminal of a crime*/*wrong,* *golden of gold*/*bright yellow; wonderful,* *prehistoric of prehistory*/*very old*) results from the type (II-i) lexicalizing into the type (II-ii). Then, we can assume the lexicalization process as indicated by the two arrows in Table 1.

Three caveats are in order. First, the arrows do not mean that all the relevant forms undergo lexicalization. As discussed in Shimamura (1990: ch. 4), forms by the default pattern are less likely to lexicalize than those by specific patterns (e.g. *golden vs. *gold* opportunity, *wooden vs. *wood* performance; see section 3.3.3). Second, the arrows do not mean that the lexicalizing form loses its original usage. Lastly, lexicalization is not the only source of morphologically complex qualitative adjectives in (II-ii) or attributive compounds in (III-ii). They can be produced by synchronic word-formation processes, also. Thus, similitudinal adjectives (e.g. *god-like, boyish*) (Nikolaeva and Spencer (n.d.: 33)) are synchronically produced members of the type (II-ii). Compare also *cellular structure* in (10b), *cellular phone*, and *cellphone*. *Cellular in cellular structure* belongs to (II-i), but the one in *cellular phone* is of the type (II-ii) or (III-ii); this ambiguity is due to lexicalization. *Cellphone*, on the other hand, suggests the working of synchronic N-N compounding.31

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31 Alternatively, *cellphone* could be viewed as a further lexicalized form of *cellular phone*, given that lexicalization can lead to phonological reduction (Brinton and Traugott...
5. Direct Modification and Phrasal Compounding

This section takes a look at Table 1 (p. 124) from the side of indirect modifiers. The type (I-i) shows that it is not the case that any phrasal modifiers can alternate with non-projecting premodifiers morphologically. According to our analysis, this is because it is not the case that any phrases can undergo incorporating patterns, which impose certain structural requirements on their inputs. Such a view, however, does not prevent phrasal modifiers unfit for incorporating patterns from turning into direct modifiers via a non-morphological path. So-called phrasal compounds attest to this possibility.

Modifiers found in phrasal compounds fall roughly into the lexicalized-phrase type (Shimamura (2003)) (23a) and the quotation type (Wiese (1996)) (23b):

(23) a. an off-the-shoulder dress, over-the-counter sales

(Beard (1995: 330–331))

b. a floor of a birdcage taste, God is dead theology (Lieber (1992: 11)), what do you think? movement, don’t tell me what to do look (Ackema and Neeleman (2004: 126))

So-called phrasal compounding is reminiscent of direct modification in several respects. First, it yields modifier-head combinations, not complement-head combinations; there is no synthetic phrasal compounding (Lieber and Scalise (2006: 12), Guevara and Scalise (2009: 111)). Second, despite its name, its output is not necessarily a compound (e.g. an off the wall sarcastic comment; a floor of a birdcage, salty taste (Shimamura (2003: sec. 2))). Third, its modifiers occur only prenominally (e.g. a taste that is *(like the) floor of a birdcage, theology *(that believes that) God is dead), except highly lexicalized PP modifiers (e.g., ?Her dress was very “off-the-shoulder” (Beard (1995: 331))).

Given the analysis of PP in section 3, it is not surprising that lexicalized PPs function as adjectives and participate in direct modification (and attributive compounding), as in (23a). These PP modifiers have an idiomatic meaning (Beard (1995: 331)). More interesting are phrasal modifiers in (23b), whose lexicalized status is doubtful (Ackema and Neeleman (2004: 126)). If they are also a type of direct modifier, we must admit the possibility of a process other than incorporating patterns that synchronically (2005: 110), Trousdale (2008)).
changes phrases into X⁰ units, such as Wiese’s (1996) quotation. Because quotation makes its input a metalinguistic object, quoted phrases are structurally opaque and semantically unitary; hence, they can act as direct modifiers. The adjectival category of the quoted modifier is indicated by the fact that it can occur with an overt adjectival suffix, as in a why-does-it-have-to-be-me-ish expression (Lieber and Scalise (2006: 15)). The quotation analysis is also consistent with the fact that this type of phrasal modifier prototypically occurs with nouns that semantically relate to human expression of feeling and thinking, and expresses a propositional content in a direct-speech form, never in an indirect-speech form (e.g. *that God is dead theology, *what you think movement, *why-it-has-to-be-me/him/her(-ish) look).³²

6. Concluding Remarks

This paper has discussed how morphology is employed to cope with the syntactic distinction between direct and indirect modification. Our discussion is summarized as follows. The syntactic conditions for direct modification, the agreement condition in particular, require direct modifiers to be non-projecting adjectives. This requirement becomes visible when indirect modifiers are of phrasal forms such as APs and PPs. Phrasal indirect modifiers alternate with direct modifiers of compounded, derived, or incorporated forms. Such non-projecting adjectives are similar to inflectional word-forms in their restricted occurrence in a specific syntactic position and compositional semantics. Apparent aberrances are due to the alternant non-projecting adjectives undergoing the diachronic process of lexicalization, which yields less compositional, qualitative duplicates.

LMBM’s theoretical hypotheses are indispensable in order to account for the existence of such inflection-like complex adjectives. Of particular importance are (a) the competitive relationship between syntax and morphology in which they work separately but in a parallel fashion and (b) the lexeme-based view of morphology. The former view accounts for those adjectives’ phrase-like semantics and their syntactic distribution complementary to phrases. The latter view captures the many-to-many mapping between

³² Quotation marks, hyphens, and intonation often function as a sort of formal marking of the quotation process. For hyphen use, the following contrast is also suggestive: an up-to-date linguistic bibliography (Escribano (2004: 5)) vs. This bibliography is {up to date/*up-to-date}. 
function and form, the head-marking-type realization of complex morpho-
syntactic representations, and the prefix-suffix distinction in the realization
of PP-based direct modifiers, functional prepositions alternating with suffixes
and lexical prepositions with prefixes.

The LMBM hypotheses also have the merit of enabling us to reassess
the discussion from a cross-linguistic viewpoint. As mentioned in sec-
tion 3.3.1, the parallel architecture view in (a) makes a crucial distinction
between morphology (M)-minimizing languages (e.g. English, French) and
syntax (S)-minimizing language (e.g. synthetic languages). The remainder
of this section is a brief sketch of how LMBM can deal with nominal modi-
fication in both of these language types.

In LMBM, the base structures for simple and composite PPs are repre-
sented roughly as follows:

\[(24)\]

a. [Primary Function [noun]]  (cf. (7a))

b. [Primary Function [Secondary Function [noun]]]  (cf. (7b))

LMBM divides grammatical functions into two types, purely grammatical
ones (Primary Functions; “F\textsubscript{P}” below) and “semi-lexical” ones, i.e. gram-
matical functions with a certain amount of lexical content (Secondary Func-
tions; “F\textsubscript{S}” below). Beard (1995: ch. 11) claims that F\textsubscript{P} in (24a, b) is real-
ized by an adposition or inflectional case marker, but we have found that
it can also be realized by a derivational adjectivizer (such as (16) and (17)
in English). He claims the same for F\textsubscript{S} in (24b), but we have found that
it can also be realized by a spatio-temporal prefix (e.g. (19)). The use of
adpositions minimizes morphology, while the use of case markers, adjectiv-
zers, and prefixes minimizes syntax. Then, the function-form mapping for
the base structures in (24) can be summarized as follows:

|             | FP                      | FS                      |
|-------------|-------------------------|-------------------------|
| M-minimizing forms | (i) functional adposition | (iv) lexical adposition |
| S-minimizing forms | (ii) case\textsubscript{F} marker, (iii) adjectivizer | (v) case\textsubscript{S} marker, (vi) spatio-temporal prefix |

What we have argued is that English, an M-minimizing language, realizes
(24) with the forms (i) and (iv) but in a S-minimizing context, it uses the
forms (iii) and (vi) instead.

If the mapping hypothesis in Table 3 is on the right track, it makes sev-
eral predictions about S-minimizing languages. First, they should choose
between the two options for realizing F\textsubscript{P} and F\textsubscript{S}, respectively. A case
of the complementary distribution between (ii) and (iii) is documented
by Nikolaeva and Spencer (n.d.: sec. 6.5) for the “adjectival representa-
tion of nouns” in Selkup, a Samoyedic (Uralic) language. According to
their descriptions, this construction is a realization of (24a) by the form (iii) and crucially, it forbids the base noun having a case marker of the type (ii), which is exceptional in this highly inflectional language. Table 3 predicts the same for the two morphological forms for Fₜ. Second, S-minimizing languages should realize (24b) with one of the following combinations (which ignore the linear order): (ii)+(v), (ii)+(vi), (iii)+(v), and (iii)+(vi). Instances of (ii)+(v) are of course provided by Beard (1995: 261–264) from Lezghian, but we also find potential instances of (iii)+(v) in Nikolaeva and Spencer (n.d.: 20–21) from Turkish and Akhvakh and Beard (1995: 287) from Basque and those of (iii)+(vi) in Beard (1995: 308) from Serbo-Croatian. As for the possibility of realizing (24b) by a combination of M-minimizing and S-minimizing forms, Beard (1995: 265–267) observes that Lezghian sometimes uses (ii)+(iv) instead of (ii)+(v).

Lastly, as the agreement condition predicts, morphological realizations of (24a, b) in S-minimizing languages agree with the nouns they modify. Nikolaeva and Spencer (n.d.: sec. 6.6) argue that cases in which a modifier seems to have two case markers of the type (ii), as does aqi-w-des in the following Awngi example, one of them, the outer ablative morpheme, should be seen as an agreement marker:

(25) wolijí-w-des aqi-w-des ṇọ̀ń-des
    old-GEN(M)-ABL man-GEN(M)-ABL house (M)-ABL
    ‘from the old man’s house’ (Nikolaeva and Spencer (n.d.: 45))

In this case, the Fₚ and agreement of a modifier are separately marked. When they are cumulatively expressed, we obtain examples such as (20a) tuberculose osseuse and (21a) les moyens extragrammaticaux (section 3.4). In addition, the ablative marker of wolijí-w-des in (25) shows that a modifier’s agreement can spread to its own dependent. We have possible analogues of this, too, in (4a) ten-year-old girl and (5a) British-based company. Section 2.2 attributed the form alternation of the underlined words to the agreement condition. Because they do not modify nouns themselves, their formal alternation could be viewed as an effect of agreement spreading from the modifier heads.

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