Attributive compounds

Anton Karl Ingason (University of Iceland)
Einar Freyr Sigurðsson (The Árni Magnússon Institute for Icelandic Studies)

Summary:
Attributive compounds are words that include two parts, a head and an non-head, both of which inlclude lexical roots, and in which the non-head is interpreted as a modifier of the head. The nature of this modification is sometimes described in terms of a covert relationship R. The nature of R has been the subject of much discussion in the literature, including proposals that a finite and limited number of interpretive options is available for R, as well as analyses in which R the interpretation of R is unrestricted and varies with context. The modification relationship between the parts of an attributive compounds also contrasts with the interpretation of compounds in other ways because some non-heads in compounds saturate argument positions of the head, others are semantically conjoined with them, and some restrict their domain of interpretation.

Keywords: attributive compounds, compounding, Contextual Domain Restriction, dissociated morphemes, Distributed Morphology, endocentricity, exocentricity, modification

1. Introduction

This chapter discusses the notion of an attributive compound, aiming to shed a light on what should be called an attributive compound and how the structure and meaning of such phenomena should be characterized in linguistic and psycholinguistic theories. Controversies surround even the most basic terminology that is used to describe compounds and their classification; hence, any commentary toward a precise analysis is likely to be incompatible with somebody's theoretical commitments.[1] However, let us begin our account by considering some examples of what we might want to refer to as a canonical attributive compound.

(1) a. tennis ball (attributive compound)
b. soda can (attributive compound)
c. bookcase (attributive compound)

A first description of the attributive compounds in (1) is that the second part is the head whereas the first part (the non-head) acts as some kind of a modifier, yielding an interpretation along the lines of 'a ball of the tennis type', 'a can of the soda type', or 'a case of the book type', respectively. The three compounds shown above are fairly typical for English attributive compounds: First, they are all endocentric — they have a "center", which is the head of the compound (Bloomfield 1933). The compound in each is a hyponym of the type; for example, a tennis ball is a type of a ball. Therefore, the head of the compound *tennis*

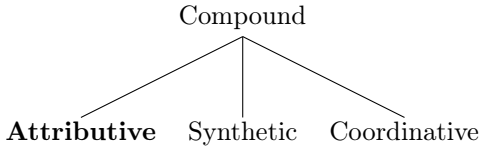
ball is *ball*. Second, the head is to the right: if tennis ball were a type of tennis, that would suggest an endocentric left-headed compound. We will for the most part focus on compounds like these, even though right-headedness is not universal and not all compounds are endocentric — some are exocentric. We briefly discuss these matters in Section 3.1.

Two roots have an interpretive effect and so does a covert relation between them, such as 'for' in something like 'ball for tennis'. This description, of course, needs to be elaborated, but let us first acknowledge that the characterization of attributive compounds is a theoretical classification task which most prominently involves drawing a useful and empirically meaningful contrast between attributive compounds and (at least) the other main types of compounds in natural language, synthetic compounds and coordinative compounds.

(2) a. meat eater (synthetic compound)
b. actor-director (coordinative compound)

Synthetic compounds manifest the type of argument-predicate relationship that is found in the syntax of verbs whereas coordinative compounds get a conjunctive interpretation. The need for the class 'attributive compound' arises because while attributive, synthetic, and coordinative compounds are at some level structurally similar, namely compounds, the semantic relationship between the head and the non-head is systematically different.

(3)



In Section 2 we develop a set of definitions that reflects this understanding of compounds; they are united by certain structural properties and differ systematically in the way in which they are interpreted. Thus, under our account, the empirical distinctions that motivate the classification in (3) are semantic and their formal correlates involve how their meaning is realized in the course of the LF-derivation. Drawing on previous work (Allen 1978; Levi 1978), attributive compounds are characterized by a covert relation R. In contrast, in a synthetic compound, the non-head root saturates an argument requirement associated with the head root whereas the roots of a coordinative compound are combined in the semantics by Predicate Conjunction (Heim and Kratzer 1998). In the Oxford Encyclopedia of Morphology, articles by Melloni (2020) and Ralli (2019) discuss synthetic and coordinative compounds, respectively. We examine attributive compounds and our approach to their status leads us to further investigate the nature of R.

An important distinction in the analysis of R involves the split between what Spencer (2011) refers to as (i) Lees's solution and (ii) Downing's solution. The former involves a finite (and relatively small) set of possibilities for R. For example, Levi (1978) proposes nine relations. In the latter type of analysis, R

is pragmatically determined and can be virtually anything at all. We discuss these avenues of inquiry and present an alternative that aims to unify insights from both approaches.

After having set up our definitions and classification system in Section 2, we use our definition of attributive compounds to frame our discussion of their structure (Section 3) and interpretation (Section 4). Structurally, we develop an account in which the morphemes of a compound are merged directly into their final position, without resorting to transformations, and in which the relation R is added post-syntactically to the structure at LF as a dissociated LF morpheme (see Section 3). Semantically, we review important issues from previous work on the meaning on R, but ultimately we develop our own analysis that assumes a limited number of relations in the spirit of Levi's work, while attributing pragmatic context dependence to the independently motivated mechanism of Contextual Domain Restriction. Section 5 concludes.

We are used to writing about morphemes in the context of Distributed Morphology (henceforth DM; Halle and Marantz 1993) and a type-driven formal semantics and this will influence some of our theoretical discussion. However, we suspect the main points will translate to other frameworks in the hands of experienced analysts and the goal of this chapter is not to compare the virtues of different theoretical frameworks. For a recent overview of the theory of the morpheme in DM, see Embick (2015). Some further formal, precise, and current implementations of how DM views the relationship between syntax and its interfaces with phonology and interpretation are for example found in Wood (2015), Ingason (2016), Myler (2016), and Sigurðsson (2017). Readers should be able to get a sense of our theoretical context by consulting these sources if they wish to do so, but we are hopeful that for most purposes our chapter is accessible to readers who are more familiar with different approaches.

Note, nonetheless, that by applying a DM approach to compounding, we are deriving all compounds in syntax or the syntactic part of the morphological component (at PF). That is different from many previous approaches, which derive compounds, at least to some degree, in the lexicon. Roeper and Siegel (1978) place the derivation of verbal compounds in the lexicon; Giegerich (2004, 2009) places some compounding in the lexicon and some in the syntactic part of the derivation. Ackema and Neeleman (2010), on the other hand, argue for an approach where compounding is derived in morphology but not syntax.

2. Definitions and background

2.1 A semantically motivated classification

Our focus will be on what is often referred to as attributive noun-noun compounds, such as *tennis ball*. We will refer to the non-head element of the compound, *tennis*, as N1 and the head element, *ball*, as N2. These labels are chosen as a notational convenience; N refers to 'noun' and 1 and 2 reflect the linear order of the non-head and the head of a canonical endocentric compound in English. It is also possible for the head of a compound to be on the left but

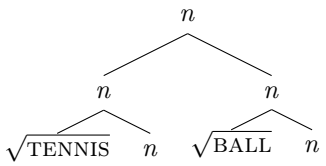
the labels N1 and N2 that reflect the canonical linear order in English are used here for convenience. Although we mostly focus on noun-noun compounds, our discussion should in general be extensible to compounds beyond nouns.

English has the roots $\sqrt{\text{TENNIS}}$ and $\sqrt{\text{BALL}}$ and they are both compatible with a nominal distribution as evident by the nouns *tennis* and *ball*. In a theoretical framework like DM in which lexical roots are category-neutral, we can say that both roots are licensed in the context of a nominalizer, n, as in (4).

(4)

These two nouns can be put together to form the compound *tennis ball*, which also has the distribution of a nominal. A minimal formal description is that Merge (Chomsky 1995), or whichever mechanism assembles elements of this size in the framework of choice, can take N1 and N2 of the syntactic type (or label) n and output the pair $\langle$N1, N2$\rangle$, also of syntactic type n. This type of a structural configuration for compounds, in which two syntactic objects of the same status combine directly with each other, is developed by Harðarson (2016, 2017), along with a more nuanced analysis of the status of other ingredients of the compound noun under such a view, including the status of inflection features. The structure of *tennis ball* is then as follows.

(5)



This is a compound noun. It is an ordered pair rather than a set because the semantic relationship between N1 and N2 is asymmetric. It is a combination of two n's rather than two roots because of the Categorization Assumption, that every root must combine with a category-defining morpheme (Embick and Marantz 2008). We elaborate on some further nuances of the analysis below. However, we are now ready to spell out some definitions.

(6) **Compound (definition)**
A compound is a complex head that contains two or more lexical roots.

This formulation of the definition is inspired by a similar definition used by Harley (2009). For us, the technical notion of a complex head is the morphosyntactic word (M-word) of Embick and Noyer (2001:574), see also Embick (2015), a syntactic head that is not dominated by another head. A lexical root is a morpheme associated with a meaning concept that is not constructed from the syntacticosemantic features that are realized by functional morphology, e.g., $\sqrt{\text{TENNIS}}$ and $\sqrt{\text{BALL}}$.

In the definition in (6), the term lexical root is important, as opposed to functional morphemes that in DM are assumed to be bundles of syntacticosemantic features. In the current sense, a syntacticosemantic feature is something

like ±PAST or ±PLURAL and it represents a basic meaning contrast, possibly universal, that has a special status in language acquisition and it can give rise to a grammatical contrast in a child's language if the grammar of the input language makes use of it. Such features are commonly realized as inflectional affixes. Sometimes a few of them are bundled together in one morpheme, e.g., [3P, PL, FEM], and the same distinction is often systematically attested across various languages and language families. In contrast, lexical roots are not hypothesized to have the same (grammatically universal or privileged) status and there are no features like ±TENNIS or ±BALL that show up systematically in inflection paradigms. Furthermore the interpretation of $\sqrt{\text{TENNIS}}$ and $\sqrt{\text{BALL}}$ is more deeply dependent on a speaker's experience and her relationship with concepts from her environment and cultural context, e.g., a professional tennis player might have a richer meaning representation for these roots than somebody who has never even watched anyone play tennis.

While the definition in (6) clearly accounts for *tennis ball*, it should be noted that we must put to the side some well-known difficulties in identifying compounds empirically. For example, M-words roughly correspond to phonological words but it remains challenging to establish universal criteria for identifying such objects empirically. Furthermore, it is difficult to draw a clear distinction between roots (l-morphemes) and functional morphemes (f-morphemes), for example because some apparent roots seem to have a meaning that could plausibly be encoded by the syntacticosemantic features of f-morphemes and some apparent f-morphemes align with roots in certain respects (e.g., Creemers et al. 2018). We acknowledge these gray areas but we put them to the side because our focus is on attributive compounds. We define them as follows.

(7) **Attributive compound (definition)**
An attributive compound is a compound in which the denotation of the non-head element (N1) restricts the denotation of the head element (N2) by combining with the denotation of N2 via a covert relation R that is not required by N2.

The covert relation in the compound *tennis ball* can be paraphrased as *for*, i.e., 'a ball for tennis'. The 'for tennis' part of the meaning does not fulfill requirements associated with the meaning of 'ball' and therefore it has the interpretive characteristics of an optional modifier, unlike, for example, 'meat' in the synthetic compound *meat eater*, which saturates the theme position required by the event described by the root $\sqrt{\text{EAT}}$. We return to the structural status of the relevant modification below.

In our semantically grounded classification, attributive compounds are distinguished from synthetic compounds because in the latter, N1 saturates a semantic argument position demanded by N2.[2] This reflects our view that semantic argumenthood is an appropriate empirical basis for a meaningful class of compounds that excludes attributive compounds.

(8) **Synthetic compound (definition)**
A synthetic compound is a compound in which the denotation of the non-

head element (N1) restricts the denotation of the head element (N2) by saturating a semantic argument position that is required by N2.

This means that the meaning of N2 requires that N1 mentions a participant (an entity of some sort) related to the meaning of N2. For example, if N2 describes an event that requires a theme argument and N1 is interpreted as such a theme, we say that N1 saturates the theme position. There are a few different ways this can be formalized. The denotation of the root $\sqrt{\text{EAT}}$ in (10) illustrates one possibility. Here, a transitive root associates an individual (entity) with the theme role that participates in the event named by the root. Crucially, the use of the root $\sqrt{\text{EAT}}$ introduces an open argument slot for a theme, here represented formally as λx. In a formal semantics, the slot will be saturated by Function Application (see Heim and Kratzer 1998:44).

(9) **Function Application**
If α is a branching node, $\{\beta,\gamma\}$ is the set of α's daugters, and $[\![\beta]\!]$ is a function whose domain contains $[\![\gamma]\!]$, then $[\![\alpha]\!] = [\![\beta]\!]([\![\gamma]\!])$.

Note that this requirement for an edible theme encodes an empirical fact and some of the implementation details in the lambda-calculus are an orthogonal issue. The details in question include the exact locus of λx and any operator that makes the theme noun an appropriate input to the function, e.g., via existential or referential closure.

(10) $[\![\sqrt{\text{EAT}}]\!] = \lambda x.\lambda e.\text{eat}(e) \wedge \text{theme}(x,e)$

The empirical fact in question can be observed in examples like (11). The root $\sqrt{\text{EAT}}$ has a theme slot when used in the verb *eat* as well as the noun *eater*.[3] Using the root without the theme sounds unnatural unless the theme is recoverable from the context.

(11) a. Cringer ate the pasta.
b. #Cringer ate.
c. Cringer is a meat eater.
d. #Cringer is an eater.

No such requirement is imposed on attributive compounds:

(12) a. Cringer bought a tennis ball.
b. Cringer bought a ball.

Here, *tennis* is an optional element and omitting it does not make the example any less well formed. It is important to note that various complexities in the nature of synthetic compounds and argument saturation are relevant but beyond the scope of this chapter. For example, the strength of the theme requirement depends on how predictable the theme is in general with a given root; see Glass (2014) for an insightful study and further references. With $\sqrt{\text{EAT}}$, speakers can

find implicit themes relatively acceptable as in (11b) because this root is usually (hence predictably) used with food. In contrast, $\sqrt{\text{DEVOUR}}$ takes more diverse themes in practice and speakers generally disallow implicit themes with this root:

(13) a. Cringer devoured the pasta.
b. *Cringer devoured.

While an attributive compound like *tennis ball* requires a covert relation R for proper interpretation, a coordinative compound like *actor-director* is interpretable without any additional structure at LF via the same mechanism as adjectives like *green* when their meaning is restrictive. Predicate Conjunction (Kratzer 2009) is an operation of semantic composition that is triggered when two sisters are of the same semantic type and it conjoins their denotations; see also Predicate Modification in Heim and Kratzer (1998).

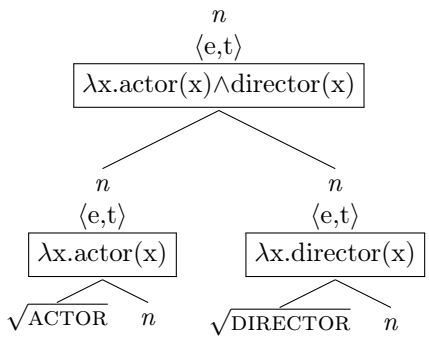
(14) **Predicate Conjunction**
If α is a branching node, $\{\beta,\gamma\}$ is the set of α's daugters, and $[\![\beta]\!]$ and $[\![\gamma]\!]$ are both in D_f, and f is a semantic type which takes n arguments, then $[\![\alpha]\!] = \lambda(a_1, ..., a_n).[\![\beta]\!]\lambda(a_1, ..., a_n) \wedge [\![\gamma]\!]\lambda(a_1, ..., a_n)$.

For coordinative compounds, this means that if nouns like *actor* and *director* are functions of type $\langle e,t\rangle$, from individuals to truth values, i.e., 'x is an actor' and 'x is a director', the compound *actor-director* denotes 'x is an actor and x is a director'. We take such meaning composition to define the class of coordinative compounds as opposed to both attributive and synthetic compounds.

(15) **Coordinative compounds (definition):**
A coordinative compound is a compound in which the denotation of the non-head element (N1) combines with the denotation of the head element via Predicate Conjunction.

The defining step of the LF derivation of *actor-director* is shown in (16) and for our purposes, it does crucially not involve any covert relation R; thus being formally distinct from attributive compounds.

(16)

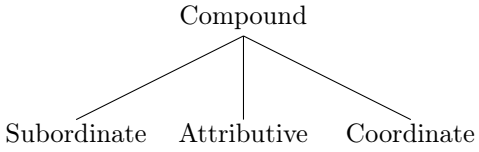


Before going into more details surrounding the analysis of attributive compounds, we turn to some further properties that are a part of the big picture.

2.2 Further classification issues

Several different classifications of compounds have been offered in the literature, as discussed in Bisetto and Scalise (2005, and Scalise and Bisetto 2009). Bisetto and Scalise themselves distinguish, for example, between three major groups (and each group can in turn have exocentric and endocentric compounds): subordinate, attributive and coordinate compounds.

(17)



Whenever there is some sort of complement relation between two constituents, the compound is classified as subordinate whereas attributive compounds include, for example, *blackboard* and *snail mail*, where one constituent expresses an attribute of the head. A complement relation, for Bisetto and Scalise, holds not only in compounds like *taxi driver* 'person who drives a taxi' but also in compounds like *apron string* 'a string of an apron', where *apron* counts as the complement of *string*.

Bisetto and Scalise's classification gives different results from our semantically driven approach. Whereas Bisetto and Scalise group together compounds on the basis of a complement relation,[4] we make a distinction between what we term attributive compounds, such as *apron string* or *tennis ball*, and synthetic compounds, like *taxi driver* or *meat eater*, on the other. Attributive compounds in our terminology include for the most part, as far as we can see, attributive compounds on Bisetto and Scalise's approach, as well as some of their subordinate compounds, i.e., those like *apron string* in which the head does not impose semantic argument requirements fulfilled by the non-head. For these compounds, we assume that the head is linked to the non-head via an optional R relationship. Note that Scalise and Bisetto (2009) take their subordinate class to include not only complements of the verbs but also adjuncts (see their verbal-nexus discussion). Therefore, subordinate for them applies not only to complement-verb compounds like *book seller* but also adjunct-verb compounds like *street seller* (p. 51).

Because we adopt a classification of compounds that is tied to a typology of semantic composition, it is reasonable to also consider other types of composition. While Function Application is commonly used to analyze cases where a piece of structure saturates an open argument position, Restrict is an operation that imposes constraints on an argument position without saturating it (Chung and Ladusaw 2004; Legate 2014:39).

(18) **Restrict**
If α is a branching node, $\{\beta,\gamma\}$ is the set of α's daughters, and β is of type $\langle$e,st$\rangle$ and γ is of type $\langle$e,t$\rangle$, then α is of type $\langle$e,st$\rangle$.

A verb like *brainwash* illustrates restriction of the relevant type in an English compound. Here, *brain* restricts the theme position of wash to the set of individuals/entities that have brains but the theme position remains unsaturated. This is shown by the data in (19).

(19) a. Taylor washed Alex.
b. Taylor washed the shirt.
c. Taylor brainwashed Alex.
d. #Taylor brainwashed the shirt.

It is possible to wash a person or a shirt, but a shirt cannot be brainwashed. Based on these facts, we refer to compounds like *brainwash* as Restrictive Compounds and in our classification they are neither attributive nor synthetic.

3. The structure of attributive compounds

3.1 The head of a compound

When determining the head of a compound like, e.g., *tennis ball*, to see whether it is endocentric or exocentric and — if endocentric — whether it is right-headed or left-headed, at least two factors are important to take into account: the denotation of the compound and grammatical features (see discussion in, e.g., Scalise and Fábregas 2010). We will look at these factors below.

When we look at the grammatical features of English compounds, such as number, English compounds generally seem to be right-headed. The compound *birthday child*, for example, consists of two nouns: *birthday* and *child*. The plural of the former is *birthdays*, with the regular plural *-s*, whereas the plural of the latter is the irregular *children*. If the head of the compound were *birthday*, we might either expect the plural to be **birthdays child* or **birthday childs*. However, it is *birthday children*, suggesting that the head is, in fact, *child* — a right-headed compound. We see the same right-headedness in the compound *child menu*, where *child* is on the left. The plural is neither **children menu*, **childs menu* nor **child menuen*; it is *child menus*.

We could also look at the category (part of speech) of compounds when we determine the head. That does not help for compounds like *birthday child* and *child menu* as they are made of two nouns. We could, however, look at compounds made of an adjective and a noun, such as *blackboard*. The whole compound is a noun, unlike *black*, which is an adjective, but like *board*, which is a noun. This would therefore suggest a right-headed compound, with *board* as the head.

Another way of determining the head of a compound is by looking at its denotation, to see whether the meaning (or range of potential meanings) of the compound is predictable from its parts, in which there is a relation between the head and the attribute (e.g., Allen's 1978 variable R and our discussion in Section 4). The transparency of headed compounds is often described in terms of hyponymy: the head is a hyponym of the compound. In this regard,

Allen (1978) discusses her IS A Condition and shows the following right-headed compounds (p. 108):[5]

(20) a. a steam-boat IS A boat
b. a rose-bush IS A bush
c. a silk-worm IS A worm
d. a beer-can IS A can
e. a night-light IS A light
f. a plant-table IS A table
g. a thesis-box IS A box
h. a pond-frog IS A frog

These compounds are transparent in that their meaning is predictable to a certain extent as long as we know what the head is. For example, a steam-boat is a boat that has some relation to steam. In the same way, a child menu is a menu that has to do with children — more specifically, it is a menu for children. We discuss the relation between the parts of a compound in Section 4.

Whereas English compounds — and compounds in other Germanic languages, for that matter — are generally right-headed (cf. Williams 1981), compounds in, e.g., Romance languages are often left-headed. Scalise and Fábregas (2010:110) discuss the Italian compound in (21).

(21) cassa forte
box strong
'safe box'

Here we can use the diagnostics described above, with respect to syntax and semantics, to determine the head of the compound in (21). The compound *cassa forte* is made of a noun (*cassa*) and an adjective (*forte*) and as a whole, it is a noun. That suggests a left-headed compound. Furthermore, *cassa forte* is a type of box, suggesting that *cassa* 'box' is the head.

Scalise and Fábregas (2010:110, 112) also discuss the noun-noun compound in (22).

(22) capo stazione
chief station
'station master'

The compound *capo stazione* is a noun but we cannot tell from that information alone whether *capo* or *stazione* is the head, as both are nouns. However, *capo* is a masculine noun whereas *stazione* is feminine, and as *capo stazione* is masculine, that suggests that the head is *capo* but not *stazione*.

We have been able to identify a head in the compounds discussed above — these are therefore endocentric. A compound without a head, on the other hand, is exocentric. There are in fact different ways of looking at endocentricity and exocentricity which relate to the headedness of a compound; for an overview,

see, e.g., Bauer (2010). For example, the head of the compound might not be of the same category as the compound itself or there might not be a semantic head in the sense that the grammatical head is not a (semantic) hyponym of the compound as a whole. It is not clear whether these factors on their own should lead us to define such compounds as exocentric. In some cases, grammatical features and semantic reading do not even identify the same part of the compound as the head. That is true for, e.g., the Icelandic compounds in (23), taken from Einarsson (1952).[6]

(23) a. mann-skratti
man-devil
'devil of a man'

b. mann-gersemi
man-jewel
'jewel of a man'

Grammatically, these noun-noun compounds are right-headed. That is particularly clear in (23b), as the compound as a whole is feminine, just like the second part, *gersemi* 'jewel', whereas the first part, *mann* 'man', is masculine. Nevertheless, *manngersemi* is not a type of jewel but of man. The head according to the denotation of these compounds is the left part, *mann-*, but according to the grammatical features, the head is the right part, *skratti* and *gersemi* in (23a) and (23b), respectively. Note, however, that the denotation of this type of compound is transparent as long as the head is taken to be semantically defined.

Let us now, on the other hand, take a look at compounds where the denotation is not predictable from their parts; these are exocentric in the sense that there is no semantic head. The following examples cannot be accounted for under Allen's (1978) IS A Condition (examples a–b are taken from Allen 1978:109; c–d from Katamba 1993:320):

(24) a. cotton-tail
b. turtle-neck
c. butter-fingers
d. block-head

With respect to grammatical features, these compounds are right-headed, suggesting endocentricity. Their meaning is, nonetheless, not transparent. A cottontail is not a tail but a rabbit; a turtleneck is not a neck but a type of sweater; butterfingers are not fingers but a person who drops things; and a blockhead is not a head but an idiot. To derive the semantics of such compounds is therefore not straightforward, as it is "impossible to work out what an exocentric compound means from the sum of the meanings of its constituents" (Katamba 1993:320). This is reminiscent of idioms, which behave irregularly and are generally not transparent. Exocentric compounds are not very common — and in, fact, Allen discusses compounds as in (24) as "exceptions" to the IS A Condition. Selkirk (1982:25–26) proposes a special semantic treatment of exocentric

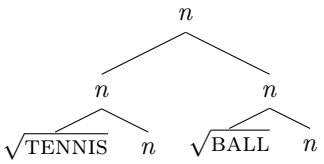
compounds: whereas they are generated by the same rules as endocentric compounds, they are "interpreted by semantic rules specific to them" (p. 26). In a similar vein, Katamba (1993:320–321) argues that exocentric compounds, being semantically opaque, need to be listed in the lexicon, just like idioms.

In our theoretical approach that invokes the framework of Distributed Morphology, all structure building takes place in the syntax, including the derivation of compounds from their parts. Adopting a similar view as the references cited above, we treat exocentric compounds like *cottontail* or *turtleneck* as idioms and for us that means that they are interpreted by the same mechanism that interprets other syntactic structures idiomatically, e.g., *kick the bucket* and *spill the beans*. Formally, the list that relates structure with its corresponding meaning can refer either to specific morphemes or pieces of structure that are larger than that. For discussion on how such larger structures are interpreted and how such interpretation may be constrained, see Ingason et al. (2016b).

3.2 The relation R as a dissociated LF morpheme

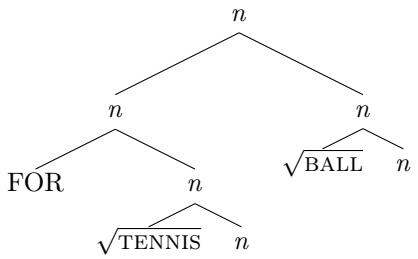
The non-head of an endocentric compound modifies the head via some unpronounced semantic relationship. We will now formalize this state of affairs. In Section 2.1, we gave the following structure for an attributive compound like *tennis ball* while noting that a covert relation R holds between the nouns *tennis* and *ball* (cf. Allen's 1978 Variable R Condition). R makes N1 (*tennis*) act as an optional modifier on N2 *ball*.

(25)



For current purposes, let R be a piece of semantic composition, FOR, as in *ball for (playing) tennis*. In (26), we show the structure for the attributive compound *tennis ball* with the covert relation FOR included.

(26)



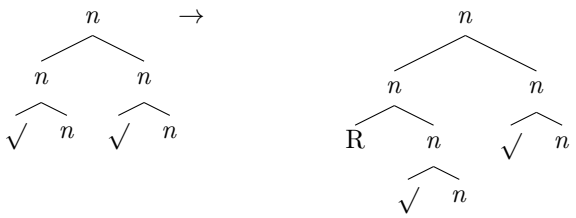
The denotation of FOR is given in (27), focusing on structural relations in the compound while abstracting away from implementation details of FOR at the Predicate Logic level.

(27) $[\![\text{FOR}]\!] = \lambda P.\lambda G.\lambda x.G(x) \wedge \text{FOR}(x,P)$

The relation FOR does not have phonological consequences and we analyze it as a dissociated interpretive (LF) morpheme (cf. Ingason et al. 2016a:45–46). The notion of a dissociated morpheme (Embick 1997) is commonly invoked in the analysis of the phonological (PF) derivation. An agreement morpheme that does not contribute to the interpretation of the structure is sometimes assumed to be adjoined to its host at PF and it is therefore invisible to interpretive processes. A dissociated LF morpheme is the mirror image of this; it is adjoined to its host in the LF derivation and it is invisible to phonological processes. This insertion is shown schematically in (28) and (29). It is possible to maintain other aspects of our analysis while disregarding the notion of a dissociated LF morpheme and assuming that all morphemes, including R morphemes like FOR, are present throughout the syntactic derivation. However, our approach facilitates formulating stronger hypotheses because the analysis can now encode the prediction that a given morpheme has no phonological consequences.

(28) **Insertion of a dissociated R morpheme at LF:**
$[n] \rightarrow [\mathrm{R}\ n]$

(29)

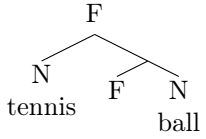


This analysis predicts that the dissociated LF-morpheme, see (30), should never be realized morphophonologically because it enters the structure in the semantic derivation — and according to the often assumed Y-model of grammatical architecture, LF and PF do not "see" each other. According to the Y-model, the syntactic derivation splits into a phonological (PF) branch and an interpretive (LF) branch and because of this split, mechanisms that operate at PF are predicted not to have an effect on LF and vice versa.

(30) **Dissociated LF morpheme (definition)**
A dissociated LF morpheme is a head that is adjoined to its host at LF.

Despite some differences, our approach is in some respects similar to di Sciullo's (2005, 2009) F-tree analysis which takes compounds to include a projection whose head is a functional head F. The structure for *tennis ball*[7] is shown below, where *tennis* occupies the specifier position of the compound and *ball* is the complement.

(31)

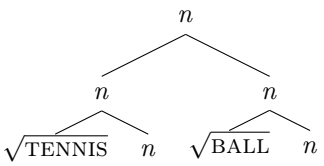


This functional layer is crucial for the interpretation of relations such as FOR at the semantics interface (LF). For di Sciullo, however, the relation originates earlier in the derivation so it is also present in the morphophonological component (PF). Whereas our analysis accounts for the fact that a relation like FOR is not realized morphologically, di Sciullo takes connectives, as in so-called *dvandva* compounds (*hit-and-run*, *truth-or-dare*), to be examples of morphologically realized relations; therefore AND and OR are included in her list of relations. Under our account, these are different from attributive compounds of the *tennis ball*-type and necessarily enter the derivation prior to Spell-Out.

3.3 The syntactic structure of compounds

In Section 2.1, we gave the following structure for an attributive compound like *tennis ball*.

(32)



There are some issues regarding this structure, however, that must be clarified. The head of the compound is *ball* but that cannot be read off of the structure if the mechanism that combines *tennis* and *ball* yields an unordered set of *n*-elements. However, much current work in syntax assumes that Merge, the operation that combines elements, comes in an unordered as well as an ordered flavor (Chomsky 2000). For Chomsky, Set-Merge is used for arguments and yields an unordered set whereas Pair-Merge is used for adjuncts and yields an ordered pair:

(33) Two types of Merge:
a. Set-Merge(α,β) = {a,b} (arguments)
b. Pair-Merge(α,β) = <a,b> (adjuncts)

While Chomsky introduces his distinction in the context of merging entire phrases into syntactic structures, we believe that it is reasonable to think that some of the formal properties of Pair-Merge also apply to compounds. There must be some way of distinguishing the head from the non-head, and if the combined element *tennis ball* is an ordered pair, we can simply say that the second member of the pair is the head. Linearization of this structure in the phonology (at PF in Chomsky's terminology) could then be language-specific (or even specified for certain compounds within a language if needed). For example, the head is to the right in English (cf. Williams 1981) but to the left in Italian.

In addition to this, not all noun-noun structures exhibit the same behavior. Some such structures seem to be what is often referred to as "phrasal", whereas other such structures are compounds. Giegerich (2004:14) demonstrates how

one-replacement distinguishes a phrase like *steel bridge* from compounds like *bread-crumb* and *table leg*. It is less natural to replace the head of the compounds with *one* than it is in the case of the phrase:

(34) a. a steel bridge and a stone one
b. ??a bread-crumb and a dust one
c. ??a table leg and a chair one

While various criteria have proven useful in the context of detecting and analyzing compounds as distinct from phrases, it must be emphasized that universal and clear-cut diagnostics remain elusive (see Giegerich 2004, 2009; Payne and Huddleston 2002:448–451). For example, it is a well-known empirical correlate of compounds in English that compounds have a strong tendency to have fore-stress whereas phrases have a tendency to bear end-stress. To begin with, this property of compounding is specific to English and thus not helpful for identifying compounds universally, but even within English, exceptions and variation complicate the picture. For example, Payne and Huddleston give the examples *full stop* 'period' as well as *hotdog* that should probably be analyzed as compounds despite being attested with stress on the second element.

It is also important to keep in mind how the structure relates to interpretation, an issue that is particularly pressing with respect to endocentric vs. exocentric compounds. As long as the (semantic) head of an endocentric noun-noun compound can be identified, we know that the reading should be 'head of the type attribute' (or 'head that is associated with an attribute'). On the other hand, if a particular compound does not have a (semantic) head, its meaning cannot be read from the combination of its parts; the denotation is not predictable. For us, the key to interpreting exocentric compounds is to treat them as idioms, a point of view that we discussed in Section 3.1.

3.4 Alternative structural analyses

Many compounds can be paraphrased using a relative clause. For example, (35a) can be paraphrased as (35b).

(35) a. virus infection
b. infection which is caused by viruses

Some earlier works on compounding, which have roots in a more transformation-oriented era, such as Lees (1960) and Levi (1978), actually hypothesized that compounds (complex nominals in Levi's work) are derived from a much larger structure, such as a head noun accompanied by a relative clause. During the derivation, however, a part of this larger structure is deleted. In a transformational grammar, a base is assumed on which various transformations can act. For *virus infection* in (35a), for example, Levi (1978:78) assumes the base *virus cause infection*. Then, a passive transformation applies, resulting in *infection is caused by virus*. To get to *virus infection*[8] a few other transformations are needed, including a relative clause formation and recoverable deletion.

Such a strongly transformational approach to morphosyntactic analysis is less frequently employed in recent theoretical work. Instead of classic transformation scenarios along the lines of deriving the passive voice from the active voice (e.g., Chomsky 1957), one can maintain some of the advantages of such an approach without the power of early transformations by assuming that a set of building blocks, morphemes in our system, can often be assembled in more than one way. We adopt such a view for compounds in general; there is no need to derive them from structures that are different and larger if we allow Merge to take two nouns and make a compound out of them.

Here, we must note that researchers are still pursuing analyses that derive compounds, including attributive compounds, from elements that are base-generated in a different configuration. For example, this is the case in Harley's (2009) analysis. Like us, she makes use of the Distributed Morphology framework. However, she assumes that an attributive compound like *nurse shoe* starts out with *nurse* as an nP complement to the root $\sqrt{\text{SHOE}}$. While this is an interesting avenue of inquiry, we believe that this approach introduces analytical questions and complexities that proponents of displacement-oriented approaches to compounding must examine and clarify more thoroughly.

As in any analysis that involves movement, a displacement assumption should be motivated. For example, a movement of a DP from object to subject position in a passive is intuitively motivated by the fact that the DP in the subject position appears to be interpreted in the object position as in the corresponding active. Whether or not that is the correct analysis, the idea that the theme DP is base-generated as the complement of the verb (or verb root) is a much more straightforward than the idea that a root like $\sqrt{\text{SHOE}}$ takes an nP complement.

For example, the hypothesized base-generated variant, *shoe nurse*, never surfaces in that configuration with the same meaning. Harley assumes that the head noun's root $\sqrt{\text{SHOE}}$ takes the nP *nurse* as its direct complement without any relational heads and that LF constructs some plausible meaning for this root-complement configuration. If this is the case, such compounds receive a special contextually determined interpretation from a base-generated configuration that never surfaces. Perhaps, this is really the case, but in our opinion, a non-trivial burden of proof rests on the displacement-oriented view to motivate and constrain such theoretical tools as opposed to the (in our opinion) much simpler view that the compound is base-generated as it surfaces.

We also have concerns about other general implications of roots selecting for bare nP complements in terms of the selection system in syntax in general and the way it interacts with interpretation but we put that to the side because we do not know enough about the theoretical assumptions behind the syntax and semantics of the displacement-oriented analysis. See also Spencer (2011) for a critical discussion of Harley's approach.

4. Interpreting attributive compounds

4.1 A finite or infinite set of relations?

The meaning of attributive compounds involves a covert relation R between two parts that is additive in the sense that it cannot be reduced to a single mechanism of semantic composition like predication or conjunction. Examining the nature of R is thus a central task in the analysis of attributive compounds. For example, a *tennis ball* is a ball for playing tennis but it is not a ball that is tennis. This means that the 'for' part of the meaning must somehow enter the mechanism that interprets the compound as a whole. Furthermore, if we keep *tennis* constant, replacing, for example, *ball* with *magazine*, we do not necessarily get the same relation: Even though a *tennis magazine* is not a magazine that is tennis, it is also not a magazine FOR playing tennis, either. Rather, it is a magazine ABOUT tennis. Therefore, different thematic relations, such as FOR and ABOUT, arise in different combinations.

A central problem in the literature has been how such relations should be accounted for. The main question is whether the set of relations is finite (which Spencer (2011) calls "Lees's solution", referring to his work from 1960) or non-finite (which Spencer calls "Downing's solution"). Levi (1978) proposes a finite set of relations that the speaker learns and can apply when using and interpreting compounds. A different number of relations have been proposed. In an often cited analysis, Levi (1978) assumes nine relations, CAUSE, HAVE, MAKE, USE, BE, IN, FOR, FROM and ABOUT: "These predicates, and only these predicates, may be deleted in the process of transforming an underlying relative clause construction into the typically ambiguous surface configuration of the [complex nominal]" (Levi 1978:76). Downing (1977) (see also Jespersen 1942, Allen 1978, Dowty 1979 and Selkirk 1982), in contrast, criticizes such approaches and argues for a non-finite number of potential compounding relations in which pragmatics play a bigger role (see also discussion in Spencer 2011).[9] According to this view, R is determined pragmatically and can be almost anything at all. Even so, it should be noted that Downing (1977:836) observes that "a small set of relationships is generally favored" and that most attested items can be covered by 12 relations. Thus, having a theory according to which infinite relations are in principle possible does not exclude the possibility that only a small subset of them are typically used.

The difference between the two types of approaches is of central interest when it comes to accounting for compound relations formally. A tantalizing tension arises because a large number of attested compounds can be accounted for in a rather satisfying manner using a fixed list of relations as in Levi's analysis whereas it is also possible to bring up examples of relations that do not straightforwardly correspond to anything on Levi's list or any plausible finite list of relations.

One source of analytical tension is rooted in seemingly fluffy applications of the more generic relations on Levi's list like FOR. In a critical discussion, Spencer (2011) points out that a compound like *elephant gun* that means 'a gun

for shooting elephants' does not receive a pleasing analysis under accounts that assume a fixed number of relations. It is not strictly incorrect to say that this is a 'gun for elephants' in some sense but the 'shooting' part of the meaning has an unclear status in such an analysis. Thus, it appears we have a choice between Lees's solution on the one hand, that is quite restrictive and accounts for a good amount of cases, but not all of them, and, on the other, Downing's solution, which is completely unrestricted. In Section 4.2, we present a proposal that aims to resolve these controversies by appealing to the independently needed mechanism of Contextual Domain Restriction (Neale 1990).

Gagné and Shoben (1997) work further with thematic relations and propose the Competition Among Relations in Nominals (CARIN) model. They propose that speakers' knowledge of the concepts involved make some relations more plausible than others: "Our proposal is that all of these relations compete for the interpretation of the combined concept and that the difficulty of interpretation is a function of the relative strength of the selected relation. We further assume that frequency of a relation [...] is a reasonable index of strength" (Gagné and Shoben 1997:81). Furthermore, Gagné (2000) explains: "A key assumption of the CARIN theory is that people use knowledge about the relations with which the modifier is typically used and, consequently, the modifier's past usage in various combinations strongly influences the ease with which a relation can be selected." Gagné and Shoben give examples using the modifier *mountain*: "Other things being equal, it is easier to arrive at the correct interpretation for *mountain stream* than it is for *mountain magazine* because the locative relation has a greater strength than does the *about* relation. In other words, it is easier to use a highly frequent relation than it is to use a less frequent relation" (Gagné and Shoben 1997:81).

Somewhat different from the CARIN model is the schema modification theory that Murphy (1988) argues for. A head noun has various slots on that theory which can be filled by the modifier. A straightforward example is green apple where the predicating adjective green fills the COLOR slot of apple resulting in an interpretation such as 'an apple that is green'. The compound *apartment dog* means, on the other hand, 'a dog that lives in an apartment' as apartment uses the HABITAT slot.

Even though CARIN and the slot-filling schema theory look similar, there is an important difference, as Gagné (2000:366) explains: "Unlike the schema-modification theory, the modifier does not become a filler within the head noun concept. That is, the combination *apartment dog* is interpreted by first selecting the relation *noun LOCATED modifier*, rather than by filling a slot denoting HABITAT. Consequently, the combined concept is not a copy of head noun schema with various slots altered. Instead, the combined concept is a newly created representation that is linked to the original modifier and head noun concepts."

4.2 Relations and Contextual Domain Restriction

Both CARIN and the schema modification model assume a finite set of thematic relations. We will, however, propose a different approach that combines insights from Lees's solution as well as Downing's solution to the R-puzzle. For this purpose, knowledge of how particular modifiers are most frequently used can be helpful but it is not essential as the meaning of a compound depends on both fixed relations and a syntactically encoded context-dependency. Our proposal for a unified solution invokes Contextual Domain Restriction (CDR) which is an independently motivated theoretical tool for the analysis of context-dependent interpretation (Neale 1990).

In informal empirical terms, CDR refers to a mechanism that is constantly at work in everyday use of language: Speakers must often focus their attention on a part of the world that is smaller than the entire world when evaluating linguistic meaning. For example, CDR is necessary for the interpretion of quantifers.

(36) Everyone came to the party.

The example in (36) is a normal English sentence in various scenarios where a party is under discussion. However, without CDR, the sentence is incorrectly predicted to be universally false, because there has never been a party that was attended by every human being. The universal quantifier *everyone* must be interpreted relative to a situation that is being discussed, i.e., the domain of the quantifier must be restricted to an appropriate set in the current context. In fact, CDR is quite a pervasive phenomenon in natural language that goes well beyond quantifiers. For example, the definite article is associated with a uniqueness requirement and as thoroughly studied by Schwarz (2009), this requirement must be evaluated relative to a situation that is usually smaller than the world. Let us for example consider the DP *the mayor*, demonstrated in (37).

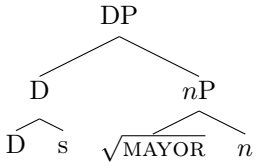
(37) Adrian met the mayor yesterday.

There are of course many mayors in the world but when uttered in the context of a given city, (37) is effortlessly interpreted as the mayor of that city. Abstracting away from the semantics of anaphoricity, the denotation of the definite article that is developed by Schwarz (2009) is given in (38).

(38) $[\![\text{ D }]\!] = \lambda s_r \, . \, \lambda P \, . \, \iota x \, . \, P(x)(s_r)$

Here, λs_r requires the definite article to combine with a covert situation pronoun that represents the part of the world that the noun phrase is interpreted with respect to. Once the definite article has had its domain restricted, it combines with the denotation of the noun phrase that is its complement and the iota operator returns 'the unique x such that the description given in the noun phrase is true of that x in situation s_r'. This structure is shown in (39).

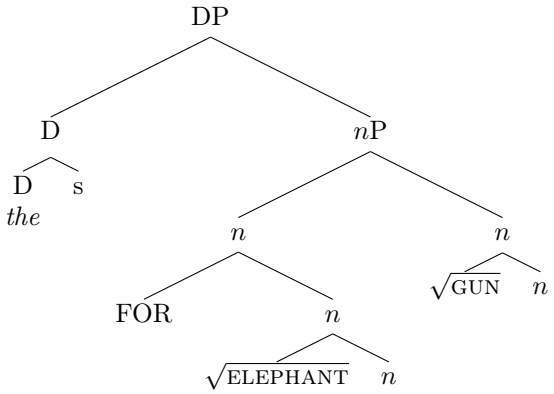
(39)



As Spencer (2011) correctly points out, a theory with a fixed set of relations R yields an unsatisfying analysis of certain compounds without a mechanism for context dependency. Spencer takes this to favor Downing's solution over Lees's solution, resorting to an R relation that is pragmatically determined and is unconstrained in the sense that it can be virtually anything. This works empirically because an unconstrained theory of R can of course derive all attested relations. However, it is not exactly ideal to completely throw away Levi's finding that nine relations cover most of the relevant empirical ground in order to allow for a few problematic cases. Let us thus consider an alternative theory where R is in fact restricted to a finite number of possibilities but the context dependency comes from CDR which is a necessary part of the semantics anyway.

Consider Spencer's example *elephant gun*, meaning 'a gun for shooting elephants'. An analysis of *n*P in terms of a FOR relation that yields 'x is a gun for elephants' seems, at first, to be hopelessly imprecise because nothing in the structure encodes the 'shooting' part of the meaning. If all the entities in the world are evaluated against such a predicate, it is indeed likely to lead to confusion. However, a noun phrase in the real world is evaluated with respect to a situation that is smaller than the world. If the interlocutors in a conversation are aware of two guns in the situation at hand (e.g., s in (40)), an elephant gun and a semi-automatic gun, 'x is a gun for elephants' turns out to pick out the elephant gun without any serious risk of misunderstanding.

(40)



Employing CDR in combination with a fixed number of relations like Levi's (1978) nine relations, CAUSE, HAVE, MAKE, USE, BE, IN, FOR, FROM, ABOUT, allows the context to shape the interpretation of an attributive compound without resorting to a completely unconstrained theory of the relation R itself. While our analysis makes a contribution to the type of work that assumes a limited

set of relations, some important questions about R remain to be investigated in further detail. For example, we are not committed to a particular size of the exact set of possible relations for R; it might be nine as in Levi's analysis or some other number. Furthermore, we leave it for future work to investigate whether cross-linguistic variation is found in the number of available variants of R in a given language. As Bauer (2009:353) notes, the different suggestions in the literature about how many relationships R may involve are based on English facts, but it is not clear whether languages differ in this respect.

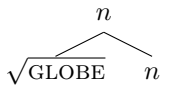
While we believe that our CDR-based approach can strengthen the empirical coverage of the theory in cases that truly do involve a compositional semantics, it is important to note that idioms are a real phenomenon in syntax. Structures that are the size of a full verb phrase, such as *kick the bucket*, can be interpreted idiomatically, and we have every reason to believe that a complex n-head, which is a smaller chunk of syntax than vP, can in some cases have a non-compositional meaning. In fact, it would be shocking if that were not the case.

4.3 Phase locality in R-resolution

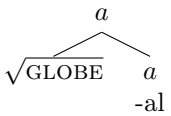
We now turn to the role of phase locality in constraining the meaning of R in a specific structure. We adopt the common assumption that syntactic structure undergoes Transfer to the interfaces of syntax with phonology and interpretation in a cyclic manner, by phase (Chomsky 2000; 2001). We furthermore follow much of current work in Distributed Morphology in assuming that category-defining morphemes define phase boundaries (Marantz 2001; 2007). If categorization heads are phase heads, the derivation of compounds is expected to be constrained by phase cyclicity. That has important consequences for their meaning, or rather, available readings of compounds as they get more complex. An attributive compound that allows for a certain set of flavors of R may at some point only allow a subset of these as further elements are added to the structure.

Marantz (2013; see also Ingason 2016) shows evidence that root polysemy is constrained by phase structure. A meaning of a root that is excluded at a certain phase boundary cannot be brought back in the derivation of an outer phase. An example he gives of this (p. 104) is the root $\sqrt{\text{GLOBE}}$ which, when nominalized, as *globe*, can have two meanings, 'sphere' or 'something spherelike' on the one hand and 'the world' on the other. When the root is adjectivalized, as *global*, however, only one of these readings is made available, namely 'world', whereas the other, 'sphere', is excluded. This is illustrated in (41).

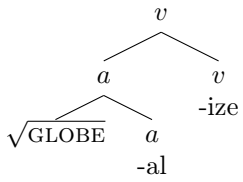
(41) **Noun:** ✓'spherelike' ✓'world'



b. **Adjective:** * 'spherelike' ✓'world'



c. **Adjective-derived:** * 'spherelike' ✓'world'



When outer heads interact with a phase that has been assembled, such as *globe* or *global*, they only have access to the readings that have been made available at the phase boundary. When the verbalizer *-ize* is added on top of the adjective *global*, it only has access to the reading 'world' because the other reading, 'sphere', has already been excluded.

A parallel pattern is found in the interpretation of compounds; their meaning is constrained by phase cycles. More than one meaning is often available when individual parts are combined to form a compound. However, when a reading has been excluded at one phase boundary, it is not available at later cycles in the derivation.

Consider the Icelandic compound *jólabækur*, constructed by merging the nouns *jól* 'Christmas' and *bók* 'book', yielding 'Christmas books'. The meaning is, however, ambiguous. It can (at least) mean either (i) 'books about Christmas' (for example, a book that discusses Christmas traditions) or (ii) 'books that are intended to be sold before Christmas or read during the holidays' — these are often bought as Christmas gifts. When we combine *jólabækur* with yet another noun, *flóð* 'flood', the result is *jólabókaflóð*, literally 'flood(ing) of Christmas books'. This compound excludes the reading 'books about Christmas' for *jólabækur*. Therefore, *jólabókaflóð* only means 'a flood of books that are intended for Christmas'. If we add yet another part to this compound, *frétt* 'news report', as in *jólabókaflóðsfrétt*, only one reading of *jólabók* is available at the outermost cycle, namely 'a book intended for Christmas', because the other reading has already been excluded. The pattern is summarized in (42).

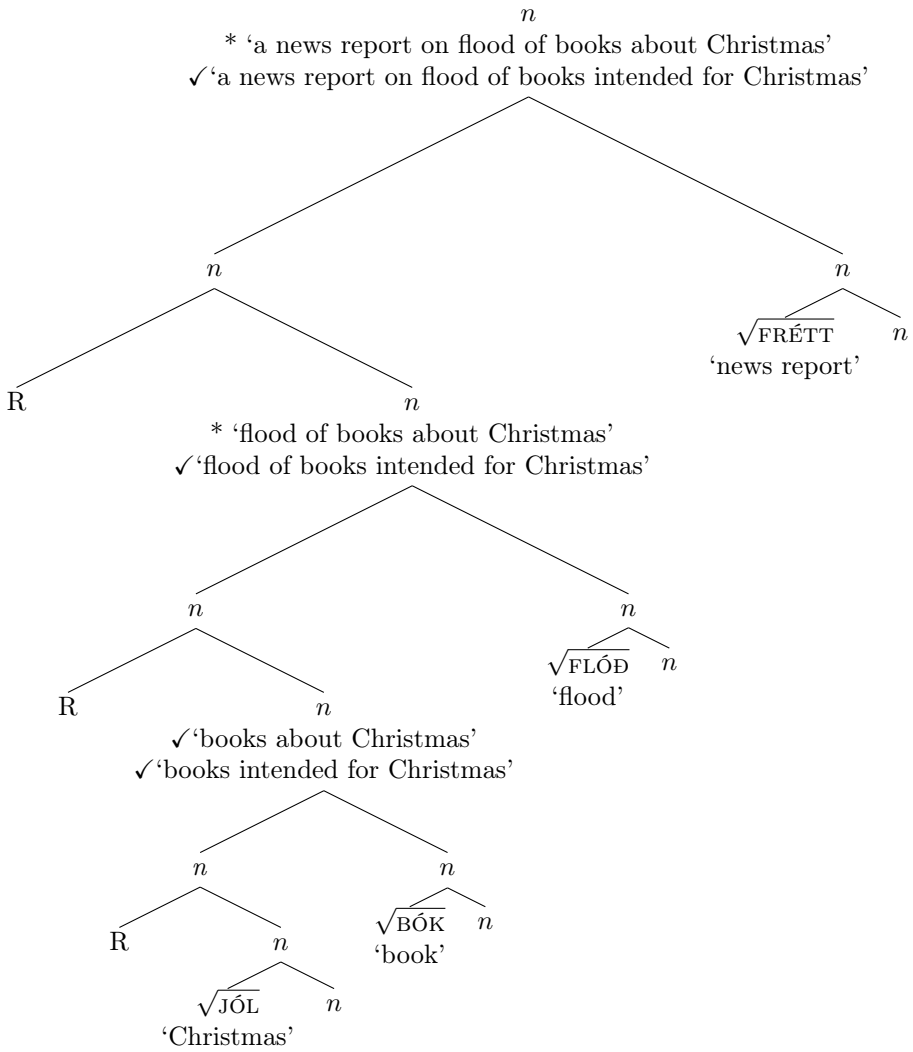
(42) a. jóla-bækur
christmas-books
✓'books about Christmas'
✓'books intended for Christmas'

b. jóla-bóka-flóð
Christmas-books-flood
* 'a flood of books about Christmas'
✓'a flood of books intended for Christmas'

c. jóla-bóka-flóðs-frétt
Christmas-books-flood-news.report
* 'a news report on the flood of books about Christmas'
✓'a news report on the flood of books intended for Christmas'

As in the $\sqrt{\text{GLOBE}}$ examples above, we assume that the category-defining heads in (43), the phase heads, are the locus of where it is determined whether a particular interpretation is still available.

(43)



This example indicates that the interpretation of R is in some ways similar to polysemy resolution of roots. A range of interpretations is sometimes available in a small structure but as further structure is added, the possibilities become more constrained.

5. Summary

We have developed an account of what counts as an attributive compound and which properties distinguish attributive compounds from the other main classes of compounds. Our approach assumes that an attributive compound is a compound in which the denotation of the non-head element (N1) restricts the denotation of the head element (N2) by combining with the denotation of N2 via a covert relation R that is not required by N2.

Furthermore, we developed an analysis of the structure of attributive compounds according to which the relation R is adjoined to the structure at LF. We referred to such an element as a dissociated LF morpheme. We discussed theories of the interpretation of attributive compounds, focusing on the covert relation R and the contrast between theories which assume an finite set of possibilities (Lees's solution) and theories where there are infinite possible flavors of R. We developed an analysis that draws on insights from both types of theories and utilizes Contextual Domain Restriction in addition to a finite set of relations.

Our proposal aims to unify some earlier insights, but we must admit that important questions remain open for discussion. The strongest version of our analysis would mean that the set of relations R is a small fixed number, as in Levi's (1978) analysis, and that the analysis applies universally to attributive compounds, cross-linguistically. However, it is possible that there are in fact more types of R than Levi, for example, assumes, and our empirical focus on English means that facts from other languages may require us to revise our proposal in the future. If this turns out to be the case, we are guilty of developing a falsifiable proposal.

Notes

[1]We wish to thank two anonymous reviewers and the editors for their comments that have improved the chapter. We also thank Kristín Bjarnadóttir for helpful discussions on compounds.

[2]See also at least Selkirk (1982) who takes verbal compounds to satisfy arguments.

[3]We use *meat eater* below as a representative for synthetic compounds, rather than, e.g., *tree eater*, which Selkirk (1982) discusses, as the former is less obviously ambiguous than the latter. Whereas *tree eater* can mean someone that eats trees, it could also mean someone that eats in trees. For *meat eater*, on the other hand, reading an eater of meat is clearly most salient, even though a different reading can probably be found.

[4]For a critical discussion of Bisetto and Scalise's classification, see Bauer (2017).

[5]Allen's IS A Condition is not supposed to account for the meaning part only; her condition, of which we do not go into details, assumes that the head of a compound is of the same category as the compound as a whole.

[6]For discussion on the compound type in (23), see Einarsson (1952), Marchand (1960:11), Grönke (1961) and Salus (1963).

[7]One of di Sciullo's (2005) examples is actually *golf ball* but not *tennis ball*.

[8]For Levi (1978:78), *virus infection* is the penultimate stage to derive *viral infection*, but we are interested in the attributive compound *virus infection*, however.

[9]Jespersen (1942:143), for example, states that "the number of possible logical relations between the two elements is endless." He furthermore shows the following examples: "a

goldfish looks like gold, a *gold-digger* digs for gold, while a *gold-smith* works in gold; *home-sickness* is caused by absence from home, but *sea-sickness* by the motion of the see" (Jespersen 1942:137).

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