English Language and Linguistics 8.2: 323–350. © Cambridge University Press 2004
DOI: 10.1017/S1360674304001406 Printed in the United Kingdom

Postnominal PP complements and modifiers: a cognitive distinction[1]

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(Received 2 September 2003; revised 10 May 2004)

This article addresses the thorny question of how to distinguish between complement and modifier PPs within the NP. Most of the accounts offered so far fail because they assume the distinction to be a rigid one: none of the semantic and syntactic criteria provided can be used as diagnostic tests for category membership, simply because the boundary between the two categories is not clear-cut. Instead, it is argued that the only viable way of accounting for the differences in formal behaviour between certain PPs within the NP is to recognize that this behaviour reflects a distinction at the conceptual level. Since, at the conceptual level, the distinction between 'complement' and 'modifier' is gradual (defined in terms of degree of activation), there is no basis for a strict linguistic dichotomy: therefore, the formal features of the PPs in question are to be regarded as approximations of the cognitive status of the concept in question, not as indications of all-or-none class membership. In addition to offering a more promising account of the complement–modifier distinction itself, the prototype-based approach proposed can also be regarded as providing plausible explanations for the formal differences commonly associated with (prototypical instances of) the two categories.

1 Introduction

A large amount of research on the NP has been devoted to the question of whether it is justified and feasible to distinguish two basic types of noun: those that take complements (often referred to as relational nouns) and those that do not (nonrelational nouns). The aim of this article is to explain why these attempts have failed and to offer a more promising approach based on cognitive principles.

Complements of nouns may take different forms and positions (e.g. Huddleston & Pullum, 2002: 439). They may appear in prehead position (e.g. *a first-year student, a flower seller, a legal adviser*), as well as in posthead position, in which case they take the form of a clause or a PP. It is the identification of PP complements, in particular, which has turned out to be problematic, since, superficially, these PPs appear in the same form and position as modifying PPs.[2] Nevertheless, the distinction between

[1] This article was written as part of the AHRB research project 'The English Noun Phrase: an empirical study' (Ref. B/RG/AN5308/APN10614), carried out at the Survey of English Usage, University College London. I would like to thank the project supervisor, Bas Aarts, for useful comments on an earlier version of this article. I am also much indebted to two anonymous referees for their detailed comments and useful suggestions. Any remaining errors are, of course, entirely my own.

[2] Postnominal complements in the form of a clause (as in *the fact that he didn't show up*, *the announcement that the train was delayed*) differ from modifying (relative) clauses in function as well as in their formal behaviour. Unlike PPs, distinguishing between complement and modifying clauses is, therefore, not a problem.

https://doi.org/10.1017/S1360674304001406 Published online by Cambridge University Press

complement and modifier PPs plays an important role in almost every linguistic theory, and a number of criteria, both semantic and syntactic, have been proposed to justify the (intuitively attractive) distinction. In this article I will argue that these criteria merely constitute tendencies and cannot be used as diagnostic tests for the status of the noun or any posthead PP. The reason why no hard-and-fast rules can be found is simply that the distinctions in question are not clear-cut. This, in turn, can be accounted for if we assume that these distinctions are cognitive in nature, reflecting differences in the degree of activation of the concepts evoked in the mind.

The question of how to distinguish between complement and modifier PPs in the NP has been approached from two different angles: while in semantically based theories the difference tends to be accounted for in terms of the type of head noun (relational versus nonrelational), more syntactically oriented approaches tend to concentrate on the behaviour of the postnominal PP (complement or modifier). In section 2, I will consider the semantic basis for the distinction between relational and nonrelational nouns; in this section, I will try to establish whether, or to what extent, the proposals offered are tenable. Section 3 will evaluate the criteria (both semantic and syntactic) put forward for distinguishing between complements and modifiers. Subsequently, in section 4, I will present an attempt to characterize the two distinctions in cognitive terms. I will argue that the differences between relational and nonrelational nouns, and between complements and modifiers, are best explained in cognitive terms. In particular, I will argue that the distinctions in question reflect differences in conceptualization, in the way in which knowledge is stored in and retrieved from memory. For this purpose I will introduce the notion of 'conceptual perspective'. This notion will be explained with the help of both schema-theory (section 4.2) and network models of knowledge representation (section 4.3). Against the background of prototype theory, I then hope to show that the only viable approach to the categorization of nouns as relational or nonrelational, and of PPs as complements or modifiers, is a cluster approach, in which some uses of nouns/PPs will be regarded as prototypes (best examples) of the category, while others will be seen as less central members of the category (section 4.4). Finally, section 5 will present some conclusions.

2 Relational versus nonrelational nouns

2.1 Introduction

Many linguists have commented upon the relational character of certain nouns. Fillmore (1968) was one of the first to distinguish a separate category of nouns to accommodate these elements. His class of 'inherently relational' nouns, examples of which are names of body parts and names of kinsmen, consists of nouns denoting entities which are obligatorily (or 'inalienably') possessed by some other entity (Fillmore, 1968: 61–2):

> one doesn't speak of a side, but of the side of something; one doesn't say of someone that she is a daughter, only that she is somebody's daughter . . .

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Löbner (1985: 292) takes up Fillmore's idea of a separate class of relational nouns, claiming that

> [n]ouns have two basic interpretations. Taken in isolation they can be considered either *sortal* nouns or *relational* nouns. Sortal nouns classify objects, whereas relational nouns describe objects as standing in a certain relationship to others. These are two fundamentally different ways to characterize objects, and one cannot be reduced to the other.

In addition to these two types of noun, however, Löbner (1985: 295) also distinguishes between a relational and nonrelational (or sortal) use of nouns. Relational nouns will typically be used relationally (i.e. will typically yield 'relational concepts'); they can, however, be used nonrelationally (as 'sortal concepts'). Nonrelational (sortal) nouns, on the other hand, although typically used nonrelationally, may, under certain conditions, also be used relationally (see also Keizer, 1992: 215). Thus, while preserving the semantic relational/nonrelational distinction, Löbner (1985) at the same time responds to the criticism levelled against Fillmore (1968) that, depending on the context, relational nouns can behave like any other noun.

In Löbner's theory sortal nouns simply classify objects and are, logically, one-place predicates (e.g. *woman*). Relational nouns, on the other hand, 'describe objects as standing in a certain relation to others' (Löbner, 1985: 292); they typically involve a second argument (e.g. *wife*). The relation between an argument and its 'value' (head noun) is one of possession: the argument possesses the value (a person has a nose/mother/address); conversely, the value is said to 'belong to' the argument (the nose/mother/address 'belongs to' a person). Löbner (1985: 297) recognizes, however, that this relation is not necessarily one of 'inalienable' possession; moreover, relational nouns can also be used nonrelationally. A relational noun like *mother*, for instance, can be used as a sortal concept 'if the additional argument of a two-place functional noun is implicitly or explicitly existentially bound (or left open)' (Löbner, 1985: 297). This use of relational nouns we find, for instance, when the noun is quantified or modified by a gradable adjective, as well as in nonfactual statements and in sentences focusing on the very existence of the referent; examples are given in (1a–d):

(1) (a) *Every mother* loves her child.
(b) They are *very liberal parents*.
(c) She only wanted *a daughter*.
(d) I have a brother and two sisters.

2.2 Basic relational nouns

Some nouns are like verbs in that they can be assumed to denote either a property of an argument or a relation between two (or more) arguments. Verbs are generally acknowledged to have argument (or thematic) structures, specifying the number and thematic roles of their arguments. A verb like *to laugh*, for example, has one (agentive) argument, a verb like *to read* has two arguments (agent and theme), and a verb like *to*

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give has three arguments (agent, theme, and recipient):

(2) (a) $\text{laugh}_V\ (x_i)_{Ag}$
(b) $\text{read}_V\ (x_i)_{Ag}\ (x_j)_{Th}$
(c) $\text{give}_V\ (x_i)_{Ag}\ (x_j)_{Th}\ (x_k)_{Rec}$

Nouns can be described in a similar fashion. Most nouns are like intransitive verbs: they predicate a property of the entity referred to by means of the NP of which they are the head. Such nonrelational nouns, like *woman*, can be provided with a predicate frame containing a slot for one argument; this argument is typically given the semantic function Ø (examples (3a,b)). In the case of a relational head noun, the predicate frame will contain an extra argument slot (occasionally two). These extra arguments may be regarded as the complements of the noun (much like the internal arguments of verbs). In constructions with basic (nonderived) relational nouns, the second argument may be given the semantic function Reference (as the entity with reference to which the relation is said to hold; see Mackenzie, 1983; Dik, 1997: 121). Some examples are given in (4):

(3) Nonrelational (sortal) nouns:
(a) $\text{woman}_N\ (x_i)_{\emptyset}$ a woman
(b) $\text{computer}_N\ (x_i)_{\emptyset}$ a computer
(4) Basic (nonderived) relational nouns:
(a) $\text{mother}_N\ (x_i)_{\emptyset}\ (x_j)_{Ref}$ Jane's mother
(b) $\text{side}_N\ (x_i)_{\emptyset}\ (x_j)_{Ref}$ one side of his face

The relation between a basic relational noun and second argument is typically one of inalienable possession (kinship or body part). However, following Löbner, I will assume that the class of relational nouns is not restricted to kinship names and body parts, but that other part–whole relations, like *door* (of a house), *engine* (of a car) or *lid* (of a jar) will also qualify as relational nouns, as each of these can be said to 'belong to' the related entity, despite the fact that the relationship is not one of inalienable possession.

2.3 Derived relational nouns

Most basic nouns, however, have only one argument; they usually just predicate a simple property of the intended referent. In the case of derived nouns, the number and semantic functions of the arguments depend on the type of base verb (intransitive or transitive), the idea being that they 'inherit' the arguments of the base verb.[3] A deverbal noun like *perseverance*, for instance, inherits the argument of the intransitive verb *persevere*, including its semantic function. Similarly, nouns or nominalizations derived from monotransitive and ditransitive verbs, such as *treatment* or *lending*, inherit the agent, theme and, in the case of ditransitive verbs, the recipient argument of the input verb. Prepositional objects, too, tend to be inherited by the deverbal noun, usually

[3] Unless the derived noun is fully lexicalized – e.g. *(a) meeting* – or no longer refers to the action denoted by the input verb, but to the product of that action – e.g. *(a) building.*

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along with the original preposition (e.g. *insistence on*, *deviation from*). Examples of the various types of derived relational nouns are given in (5).[4]

(5) (a) $\text{perseverance}_{N}\ (x_i)_{Ag}$ — the perseverance of his lawyer
(b) $\text{treatment}_{N}\ (x_i)_{Ag}\ (x_j)_{Th}$ — the company's treatment of its employees
(c) $\text{lending}_{N}\ (x_i)_{Ag}\ (x_j)_{Th}\ (x_k)_{Rec}$ — the lending of textbooks to students by the library
(d) $\text{deviation}_{N}\ (x_i)_{Ag}\ (x_j)_{So}$ — the artist's deviation from the established norms

Finally, inheritance of argument structures is not restricted to deverbal nouns, but is also found with deadjectival nouns. Adjectives denoting physical properties, such as *high* and *long*, typically have one argument: the entity the property is predicated of. Nouns derived from these adjectives inherit this argument. The same holds for adjectives denoting more abstract properties, such as *weak* or *inferior*. Where the adjectival input is itself relational, as in the case of *fond (of)* or *susceptible (to)*, all arguments are inherited by the deadjectival noun, together with their semantic functions and the original preposition. Examples can be found in (6).

(6) (a) $\text{length}_{N}\ (x_i)_{Ref}$ — the length of the house
(b) $\text{fondness}_{N}\ (x_i)_{\emptyset}\ (x_j)_{Th}$ — his fondness of Italian food

Obviously, there are important differences between the arguments of verbs and nouns in terms of the form, position, syntactic function, and case of the arguments. A further difference concerns the fact that the arguments of verbs are, in the majority of cases, obligatory and need to be explicitly expressed, whereas in the case of nouns it is much easier to omit any arguments, although this may vary from noun to noun and from occasion to occasion (see e.g. Mackenzie, 1985a, 1985b, 1996). This means that the presence or absence of an argument cannot be used as a reliable test for distinguishing between relational and nonrelational nouns. Moreover, since relational nouns can be used nonrelationally, and vice versa, the semantic definition of relational nouns as nouns which require the presence of a complement becomes difficult to maintain. Finally, it will be clear that the semantic relation between a derived relational noun and its argument(s) is typically not one of possession. We may therefore conclude that characterizing relational nouns as nouns which need the presence of an argument, and the relation between noun and argument as one of possession, is clearly inadequate to sharply delineate the class of relational nouns from the class of nonrelational nouns.

3 Complements versus modifiers

3.1 Introduction

Instead of relying solely on the semantic characterization of head nouns as either relational or nonrelational, some linguists have concentrated on the formal behaviour

[4] An obvious exception are deverbal *-er* nouns (person, participant or first argument nouns), such as *teacher*, *successor* or *runner*, where the first (typically agent) argument of the input verb functions as the first (zero) argument of the derived noun (i.e. its denotation).

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of posthead PPs to determine the status both of the head noun and the PPs in question. In this section we will look at some of these attempts to formulate diagnostic tests for distinguishing between complement and modifier PPs.

In his discussion of the difference between complements and modifiers in the NP, Huddleston (1984: 262) describes complements as generally corresponding to arguments of a semantic predicate expressed in the head noun, while modifiers generally give properties of what is denoted by the head. In addition to a general semantic definition, Huddleston (1984) and Huddleston and Pullum (2002) also provide a number of criteria to differentiate between complements and modifiers. Some of these are of a semantic nature, concerned with the semantic roles of the arguments, the selection restrictions of the head, and the licensing of complements by the head. These tests will be evaluated in section 3.2. The majority of tests, however, are of a syntactic character. Section 3.3 will discuss the syntactic tests proposed by Radford (1988) – which largely coincide with the ones proposed by Huddleston (1984) and Huddleston and Pullum (2002) – as well as Fries's (1999) evaluation of these tests.

For all of these tests, it will be shown that they cannot be used as criteria for determining the status of the postnominal PP; as we will see, however, they fail for different reasons.[5] In some cases it can be shown, on the basis of numerous counterexamples, that the predictions made are simply incorrect. This is true for most of the syntactic tests (the last four to be discussed). In other cases, the failure is of a more problematic kind: it can be demonstrated that the evidence presented does not prove the test to be valid; at the same time, however, the test cannot be falsified. This seems to be true for the three semantic tests to be discussed, as well as for the first two syntactic tests. The former, as we will see, are based on intuitions which seem to be generally shared, but which cannot be proven to be correct on the basis of the evidence provided. As for the first two syntactic tests, it appears that the observations involved are correct, but that the syntactic behaviour described can nevertheless not be used as a criterion for complement status, either because the differences observed can be attributed to other factors, or because the observations in question are themselves based on the complement–modifier distinction and cannot, therefore, be used as a test for this distinction.

3.2 Semantic tests

According to Huddleston (1984: 260ff.) and Huddleston and Pullum (2002: 440ff), complements within the NP differ from modifiers in the following respects:

(a) Semantic roles of the complements depend on the head noun
Since complements are semantic arguments of the head noun, their semantic roles are fixed and determined by the head noun. In this respect nouns serve the same function within the NP as verbs within the predication. Whereas in predications the semantic

[5] I am grateful to one of the anonymous referees of this paper for bringing this point to my attention.

https://doi.org/10.1017/S1360674304001406 Published online by Cambridge University Press

roles of the subject and object(s) depend on the meaning of the verb, in noun phrases, Huddleston and Pullum (2002: 443) argue, it is the head noun which determines the roles of the genitive NP and PP complements. The example they use is that of *the resignation of the secretary*, where *the secretary* is the agent, and *the assassination of the secretary*, where *the secretary* is the theme.

There are, however, plenty of cases where the head noun does not seem to act in this way. Where the complement takes the form of a genitive NP, for instance, the semantic role often remains undetermined. This is true even for the nouns used by Huddleston and Pullum: in the noun phrase *the secretary's assassination*, *the secretary* may be either the agent or the theme.

Moreover, in the case of modifiers, too, the semantic role of the PP may be determined by the head noun. In a construction like *a man with a mansion*, for instance, the semantic role of the modifier will be that of 'entity possessed by the head', whereas in a construction like *a park with a mansion* the same PP will be interpreted as indicating 'entity contained by the head'. Instead of saying that the head noun in these cases determines the semantic role of the modifier, a common way of accounting for this difference is to assume that the preposition *with* has (at least) two different senses (see also (c) below), and, consequently, that it is the preposition which is responsible for the different interpretations of the PP. In that case, however, one might just as well argue that the preposition *of* , too, has different senses.

The same is true for genitive constructions, where the range of semantic relations between the genitive NP and the head is huge (see Huddleston & Pullum, 2002: 473). In some cases, the genitive will be analysed as a complement (*John's sister, John's nose*), in other cases as a modifier (*John's swimming pool, John's chauffeur, John's students*). In all these cases, the semantic relation between head and genitive NP depends on the meaning of the head noun (in combination with further linguistic and extra-linguistic information).

(b) Semantic selection restrictions in NPs involve complements

Huddleston and Pullum explain this property of complements as follows:

> This property too is a natural consequence of the semantic argument status of complements. A spire is an inherent part of a building, and this imposes a semantic relation restriction on the denotation of the complement. While we can have *the spire of the cathedral*, we cannot have #*the spire of the rocket* or #*the spire of Mary*. Similarly a speech can only be made by a person, so we have *the speech by the mayor*, but not #*the speech by coffee*. (Huddleston & Pullum, 2002: 443)

Selection restrictions within the NP do not, however, involve only complements. Thus, we can have *the (mayor's) speech at the conference* (where *at the conference* will generally be regarded as a PP modifier), but not #*the (mayor's) speech in my coffee*. Likewise, we can have *a table with three legs*, but hardly #*a table with ten toes*. Moreover, even in the case of complements, the selection restrictions imposed by the noun may not be as strict as implied. Thus *the spires of Wren* is acceptable, as is *the spires of Amsterdam*, since spires are designed by architects and can be found in

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towns. Finally, although selection restrictions may be strict in cases like *spire*, there are numerous cases where the relational noun is so general or abstract that it hardly imposes any restrictions at all (e.g. *part*, *aspect*, *form*, *sort*).

(c) Complements must be licensed by the head noun

This is clearest in constructions with 'content' nouns like *fact*, where the type of clausal complement is determined by the head noun: we can have *the fact that John was late*, but not **the fact whether John was late*. With PP restrictors the distinction is somewhat more problematic, since all PPs, whether complements or modifiers, have the same outward appearance. Here, however, the difference is claimed to reside in the fact that in the case of complements the head noun determines the choice of preposition (or the limited range of permitted choices). The default preposition is *of*, and this is often the only possibility, as in *the king of France* (Huddleston & Pullum, 2002: 440). In some cases, particularly with deverbal nouns, some other preposition is selected (as in *reliance on*, *collaboration with*).

Although it is certainly true that in the case of complements the choice of preposition seems to be more restricted, this choice can hardly be used as a criterion for complement status of the PP. One problem concerns the fact that relational nouns can also be used nonrelationally, in which case they allow for a whole range of prepositions. Thus, apart from *the king of France*, we can also have *the king with the long beard*, *the king on the painting* or *the king in France*. Now, of course, one can argue that we here have prepositions other than *of* because the head is used nonrelationally, and the PPs function as modifiers. But this means that we have to establish in which of these cases the head functions as a relational noun, and the PP as a complement, and in which cases the head is used nonrelationally and the PPs function as modifiers. We cannot, however, use the choice of the preposition as a test, as this would amount to circular reasoning.

A further complication is presented by the fact that one and the same preposition can be used to introduce both complements and modifiers. We can have *the king of France*, as well as *a king of wood* or *a king of considerable intelligence*; we can have *the book on physics* as well as *the book on the table*. According to Huddleston (1984: 264), however, we are dealing with two different classes of prepositions: modifiers are introduced by lexical prepositions, while complements are introduced by functional (or grammaticalized) prepositions (see also Huddleston & Pullum, 2002: 653ff.). In (7a), for instance, *on* has no obvious meaning of its own but is, rather, determined by the head nouns *reliance* and *book*; in (7b), on the other hand, *on* has its ordinary locative meaning.

(7) (a) her reliance on her father; a book on physics
(b) the book on the table

Apart from such clear cases, the distinction between lexical and functional prepositions is, however, hard to make. This is first of all due to the fact that it is not always possible to establish the lexical meaning of a preposition. The best example is, presumably, the preposition *of*, which at an early stage lost its original locative meaning

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(close to *away/from*, indicating source) and has since developed a host of meanings, including geographical origin, possession, part-of, attribute-of, type-of, quantity-of, and depiction-of (Huddleston & Pullum, 2002: 658; see also 477; Lindstromberg, 1997: 195). Thus, in its present-day use, *of* does not seem to have a literal (spatial) meaning; nor is it at all clear which of its uses is to be regarded as prototypical. Nevertheless, it is generally acknowledged that *of* can introduce both complements and modifiers. In the examples in (8), for instance, the *of*-PPs are usually regarded as complements; those in (9), on the other hand, are taken to function as modifiers.

(8) (a) the sister of Mary
(b) the house of her former husband
(c) the spire of the cathedral
(d) a glass of water
(e) the death of the emperor
(f) the conquest of Persia

(9) (a) the wines of France
(b) a man of honour
(c) a girl of a sunny disposition
(d) a boy of sixteen
(e) a frame of steel
(f) a matter of no importance

In (9), Huddleston and Pullum (2002: 659) argue, the preposition *of* is not selected by the head and thus makes an independent contribution to the meaning. This claim may be justified for example in (9a), where *of*, indicating geographical origin, comes closest to having its original locative meaning. It may also be justifiable in (9b), where, as pointed out by Huddleston (1984: 264), *of* can be paraphrased by means of the (lexical) preposition *with* and alternates with *without* (*a man of/without honour*). In examples (9c–f), however, it is much more difficult to maintain that *of* contributes independently to the meaning of the construction. In all these cases the lexical meaning of *of* seems to be much more elusive than, for instance, its meaning in examples (8b,c), where the semantic contribution of the preposition (possession, part-of) is much more tangible.[6]

A more promising approach is one in which the various meanings of prepositions are viewed as sharing some basic sense. Cognitive linguists in particular have been interested in the polysemy of prepositions and the relations between their various senses. In their view, the various meanings of a preposition are not separate, discrete memory units, but together form a motivated semantic network organized with respect

[6] That it is often difficult, particularly in constructions with the preposition *of*, to determine the status of the PP, is shown by the fact that Huddleston and Pullum are not consistent in their treatment of these PPs. Thus, whereas the *of*-PPs in (9) are classified as modifiers (Huddleston & Pullum, 2002: 659), the constructions in (i) are treated as monovalent constructions, i.e. as constructions with one complement (Huddleston & Pullum, 2002: 475, 477).

(i)(a) the dress of washed silk
(b) the girl of twelve years
(c) the men of honour

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to a primary (or prototypical) sense (Tyler & Evans's (2001) 'protoscene'). These networks form continua of meaning: additional meanings are represented as little or far removed from the prototype, depending on the degree of deviation from the prototype (Tyler & Evans, 2001: 725). It will be clear that such an approach does not recognize a separate class of functional prepositions; instead the 'functional' or 'nonlexical' uses of a preposition are simply seen as peripheral members of the set of related senses of that preposition.

Let us consider the preposition *over*. For Tyler and Evans (2001: 735), the protoscene of *over* involves a locand (the element located and in focus) and a locator (the element with respect to which the locand is located and in background), with the locand typically being smaller and moveable, and the locator larger and immovable. Examples are given in (10).

(10) (a) the picture over the mantel
(b) the lamp over the table
(c) the stars over our heads

Additional meanings of *over* include both locative meanings and more abstract meanings (Tyler & Evans, 2001: 746ff). Examples of the former are the meanings of 'covering' (11a) and 'on the other side of' (11b). More abstract meanings include 'focus of attention' and 'control', examples of which are given in (12a,b), respectively.[7]

(11) (a) There is a particular range of values for the greenhouse effect where the Earth can exist quite happily either with or without *an icecap over the Arctic Ocean*. <ICE-GB:W2B-025 #58:1>
(b) . . . it was on the pinky-grey editorial floor of *the paper's new building over Chelsea Bridge* <ICE-GB:W2B-015 #4:1>
(12) (a) Equally important are *the profoundly moral arguments over the origin of life*, the status of the embryo and the freedom to experiment on and then destroy human life in its first fourteen days <ICE-GB:S1B-060 #2:1:A>
(b) Thus Nellie, who has been unable to acquire much power in journalism or politics, creates for herself *a perverse hold over Caroline*. <ICE-GB:W2B-009 #112:1>

Even in these abstract cases, however, the meaning of *over* is related to the primary sense of the preposition. The 'focus of attention' uses are derived from the primary sense via the sense of 'examining', as in *to look over something* or *to glance over something*, which, like the 'control' sense, shares with the primary sense the element of vertical elevation. Moreover, within the semantic network representing the senses of *over*, these abstract meanings are not necessarily further removed from the central cases than the more literally spatial ones: each of these uses of *over* has a clear meaning, derived from the central case. Therefore, there seems to be no justification for classifying these uses of *over* as functional. Nevertheless, the PPs they introduce are typically analysed as complements (examples in (12)).

[7] The authentic examples used in this article are from the ICE-GB Corpus, a one-million-word corpus, tagged and parsed, of spoken and written English composed at the Survey of English Usage, University College London.

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The opposite is also true: modifiers are not always introduced by lexical prepositions. We have already considered the case of *of*, where it proved to be difficult to establish the lexical meaning in the first place. In other cases, however, the lexical meaning can be established without too much difficulty; but it is not this lexical (literal, most concrete) meaning which is most frequently found in PP-modifiers. Take, for instance, the preposition *by*. Its primary sense is a locative one, indicating proximity in the horizontal plane (Lindstromberg, 1997: 141; Huddleston & Pullum, 2002: 655), which we do, indeed, occasionally find in PP-modifiers, as in (13a). Most uses of *by* when used to introduce PP-modifiers, are, however, clearly metaphorical. Sometimes this is inevitable on account of the abstract nature of the head, as in examples (13b–e), where it conveys manner, cause, route of access, and mode of transport, respectively. In other cases, the head noun has a concrete denotation; nevertheless the use of *by* is clearly metaphorical, despite the fact that we are dealing with PP-modifiers (13f).

(13) (a) The belt smashed into *the table by his side* and his whole body flinched. <ICE-GB:W2F-001 #135:1>
(b) It's *centralisation by stealth* <ICE-GB:S1B-033 #90:1:F>
(c) In 1946 Harold Laski sued the Newark Advertiser for stating that he advocated *revolution by violence.* <ICE-GB:W2B-015 #94:1>
(d) *Access by sea* is straightforward given the recognized hazards of the time such as storm wreck and piracy <ICE-GB:S2B-043 #12:1:A>
(e) Commuters in Athens pay just 30p for *a similar trip by tube, bus or train*. <ICE-GB:W2C-020 #118:7>
(f) Douglas Hurd *a quiet man by nature a diplomat by training* couldn't resist pointing out on Guy Fawkes Day that he'd had enough of the explosions of the past few days <ICE-GB:S2B-007 #16:1:C>

In sum, distinguishing between lexical and functional prepositions or uses of prepositions is problematic because the distinction is graded. Although, with the possible exception of *of*, it may not be too difficult to establish the most straightforward lexical uses of a preposition, there seems to be little reason for distinguishing a separate, discrete category of functional prepositions. Each preposition has a large number of derived literal and metaphorical uses, extending from its primary sense. Although there may be a tendency for the preposition introducing a PP-modifier to convey a more literal meaning (but no more than a tendency, given the numerous counterexamples), the meanings of the prepositions introducing what are generally regarded as PP-complements are by no means nonlexical (without a meaning of their own). The lexical/functional distinction, even if tenable, can therefore not be considered a reliable test for the complement/modifier distinction.

3.3 Syntactic tests

As semantic criteria failed to provide a reliable basis for the distinction between complement and modifier PPs within the NP, linguists concentrated on finding differences in syntactic behaviour. This has resulted in a number of formal tests for the complement/modifier status of PPs.

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(a) Number of complements/modifiers

Huddleston (1984: 261) observes that while 'the number of complements in any one NP is strictly limited', 'there is no grammatical limit to the number of posthead modifiers occurring in a single NP, but considerations of style and comprehensibility will normally keep them to one or two' (1984: 264; cf. Fries, 1999: 97). In (14a), for instance, the head noun *author* has one posthead complement; in (14b), the head noun *criticism* has two (assuming the *for*-PP to have complement status); while (14c) may be regarded as having three (although the complement status of the *for*-PP may again be arguable).

(14) (a) the author of both books
(b) his criticism of the book for its repetitiousness
(c) his purchase of the land from the Government for £10,000
(Huddleston, 1984: 261)

True as this may be, it means that the number of PPs in a noun phrase does not tell us much about their status: whether they be complements or modifiers, the upper limit is about three. Moreover, since complements and modifiers may co-occur, one and the same head may actually have up to five or six posthead PPs, as exemplified in (15), which can be analysed as containing a head noun *collision* followed by one PP-complement (*between two cars*), two PP-modifiers (*on the A259*; *near Worthing*) and one NP-modifier (*last night*). In view of the fact that complements need not be closest to the head and need not always be expressed, the fact that *collision* can only have a limited number of complements does not help us to determine which of the posthead PPs in (15) function as complements and which as modifiers.

(15) . . . a collision between two cars on the A259 near Worthing last night . . .
<ICE-GB:S2B-009 #49:1:A>

Radford's (1988) claim concerning the number of complements and modifiers within one NP is similar to that of Huddleston, although somewhat more explicit. Using the X-bar framework, Radford accounts for the unacceptability of (16c) (as opposed to (16a,b)) by assuming that the rule generating adjuncts (modifiers) is recursive while the rule introducing complements is not. Consequently, whereas indefinitely many modifying PPs can be 'stacked' on top of each other, this is not possible in the case of complements. Moreover, this difference between complements and modifiers would predict that PP modifiers can occur in any order, a prediction which seems to be borne out by examples (16a,b):

(16) (a) the student [with long hair] [in the corner]
(b) the student [in the corner] [with long hair]
(c) *the student [of physics] [of chemistry]

These observations can, of course, easily be accounted for in semantic terms. Once the argument positions of a relational noun have been filled, the noun and its arguments together cannot take another argument, i.e. saturated relational nouns form nonrelational concepts. In other words, while *mother* is a relational noun requiring one

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complement, the construction *mother of Jane* is a nonrelational concept; as such we cannot have **mother of Jane of John*.

The main problem with using the unacceptability of (16c) as proof of the complement status of the PPs *of physics* and *of chemistry* is that it requires us to recognize the head as a relational noun and the PPs as complements to start with. Without the knowledge that *student* is a relational noun accepting only one argument, and that both *of physics* and *of chemistry* function as complements here, we cannot attribute the unacceptability of (16c) to the fact that there are restrictions on the number of complements in any one NP. The reason for this is that it is not the form or position of the PPs here, or even their number, that causes the unacceptability, but the fact that we are unable to construe a meaningful semantic relation between the second PP and the part it modifies. This, however, is due to the semantic content of the PP in question, not to any formal features. As shown in examples (17a–c), it is perfectly acceptable to have more than one *of* -PP in an NP, as long as the second (third, etc.) *of* -PP can be interpreted as a modifier stacked onto the preceding part (example (17a)), or as a complement or modifier nested within the subsequent PP(s) (examples (17b,c), respectively).

(17) (a) a student of physics of high intelligence
(a′) a [[student [of physics]] of high intelligence]
(b) . . . a notable absence of true pictures of the atrocity of war . . .
<ICE-GB:S1B-031 #54:1:C>
(b′) a [notable absence of [true pictures of [the [atrocity of war]]]]
(c) the lives of people of high intelligence
(c′) the [lives of [[people] of high intelligence]]]

Moreover, in the absence of a meaningful relation between a PP and the part it modifies, any sequence of PPs will be unacceptable, irrespective of the status of these PPs. This is illustrated in example (18), where the two modifying PPs contain contradictory information.

(18) (a) *?a student from Japan from India
(b) *?a house in London in Berlin[8]

[8] As pointed out by one of the referees of this article, these examples can be made to work in the proper context. Example (18b), for instance, would be acceptable in the following context (cited by the referee):

> We're having to use slightly different graphic designs depending on where we market our new 'London Underground' computer game because of the differing preconceptions of players in those locations. For example, a house in London in Berlin has to look different from a house in London in London, because Berliners have a stereotyped idea of what London looks like, while real Londoners know better.

It will be clear, however, that in this context the two PPs in the construction *a house in London in Berlin* do not fulfil the same semantic function with regard to the head noun; consequently, the information provided is not contradictory. In fact, neither PP of these PPs fulfils the function normally associated with this type of PP, that of physical location of the entity denoted by the head noun. Thus the first PP, *in London*, here functions to indicate a type of house, not its physical location, while the second PP, *in Berlin*, indicates the place where the stereotyped idea referred to is assumed to be located. This difference is reflected in the scope relations: the first PP, which has a qualifying function, is closer to the head and within the scope of the second operator, the locator. This, then, also explains why the NP *a house in London in London* is not redundant in this context.

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In other words, although it is certainly true that there are limits on the number of complements within an NP, this feature of complements cannot be used as a diagnostic test for the complement status of PPs.

(b) Co-ordination

Radford's (1988: 190) claim that it is impossible to co-ordinate complements with modifiers is entirely correct. When a head noun is followed by a complement and a modifier (irrespective of their relative order), the complement will be in the scope of the modifier. Since co-ordination is only possible between two elements with identical scope, complements can be co-ordinated (as shown in (19a)), as can modifiers (19b), but complements and modifiers cannot (19c,d):

(19) (a) a student *of Physics* and *of Chemistry*
(b) a student *with long hair* and *with short arms*
(c) *a student *of Physics* and *with long hair*
(d) *a student *with long hair* and *of Physics* (Radford, 1988: 190)

However, since it is not always possible to co-ordinate two complements or two modifiers either, this syntactic feature cannot be used as a test for the complement or modifier status of a PP. As Fries (1999: 101) points out, complements can only be combined when they are introduced by the same preposition; thus, whereas examples (20a,b) are acceptable, example (20c) is not. When the two PPs have different semantic roles, the result is even worse (20d).

(20) (a) a change *in volume* and *in consistency*
(b) a change *of volume* and *of consistency*
(c) *a change *in volume* and *of consistency*
(d) *the division *of European history* and *into national histories*
(Fries, 1999: 101)

Moreover, modifiers cannot always be co-ordinated either, which suggests that some PP modifiers (e.g. locative ones) must be interpreted as taking other PP modifiers (e.g. qualifying ones) in their scope. This is illustrated in (21):

(21) (a) a book *for children* and *of great importance*
(b) *a book *of comics* and *on the table*
(c) *a man *of discretion* and *from Japan*
(d) *a girl *of sixteen* and *with long hair*

Therefore, although the prediction made by Radford is correct, it is once again not possible to use the formal behaviour of co-ordinated PPs as a test for complement or modifier status of the PPs in question.

(c) Scope of anaphora

For Radford (1988) the difference between complements and modifiers is a structural one: while complements combine with a noun (N) to form an N-bar constituent, modifiers attach to N-bar constituents to form new N-bar constituents. Since the pronoun *one* is regarded as an N-bar pronoun, it should be possible for *one* to co-occur with modifiers, but not with complements. The examples provided by Radford

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(1988: 189), given in (22), confirm the first part of the prediction; Radford does not provide examples to support the second part of the claim.

(22) (a) Which [student]? The *one* with long hair in the corner?
(b) Which [student with long hair]? The *one* in the corner?
(c) Which [student with long hair in the corner]? That *one*?

Huddleston and Pullum (2002: 440–1), too, assume that the indefinite pronoun *one* takes as its antecedent a noun together with its complements. This, then, would account for the fact that the primeless examples in (23) are impeccable, whereas the primed examples 'show various degrees of infelicity' (Huddleston & Pullum, 2002: 441):

(23) (a) I prefer *the poems in Part I* to *the ones in Part II*.
(a′) ?I prefer *the poems of Goethe* to *the ones of Schiller*.
(b) This key is identical to *the one in the door*.
(b′) ?I have the key to the basement but not *the one to the attic*.
(Huddleston & Pullum, 2002: 441)

Once again, however, this claim is far too strong. First of all, the differences between the primeless and primed examples in (23) are so slight that they do not support the claim that *one* can only replace a head noun and its complement(s); in that case, (23a′) should have been uninterpretable. Secondly, as pointed out by Huddleston and Pullum (2002: 441), *one* can be used to replace a head noun without its complement(s) if this head noun is a deverbal noun; hence the examples in (24) are perfectly acceptable:

(24) (a) I support the ban on smoking, but not *the one on alcohol*.
(b) The proof of Pythagoras' theorem is more clearly formulated than *the one of Parseval's equality*. (Huddleston & Pullum, 2002: 441)

There are, however, also plenty of cases where *one* replaces a basic head noun without its complement(s). Some examples are given in (25); note that in each case the pronoun takes its own complement.

(25) (a) A: How come you gotta 've got to do twelve. There's only six.
B: Only do *six essays* not twelve . . . .
A: I'd uh like to do *one on process*
<ICE-GB:S1A-053 #60:1:A>-<ICE-GB:S1A-053 #80:1:A>
(b) she was showing me *some photographs of uh herself and John* in the Lake District and uh oh *various ones of Chris and Zoë* and uhm also some of the cottage <ICE-GB:S1A-009 #112:1:A>
(c) It is a beautiful image which is presented here, it is *one of longing*.
<ICE-GB:W1A-018 #61:1>-<ICE-GB:W1A-018 #62:1>

Moreover, although it is true that the use of pronominal *one* in combination with a posthead PP may yield a marked construction, it is not at all clear that this difference in acceptability can be attributed to the complement–modifier distinction. Thus it appears that other factors, too, can influence the acceptability of *one* followed by a complement. One of these concerns the definiteness of the NPs in question. Consider the examples

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in (26):

(26) (a) Which watch? – The one of gold/The watch of gold.
(a′) What kind of watch? – One of gold/A watch of gold.
(b) Which loss? – *?The one of faith/The loss of faith.
(b′) What kind of loss? – One of faith/A loss of faith.

The markedness of the first answer in example (26b) is not so much caused by the fact that *loss* here is followed by a complement; after all, *loss* is a deverbal noun and should as such allow for the presence of a posthead complement (cf. example (24)). Moreover, example (26b′), with an indefinite NP, is perfectly acceptable.

I will not pursue these issues in further detail here. The examples provided suffice to show that the claim that *one* must replace the head noun together with its complements, and as such cannot be followed by a complement, is too strong and cannot be used as a diagnostic test for the complement or modifier status of a posthead PP.

(d) Relative ordering of complements and modifiers

According to Radford (1988: 177), complements will always be closer to their head than modifiers. The following examples (from Hornstein & Lightfoot, 1981: 22), he claims, show this prediction to be correct:

(27) (a) the student of Physics with long hair
(b) *the student with long hair of Physics

Huddleston and Pullum (2002: 454) are more tentative in their claim: according to them posthead complements have a tendency to follow the head noun directly. Whether or not they do depends, however, on their 'weight' (as determined by the length and complexity of a constituent). They therefore propose the following constraints:

(28) (a) Light posthead complements > Posthead modifiers
(b) Light dependents > Heavy dependents

The constraints in (28) predict that where two PPs are both light, the complement normally precedes the modifier; when the complement PP is heavy and the modifier light, the modifier tends to precede the complement; and when both PPs are heavy, both orders are acceptable. Huddleston and Pullum emphasize, however, that the ordering constraints merely give the preferred order in the default case and that violation of the constraints, although typically reducing the acceptability of an expression, may be justified by considerations of scope and information packaging (Huddleston & Pullum, 2002: 452). Thus it is not only the Principle of End Weight that may influence word order, but also that of End Focus.

Finally, complements, whether heavy or light, salient or nonsalient, can follow a PP-modifier when ambiguity may arise about the scope of the PP in final position (see also Fries, 1999: 96). A simple example is given in (29), where the choice between the two orders is determined by the scope of the modifier *in Britain*, which, in final position, can be taken to modify either *fear* or *attack*.

(29) (a) the fear of a terrorist attack in Britain (ambiguous)
(b) the fear in Britain of a terrorist attack

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(e) Extraposition[9]

The last two formal differences between complements and modifiers given by Radford concern the freedom of movement of these elements within the clause. In both cases, however, the wording is remarkably hedged. The first of these differences concerns the possibility of extraposition, which, according to Radford (1988: 191), is allowed 'more freely' by modifiers than by complements. He illustrates this by means of the examples in (30).

(30) (a) *A student* came to see me yesterday *with long hair*.
(b) **A student* came to see me yesterday *of physics*.

It will be clear, however, that Radford's statement is too tentative to be useful as a diagnostic test. Moreover, no explanation is offered of what is meant by 'more freely': which complements or modifiers do allow for extraposition, and which do not; and under which circumstances? That the tentativeness expressed is, indeed, fully justified is shown by the numerous counterexamples to Radford's claim. Thus, as shown by the examples in (31), modifiers cannot always be extraposed:

(31) (a) *A student from Japan* borrowed a book yesterday.
(a′) *?*A student* borrowed a book yesterday *from Japan*.
(b) *A student of considerable intelligence* came to see me yesterday.
(b′) *?*A student* came to see me yesterday *of considerable intelligence*.
(c) *The student with long hair* came to see me yesterday.
(c′) **The student* came to see me yesterday *with long hair*
(d) *Sheets of silk* were on the bed.
(d′) **Sheets* were on the bed *of silk*.
(e) *A girl of sixteen* came to see me yesterday.
(e′) *?*A girl* came to see me yesterday *of sixteen*.

Moreover, there is little to stop complements from being extraposed, given the appropriate circumstances. In example (32a), for instance, the extraposed complement PP is very long and complex. This is not necessarily the case, however. Thus, in (32b) the extraposed PP is relatively short and simple; as in (32a), however, this PP presents new or otherwise focal information, while the information value of the verb is relatively low.

(32) (a) *A hunt*'s begun *for two gunmen who burst into a pub in South London and opened fire on drinkers killing two* <ICE-GB:S2B-016 #3:1:A>
(b) I had *a very frank talk with him* the following morning *about offices* when as you rightly say he was not disposed to offer me the Foreign Secretaryship <ICE-GB:S1B-040 #37:1:D>

(f) Preposing

Radford's last formal difference between complements and modifiers, concerning preposing, suffers from the same weakness as his observation about extraposition

[9] In what follows I will use the terms extraposition and preposing as these are the terms used in the original proposals. This does not, however, mean that I commit myself to the theoretical assumptions of the frameworks from which they originate.

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in that, once again, we are dealing with a tendency rather than a hard-and-fast rule. Radford's prediction is that complements more easily allow preposing of the embedded NP than do modifiers (Radford, 1988: 191).[10] The difference is illustrated in (33).

(33) (a) *What branch of physics* are you *a student of*?
(b) **What colour of hair* is he *a student with*? (Radford, 1988: 191)

A similar claim can be found in Huddleston (1984: 264), who observes that in NPs like the ones in (34a,b), it is possible to prepose the PP (or part of it) if the PP is a complement (34a′), but not if it is a modifier (34b′).

(34) (a) He was *king of England*.
(a′) *What country* was he *king of*?
(b) He was *a king of considerable intelligence*.
(b′) *How much intelligence was he *a king of*?

According to Davies and Dubinsky (2003), however, the possibility of preposing (in their case *wh*-extraction from an embedded NP) depends on the type of head noun, as well as on whether the construction as a whole is definite or indefinite. Following Grimshaw (1990), Davies and Dubinsky recognize three types of nominal: complex event nominals, result nominals, and concrete nominals. Complex event nominals (e.g. *destruction* or *subordination*) denote events (can be modified by *frequent*); as such they have argument participants. Result nominals, on the other hand, do not denote events (e.g. *victory* and *triumph*); they may take overt participants, or else imply participants, but these participants are not grammatical arguments. Concrete nominals (e.g. *dog*, *car*) do not have participants.

According Davies and Dubinsky, these classes of noun differ with regard to the possibility of *wh*-extraction. Complex event nominals always allow extraction of their participants, as shown in example (35a). Concrete nominals, on the other hand, never permit extraction, as illustrated by example (35b). Result nominals do allow extraction of their participants, but only when the construction is indefinite. This is shown in example (35c).

(35) (a) *What* did they observe/hear about/remember/decry *the production of*?
(Davies & Dubinsky, 2003: 15–17)
(b) **Which wood* was Gene hoping to find *a table of* for the kitchen?
(Davies & Dubinsky, 2003: 16–18)
Who were the Phillies hoping for *a/*the/*that victory over*?
(c) *What subject* was the student hoping to pass *an/some/*the/*that examination on*? (Davies & Dubinsky, 2003: 16–19)

Even with these elaborations, however, the criterion of preposing fails to cover all cases. In (36a), for instance, the derived noun *reliance* should count as a complex event nominal (as shown by the fact that the modifier *frequent* can be used); nevertheless,

[10] Note that Radford's claim concerns the NP embedded within the complement PP, not, as we are given to understand by Fries (1999: 104), the complement PP itself.

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wh-extraction leads to an unacceptable result (unless, perhaps, as an echo-question, with strong emphasis on *who*).

(36) (a) I resent *her (frequent) reliance on her father*.
(a′) *?*Who* do you resent *her (frequent) reliance on*?

In this section, previous attempts to distinguish a separate class of relational nouns have been shown to be inadequate. First of all, it has been demonstrated that the semantic definition of relational nouns as nouns which cannot be used by themselves, without reference to some other entity to which it must be related in a specific way, does not suffice to distinguish a separate class of nouns. The first complicating factor concerns the fact that so-called relational nouns can be used nonrelationally, while many apparently nonrelational nouns can be used relationally. Moreover, the relation between relational nouns and their argument(s) proves difficult to define.

The alternative approach of distinguishing the status of posthead PPs on the basis of a number of clear-cut criteria has proved equally unsuccessful. In some cases this is due to the fact that the observed differences in behaviour have been shown to be tendencies and, as such, cannot be captured in hard-and-fast rules. In other cases, the intuitions and observations recorded seem to be correct, but cannot be shown to be so on the evidence available. There is, however, no reason to assume that the differences in formal behaviour between PPs within the noun phrase are not real, or that the complement–modifier distinction is not valid (cf. Huddleston, 1984: 264). What we *can* say is that it is futile to look for strict formal criteria for the classification of PPs as either complements or modifiers.

4 A cognitive approach

4.1 Introduction

It will be clear that, even though the differences in formal behaviour between postnominal PPs cannot serve as reliable criteria for distinguishing complement PPs and modifier PPs, the tendencies and intuitions described still need to be accounted for. That is to say, any account of the differences in form and function of postnominal PPs should at least explain:

(a) why some postnominal PPs are more easily omitted than others;
(b) why some head nouns are typically followed by PPs fulfilling a particular semantic role; why the number of such PPs is restricted;
(c) why some postnominal PPs can be co-ordinated whereas others cannot;
(d) why the indefinite pronoun *one* combines more easily with some PPs than with others;
(e) why some PPs are more restricted in terms of the position they can take (in the NP or the clause) than others.

In this section I will argue that the answers to these questions are best given in cognitive terms. In particular, I will argue that the distinctions in question reflect differences in conceptualization, in the way in which knowledge is stored in and retrieved from

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memory. For this purpose I will introduce the notion of 'conceptual perspective'. Moreover, I hope to show that the only viable approach to the categorization of nouns as relational or nonrelational, and of PPs as complements or modifiers, is a cluster approach, in which some uses of nouns/PPs will be regarded as prototypes (best examples) of the category, while others will be seen as less central members of the category. Finally, I will suggest that the prototype-based approach proposed is also better equipped to account for the differences in formal behaviour between prototypical PP complements and modifiers.

4.2 The conceptual perspective

In schema-theory, the basic units in the storage and retrieval of human knowledge extend beyond the meaning of individual lexical items. Instead, words, or a combination of words, activate schemata, i.e. data structures for representing generic concepts in memory (Anderson, 1977: 68; Rumelhart & Ortony, 1977: 101). These schemata – which I will refer to as general knowledge structures – represent the way in which we conceptualize objects, situations, events, etc. They have been shown to play an important role in the comprehension of information, the acquisition of knowledge, the process of making inferences, etc.

General knowledge structures (henceforth GKSs) are structured in that they contain a hierarchical network of interrelations among their various constituents, which may themselves be knowledge structures. Given the associative nature of our memory, this is what typically happens: an activated knowledge structure will evoke a number of related knowledge structures, which in turn will call up yet other structures. This may be assumed to continue until some 'primitive' attribute is reached, or until the relation has become so indirect and tenuous that no further information is activated. At the top level, on the other hand, we are likely to find information that will (almost) invariably be part of a particular knowledge structure – that is, the kind of stereotypical knowledge gained through previous experience and used to structure and comprehend similar situations.

For example, a linguistic cue like *church* will automatically evoke a knowledge structure comprising its various parts, as well as any general cultural background information we have about churches. As such, at the top level, it will presumably have a slot for 'spire'. Similarly, mention of the word *spire* will automatically evoke a larger knowledge structure of, for instance, 'church', as well as any general information we may have about spires (and churches). However, although *church* and *spire* evoke each other, there is an important difference in conceptualization – a difference I will refer to as a difference in 'conceptual perspective': whereas *church* tends to evoke various substructures (including one for 'spire'), *spire* invariably and strongly evokes a 'superstructure' (for a church-like building).

The notion of 'conceptual perspective' is obviously related to Langacker's notions of 'conceptual autonomy' and 'conceptual dependency'. Langacker uses these notions

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to distinguish between noun and verb prototypes, or rather, between the objects and the interactions they denote:

> an interaction does not exist independently of its participants. Though we can perfectly well conceptualize an object separately from any interaction involving it, the conception of an interaction inherently presupposes some reference – however vague or schematic – to the entities through which it is manifested. (Langacker, 1991: 14)

Now, it may be true that the prototypical noun denotes an independent concept. As we have seen, however, there are plenty of instances where nouns are more like verbs in that they are not conceptually independent, but presuppose some reference to other entities (as pointed out by Taylor, 1996: 39). Moreover, the notions of 'conceptual autonomy' and 'conceptual dependency' fail to capture the difference in conceptualization between, for example, the nouns *church* and *spire*.

Let us consider the role of conceptual perspective in distinguishing between the concepts 'church' and 'spire'. As we have seen, the two concepts differ in that whereas 'church' is typically conceptualized as a whole, 'spire' is typically conceptualized as part of some larger knowledge structure. As 'church' will activate one independent knowledge structure, this structure will be the conceptual perspective. 'Spire', on the other hand, invariably and strongly evokes a coherent, larger structure: that of 'church'. For 'spire', too, the cognitive perspective is that of 'church'.

There may, of course, be contexts in which typically independent concepts are presented and interpreted as part of a larger knowledge structure. I will use the concept of 'house' by way of illustration. In example (37) 'house' is conceptualized as an independent whole: the pattern evoked is that of an independent entity and its various attributes. 'House' can, however, also be conceptualized as a property of some other, larger knowledge structure – for instance, as part of a person-structure. In that case a mental representation will be created in which 'house' is a substructure of the knowledge structure for 'person'. This will be the structure evoked by the discourse in (38), where the person referred to, rather than the house, is the topic of conversation.

(37) This *house* is gloriously old and tatty: plaster flakes off the walls, dirt accumulates on windowsills, the air conditioning system is vintage 1950s as is the fridge + other kitchen furniture. <ICE-GB:W1B-012 #82:2>–<ICE-GB:W1B-012 #85:2>

(38) A: Uhm but as she she's got – he's got somebody living in his *house* who's who used to go to Mrs Parsons'.
B: So how did you meet up with him then
A: Oh he was a member of the bicycle polo club last year
<ICE-GB:S1A-025 #197:1:A>–<ICE-GB:S1A-025 #199:1:A>

Thus, our mental representation of such concepts as 'house' depends on the context, on what forms the focus of attention in the discourse. With some concepts, however, there seems to be a strong preference for one perspective, irrespective of the context. In that case, the preferred conceptual perspective need not coincide with pragmatic highlighting; instead, it will be a long-term, generic feature of the concept in question.

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This is what we typically find with the clearest examples of relational nouns (Fillmore's inalienably possessed nouns).

In other words, relational nouns can be described cognitively as nouns which automatically and invariably activate some other GKS, within which the concept evoked by the relational noun functions as an attribute; i.e. relational nouns are conceptualized from the perspective of this other knowledge structure. Nonrelational nouns, on the other hand, are not typically conceptualized as part of some other knowledge structure.

4.3 The network approach

Schemata and frames have often been criticized as being too rigid, too inflexible, for not allowing differences or changes in the degree of activation; as a result, it has been claimed, they cannot easily adapt to novel situations. These shortcomings are remedied in so-called connectionist or network models of human cognition (e.g. McClelland & Rumelhart, 1986a,b).[11] These models consist of a network of elementary units or nodes, activated in various degrees and sending signals to other units. The network is a dynamic system and, once supplied with initial input, spreads excitations and inhibitions among its units. Each of the connections between the units has a particular strength, which determines the degree of activation (if any) of the unit given a certain input (e.g. Bechtel & Abrahamsen, 1991: 2; see also McClelland, Rumelhart & Hinton, 1986). Thus, a linguistic cue like the name of a person will activate not only the name unit of this person, but all the property units connected to the person unit in question, thus creating the pattern of activation belonging to this person.

In connectionist models, the difference in conceptualization between the nouns *church* and *spire* can be accounted for in more or less the same way as in schema-theory. The linguistic cue *church* activates a label unit associated with a particular kind of entity known as a church. A relational noun like *spire*, on the other hand, figures prominently in the activation patterns of two entities: it will not only activate a central unit representing the pattern for 'spire', but will also strongly activate the activation pattern for 'church'.

What distinguishes connectionist models from schemata and frames, however, is that what is stored in memory is not the representation of an entity, or even the corresponding activation pattern, but the connection strengths between the units that allow this pattern to be recreated. Each time a particular pattern is activated, changes occur in the strengths of the connections between the units which make up this pattern.

[11] Connectionist models of language processing have, in turn, from their conception, also been fiercely attacked. Early critiques by linguists were characterized by a total rejection of the connectionist approach (Fodor & Pylyshyn, 1988; Pinker & Prince, 1988), in particular its claims about the nature of language acquisition. In the course of two decades network modellers have tried to parry part of the criticism, rejecting it as either mistaken or ill-founded (e.g. Seidenberg & McClelland, 1990; Seidenberg & MacDonald, 1999; McClelland & Seidenberg, 2000), while remedying some of the failings pointed out by theoretical linguists in new, adjusted models (for an overview, see e.g. Christiansen & Chater, 1999, and Clahsen, 1999: 993ff.; see also Jackendoff, 2002, e.g. 163–5).

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These strengths, in turn, determine which parts of a memory will be activated given a certain cue, as well as the strength of the activation.

It is this property which makes connectionist models flexible, and which accounts for the fact that differences between relational nouns and nonrelational nouns, and between complements and modifiers, are graded rather than clear-cut, and may differ from situation to situation: given a certain cue, some units are simply more strongly activated than others. Now, the more frequently two properties are activated together, the stronger the connection between these units will become. In the case of relational nouns, the connection between two units is so strong that activation of one will automatically lead to activation of the other.

4.4 Prototype effects

Over the last few decades, the assumption that categories must have clear-cut boundaries and that category membership can be determined on the basis of strict criteria (defining necessary and sufficient conditions) has begun to lose its appeal. The alternative approach, supported by evidence from research in a large number of branches within cognitive science, is to accept that categories need not have clear boundaries, and that even if they do, category membership may be graded, with some members being better examples of the category than others. This principle has been applied to a number of linguistic categories, including syntactic categories such as nouns and verbs (Hopper & Thompson, 1984), syntactic functions (e.g. subjects; Givón, 2001), transitivity (Hopper & Thompson, 1980), thematic roles (Dowty, 1991) and referring expressions (Keizer, 1992).[12] It will be argued that the distinction between relational and nonrelational nouns, and that between complements and modifiers, should be treated in a similar fashion.

On the basis of the discussion in sections 2 and 3, we can draw up a list of features of what may be regarded as prototypical 'relational noun + PP complement' constructions. Obviously, these features are not to be regarded as strict criteria; instead they are intended to capture the intuitions and tendencies observed. In addition, a cognitive explanation will be provided for each of these features of why the construction should behave the way it does. Although these explanations are admittedly often speculative in nature, it will be clear that they are in keeping with the cognitive approaches sketched in this section.

Features of Prototypical 'noun + PP complement' constructions:
(a) *Complement PP cannot be omitted (must be explicitly expressed or inferrable)*. Conceptually, relational nouns have a dual function: they evoke a GKS representing the entity denoted and, at the same time, represent a property of a second GKS. Retrieval of the correct mental state requires both these knowledge structures to be activated. This may be achieved through linguistic means within one and the same NP; in that

[12] For a collection of key texts on linguistic categorization and fuzziness, see Aarts et al. (2004).

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case, the substructure is denoted by means of the head noun, the larger GKS by means of, for instance, the (NP embedded in the) PP complement.

(b) *Semantic roles of the complements depend on the head noun; number of complements is restricted.* The connection between the two concepts is both fixed and generic: the concept evoked by the relational noun will always play the same role in the related GKS. Since this relation is reflected in the semantic function assigned to the NP embedded in the complement PP, the semantic function of this NP, too, will be fixed. Since it is the concept denoted by the head noun which features as a property in the configuration of the NP embedded in the PP complement, and since this latter configuration may contain any number of properties, it is the head noun which determines the relation between the two concepts.

It is plausible to assume that the number of slots automatically activated when a GKS is evoked is limited; it is, after all, only those concepts that are most intrinsically and strongly connected to the central concept that become active each time the GKS is evoked. Since each slot is unique within the GKS, and since each slot can be filled only once, the number of complement PPs (providing the information to fill the most strongly activated slots) is equally limited.

(c) *Complements can only be co-ordinated with other complements with the same semantic function*. Within a GKS every slot is unique in terms of (i) the type of relation with the concept represented by the GKS (i.e. the role of the concept filling the slot within the GKS); (ii) the intrinsicness and strength of the connection between the two concepts. Within each GKS, every slot can be filled only once. Co-ordination of complements is therefore only possible when the concepts evoked by the two co-ordinated parts can be interpreted as together filling one slot. Co-ordination of two complements with different semantic roles, or of a complement and a modifier PP, is not possible, because in either case only one of the co-ordinated parts can fill the slot in question.

(d) *Complements cannot follow the pronoun* one. Let us assume that pronominal *one*, rather than replacing a single lexical item (the head noun), stands for a recently activated GKS. Now, we have argued that in the case of a relational noun, the conceptual perspective tends to be the larger GKS. It is therefore only plausible that *one* should tend to represent this larger GKS, rather than the concept evoked by the relational noun only. Hence *one* will typically denote the relational noun and its complements (a 'closed predication') and will not itself be followed by complements.

(e) *Complement PPs immediately follow the head*. The position of the PP as adjacent to the head reflects the close connection between the two units.

(f) *Complements resist extraposition*. Since, on account of the close connection between them, the prototypical complement immediately follows the head, extraposition will not be favoured.

(g) *The PP complement is introduced by the preposition* of. The relation between the two concepts is typically not (literally) spatial or temporal, but tends to be rather abstract in nature (part-of, attribute-of). Having lost its original meaning at an early stage, the preposition *of* is now used to cover a range of these relations; it has, therefore,

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come to be used as the default choice in constructions headed by relational nouns. This is not to say that *of*, when used in combination with a relational noun, has no meaning of its own; it merely means that it indicates the strength and intrinsicness rather than the type of the relation.

(h) *Complements allow preposing of the embedded NP*. In prototypical head-complement constructions, the function of the preposition *of* is to express the presence of a strong and fixed (intrinsic) relation between the head and the NP referred to in the complement. Since, conceptually, relational nouns denote a property of the entity referred to in the PP-complement (part-of, attribute-of, possession-of), we may prefer to assign the construction as a whole the internal structure in (39a), rather than the one in (39b). This will reflect the property-like status of the head noun (*spire*) in relation to the independent concept evoked by the second NP (*church*):

(39) (a) $[_{NP1}$ [spire [of]] $[_{NP2}$ the church]]
(b) $[_{NP1}$ [spire] $[_{PP}$ of $[_{NP2}$ the church]]]

If so, it is not surprising that NP_2 can more easily be preposed than the string '*of* + NP_2'.

In addition, since, in the case of preposing, the larger GKS is evoked before mention of the relational noun, the addressee, on hearing the relational noun, will merely have to incorporate the property denoted by the relational noun into the already active larger GKS.

As pointed out before, together these features may function as an indication of the complement status of a PP; they should, however, not be seen as strict criteria, neither as a set nor individually. In fact, it is highly unlikely that there is any noun in the English language which, on each occurrence, possesses all the features mentioned. This does not, however, invalidate my claim of what prototypical head-complement constructions look like. As pointed out by Rosch (1978), prototypes are not specific members of a category. Accordingly, in McClelland and Rumelhart's (1986a,b) connectionist models, prototypes exist even if there is no specific entity representing them.

Next, of course, the question arises whether it is possible to measure the gradience exhibited by syntactic categories on the basis of the number of features it shares with the prototype (cf. Aarts, 2004). Although this may be a desirable approach, I do not feel that it is justifiable. First of all, it is important to realize that there may be no consensus about the proposed features; and even if there is, there is no guarantee that the list is complete. And even if we feel the list is complete, we cannot be sure that all the features are truly diagnostic of the distinction we want to make. Moreover, we cannot be sure that each feature is equally important; and if we feel that there are differences in weight, it will be difficult to establish the value of each feature. This is further confounded by the fact that some of the features are clearly not independent. Finally, as pointed out, some features do not lend themselves very well as diagnostic tests (in particular those defined in negative terms, e.g. extraposition).

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Consequently, I do not propose to use the features listed as a basis for deciding exactly how good an example a particular construction, or (use of a) noun or PP, is. Now, this may be considered unfortunate. It is, however, only unfortunate for those among us demanding clear-cut answers – even where there are none. Moreover, I do not feel that the lack of any exact measurements seriously undermines the approach suggested, as my concern is primarily with providing plausible explanations for differences in meaning, form, and use of certain constructions, rather than with providing a means of calculating, for each separate noun or PP, on each of its uses, the exact degree to which it deviates from the prototype.

Nevertheless, it will be clear that, on the basis of the characteristics given, some nouns can plausibly be considered better examples of the category of relational nouns than others, just as some posthead PPs will more closely resemble the prototypical complement than others.

5 Conclusion

The traditional distinction between relational and nonrelational nouns, as well as the distinction between complements and modifiers, is a valid distinction to make. The reason that attempts to define these categories in terms of a number of strict (semantic and syntactic) criteria have failed is simply that the distinctions in question are not strict and clear-cut, but gradual. This, in turn, is due to the fact that the differences we intuitively feel exist between certain nouns and PPs reflect a difference in activation status of the concepts denoted. Since differences in activation are a matter of degree, so is the difference between the linguistic expressions reflecting the activation status of a concept.

Consequently, the only viable approach to explaining the differences observed is a cognitive one. As shown in this article, both schema-theory and network approaches provide useful insights into the nature of the distinctions in question, as well as into the why and the how of their development. Moreover, Rosch's recognition that categories in the mind are organized around prototypes provides us with a way of accounting for the fact that even among what are generally regarded as relational nouns, or as complements, some seem to be better examples of the category than others.

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