

# **Double R Grammar**

## **The Grammatical Encoding of Referential and Relational Meaning in English**

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### **Abstract**

Double R Grammar is a linguistic theory of the grammatical encoding and integration of referential and relational meaning in English. Double R Grammar is fundamentally a Cognitive Linguistic theory (Langacker, 1987, 1991; Lakoff, 1988; Talmy, 2003) and the use of the term “grammar” encompasses both meaning and structure as it does in Cognitive Grammar (also known as Cognitive Semantics). Grammar is the symbolization of meaning. Discussion of grammar goes hand in hand with discussion of the meaningful consequences of grammatical variation. The linear stream of English text encodes multiple dimensions of meaning. The encoding of multiple dimensions of meaning in a single linear dimension results in trade-offs in encoding across dimensions and variation within a given dimension across different grammatical contexts. A primary goal of Double R Grammar is to provide integrated representations of referential and relational meaning that reflect these trade-offs.

# The Grammatical Encoding of Referential and Relational Meaning in English

## 1. Introduction

Double R Grammar is a Cognitive Linguistic theory (Langacker 1986, 1987, 1991; Lakoff, 1988; Talmy 2003) of the grammatical encoding and integration of referential and relational meaning in English. In Cognitive Linguistics, all grammatical elements have a semantic basis, including parts of speech, grammatical markers, phrases and clauses. Our understanding of language is embodied and based on experience in the world (Lakoff and Johnson, 1980). Categorization is a key element of linguistic knowledge, and categories are seldom absolute—exhibiting, instead, effects of prototypicality, family resemblance (Wittgenstein, 1953), fuzzy boundaries, basic level categories (Rosch, 1975, 1978), radial structure and the like (Lakoff, 1987; Taylor, 1989). Our linguistic capabilities derive from basic cognitive capabilities—there is no autonomous syntactic component separate from the rest of cognition. Knowledge of language is for the most part learned and not innate. Abstract linguistic categories (e.g. noun, verb, nominal, clause) are learned on the basis of experience with multiple instances of words and expressions which are members of these categories, with the categories being abstracted and generalized from experience. Also learned are schemas which abstract away from the relationships between linguistic categories. Over the course of a lifetime, humans acquire a large stock of lexical items and schemas. Schemas at multiple levels of abstraction and generalization supplement the knowledge of lexical items that humans acquire, although they are typically tied to specific lexical items. However, more abstract constructional schemas like that of Fillmore and Kay (2003) and Goldberg (1995) are not precluded and may be important for language understanding. If lexical items are the basis of **lexical semantics**, then schemas are the basis of **grammatical semantics**. Together, they provide much of the capability needed for representing knowledge of language and supporting language comprehension.

Double R Grammar takes a strong position in arguing that there is no distinction between syntactic structure and semantic structure for the representation of linguistic aspects of meaning. This position is consistent with Langacker's claim (1987, p. 12) that "...it makes no more sense to posit separate grammatical and semantic components than it does to divide a dictionary into two components, one listing lexical forms and the other listing lexical meanings. Grammar is simply the structuring and symbolization of semantic content." Double R Grammar's position is also related to, but stronger than, Jackendoff's **Grammatical Constraint** (1983, pp. 13-14):

...one should prefer a semantic theory that explains otherwise arbitrary generalizations about the syntax and the lexicon...a theory's deviations from efficient encoding must be vigorously justified, for what appears to be an irregular relationship between syntax and semantics may turn out merely to be a bad theory of one or the other.

Further, Double R Grammar's position differs from approaches like **Montague Grammar** (Partee, 1975) and Steedman's (2000) **Combinatory Categorical Grammar** which posit a one-to-one mapping between syntactic and semantic rules. If syntactic and semantic structure are one and the same, there is

no need for a one-to-one mapping between syntactic and semantic rules. In terms of the debate over the interaction of syntax and semantics versus the autonomy of syntax, Double R Grammar's position is interactive in the extreme. In fact, using the term interactive to describe Double R Grammar is somewhat misleading in that it suggests a distinction between syntactic and semantic influences which is presumed not to exist. As Johnson-Laird (1983, p. 334) notes, "...the question of autonomy versus interaction can only be raised on the assumption that they [syntactic and semantics processes] are separate enterprises...."

The focus of Double R Grammar is on the determination of the referential and relational meaning of English texts. The sentence

The book is on the table

and the expression

The book on the table

have essentially the same relational meaning. However, they differ in their grammatical realization. An important reason for this difference is that in addition to encoding relational meaning, surface text encodes other facets of meaning—especially referential meaning. In this case, the difference in grammatical realization reflects the fact that the sentence "the book is on the table" refers to the relation "is on" existing between the expressions "the book" and "the table," whereas the expression "the book on the table" refers to "the book" which happens to be "on the table". In general, Double R Grammar follows Givon (1984) in arguing that grammatical variation is largely the result of a compromise between the differing requirements for the encoding of both semantic and discourse pragmatic aspects of meaning. For example, according to Givon, the discourse topic is typically encoded as the subject in English, as is the semantic agent of an action. However, when the discourse topic and agent do not coincide in a given sentence, grammatical variation (e.g., passivization or topicalization) results. While this work does address the meaningful consequences of grammatical variation resulting from trade-offs in the encoding of referential and relational meaning—as in the difference between the word "red" in "the book is red" and "the red book"—no attempt is made to provide a complete account of grammatical variation. To large extent, the encoding of referential and relational meaning will assume an unmarked or canonical ordering of lexical items. A more complete treatment will have to consider the representation of marked or noncanonical forms of text and the encoding of discourse pragmatic aspects of meaning more generally.

Different languages encode different aspects of meaning. A meaning component which may be crucial to proper expression in one language may be completely missing in another language. This reality does not detract from the meaningfulness of such encodings. It only reflects the crosslinguistic diversity in the encoding of various aspects of meaning. Double R Grammar agrees with Langacker (1987) in suggesting that the linguistic representation of meaning is to large extent language dependent and non-universal. This position follows from the rejection of anything like a universal nonlinguistic conceptual level of representation. But all is not chaos. After all, languages do reflect reality, they just don't do so via some universal conceptual realm which clarifies all confusions and divides the world up into neat well-defined categories. Linguistic representations for a given language should represent those aspects of meaning which are explicitly (i.e. grammatically or lexically) encoded in that language, and should avoid representing aspects of meaning for which the language makes no provision. According to Fawcett (1988, p. 206),

the SEMANTICS of a given language...contains THOSE MEANINGS THAT ARE BUILT INTO THE ORGANIZATION OF THE LANGUAGE...

This position is in conflict with the search for language universals to the extent that that search leads to the assumption that purported universals which are not manifested in particular languages nonetheless exist in those languages. **Case Grammar** (Fillmore, 1968) is a case in point. English just does not express case roles like agent, patient and instrument as the participants of predications. Rather, in English, the participants of predications are grammatically specified as semantic complexes called subjects, objects, and complements. That these grammatical categories are semantically based is suggested by Halliday (1988, p. 35)

In my opinion the category of Subject is no less 'meaningful' (semantically motivated) than other functional categories in grammar.

English also provides for the more specific description of the participants in various relationships via the use of grammatical markers like the morpheme “-er” as in “hunter,” “batter,” “runner,” “receiver,” etc., and the less common morphemes “-ee” and “-or” as in “lessee” and “lessor”. The problem with Case Grammar is that it represents a level of organization of meaning which is not grammatically marked in English. Since case roles are not marked in the language, their identification in a given text (to the extent they can be identified) requires the very understanding of the text which they are supposed to facilitate. For example, in the sentence “the man traveled” (Miller & Johnson-Laird, 1976) we just do not know whether “the man” is the agent or the patient, but we do know that “the man” is the person doing the traveling (i.e. the “traveler”).

As noted above, the focus of Double R Grammar is on the consideration of two key dimensions of meaning which are grammatically encoded in English: 1) **referential meaning**, and 2) **relational meaning**. Whereas relational meaning may be largely explicated in linguistic terms, referential meaning requires consideration of nonlinguistic aspects of meaning as encoded in nonlinguistic representations. The basic relationship between linguistic and nonlinguistic representations is one of grounding. Nonlinguistic representations ground the **sense** and **reference** of related linguistic representations. Nonlinguistic representations of **types** (i.e. categorizations of previously experienced instances), **prototypes** (i.e. abstractions over previously experience instances), **exemplars** (i.e., previously experienced instances that are salient) and current **instances** ground the sense and reference of corresponding linguistic representations. Linguistic representations may be directly related to other linguistic representations, and may gain much of their meaning from such associations, but linguistic representations are ultimately ground in nonlinguistic representations (see Figure 1.1).

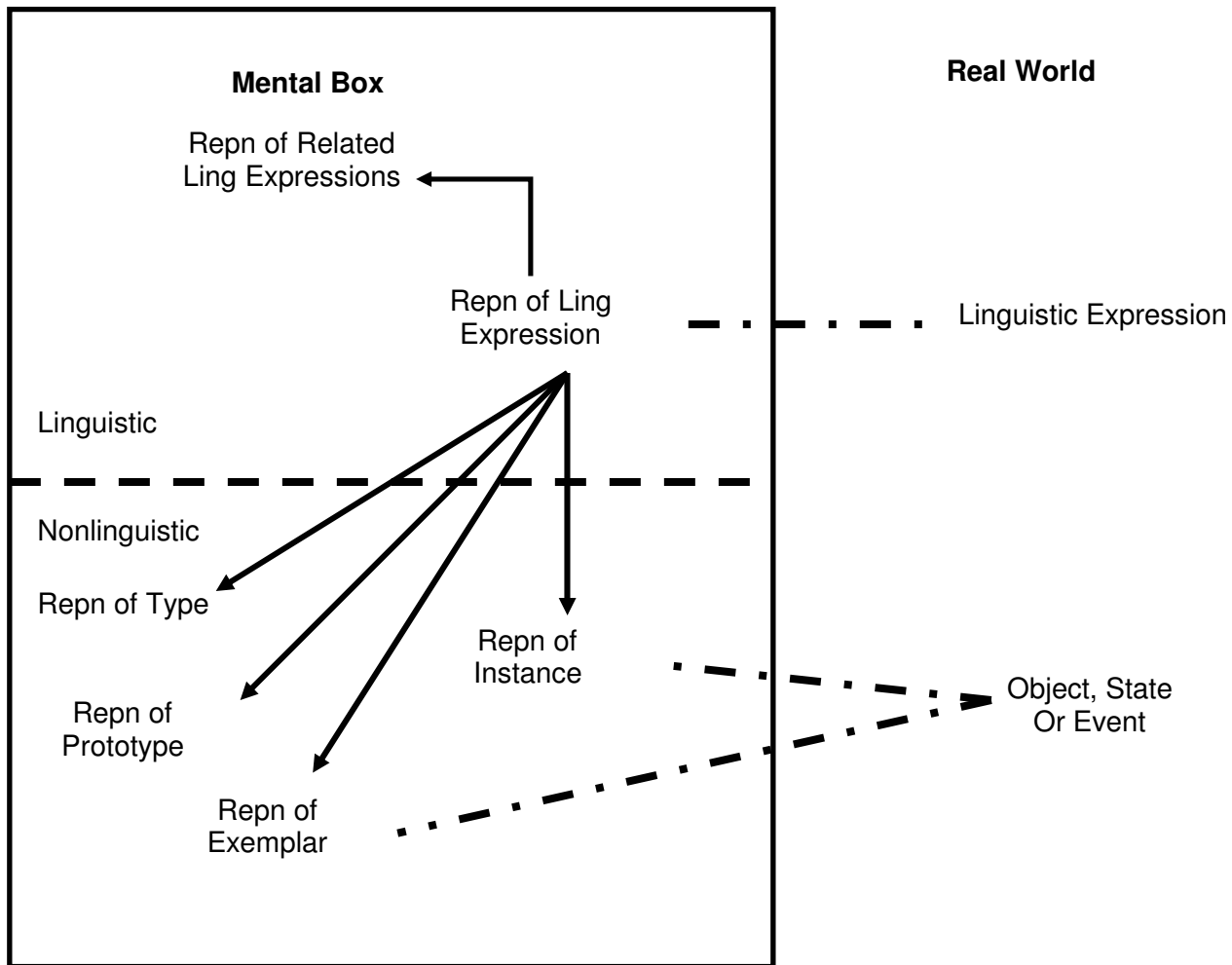


Figure 1.1: Double R Grammar’s System of Mental Representation

In Double R Grammar, there are no completely abstract, non-perceptual representations which mediate between language and the world. In place of a meaning triad—language, thought, and reality—Double R Grammar posits the existence of a meaning quadrad—language, linguistic representations, representations of the real world, reality (Hockett, 1987)—where meaning suffuses linguistic and real world representations and the associations between them. In place of non-perceptual, abstract concepts, there are perceptually based symbols that are arbitrarily associated with other perceptually based symbols, as when the perceptually based word “dog” (i.e. visually and auditorily based) is associated with the perceptual experience of four-legged animals that bark (also visually and auditorily based, but smell and touch based as well). Note that perceptually based symbols can be arbitrarily associated with any number of corresponding symbols derived from different input modalities. Perceptually based linguistic symbols are a candidate for a perceptually based **language of thought** (i.e. an interface between different input modalities) that does not require positing the existence of abstract, non-perceptual concepts, and also does not require positing separate interfaces between each pair of input modality for each pair of associated symbols. Smell based inputs may be associated with visual inputs via simultaneous perception, but they may also be associated via linguistic intermediaries (e.g. the expression “the pumpkin pie smells of cinnamon and nutmeg” evokes an image of a pumpkin pie and

associates it with representations of smells which are themselves associated with images of cinnamon and nutmeg).

Double R Grammar's position is at odds with the assumption that there is something like an abstract conceptual (or propositional) level of representation which mediates between language and the world—an assumption which is widely held by researchers in psychology (Clark & Clark, 1977; Kintsch, 1974; Johnson-Laird, 1983, Miller & Johnson-Laird, 1976), linguistics (Givon, 1984, 1989; Jackendoff, 1983), philosophy (Fodor, 1975), and AI (Schank, 1975). Givon (1989, p. 87) goes so far as to suggest that “since both linguistics and psychology have established the independent reality of both sentences and propositions beyond any reasonable doubt, we will forego belaboring the point here.” A basic argument of this position is that two different sentences which are equivalent in meaning should be represented by the same proposition. But Quine (1986, p. 10) argues convincingly that the existence of linguistically independent propositions offers no solution to the problem of determining synonymy of meaning which does not require “...some suitable definition of equivalence of sentences” and this being the case “why not just talk of sentences and let the propositions go?” In essence, Quine is saying that in order to know that two sentences should map to the same proposition you must first know that they are equivalent in meaning. However, “there is no evident rule for separating the information [contained in sentences] from stylistic and other immaterial features of sentences” (Quine, 1986, p.4). Rather, the lure of propositions and “their promise of more is mainly due to our uncritically assuming for them an individuation which matches no equivalence between sentences that we know how to define” (Quine, 1986, p. 10). Further, positing the existence of non-perceptual and non-experiential conceptual representations begs the question of how such representations could come into existence in the first place and leads some researchers (e.g. Fodor, Chomsky) to make the striking claim that all concepts are necessarily innate since there is no way they can be learned. Even if they were innate, there is still the question of how they could come to be associated with perceptual experience. That is, given an abstract DOG concept that is innate, how does that concept come to be associated with the experience of dogs. Are we to assume that the brain is innately wired to associate perceptual experiences with the relevant and equally innate concepts (of which there are presumably a massive number)?

Barsalou (1999) presents a strong defense of the perceptual basis of cognition. He notes the widespread acceptance of this position prior to the advent of **mentalism** in the middle of the last century. He also notes that the belief that propositions are nonperceptual is now so firmly entrenched that “the term ‘propositional’ is reserved solely for nonperceptual theories of knowledge.” He argues against this position and goes on to say that “if one adopts the core properties of perceptual symbol systems, the important properties of propositions follow naturally...” and perceptual symbol systems “...are propositional systems.” Barsalou (1999) is concerned with describing how “a perceptual theory can implement a fully functional conceptual system” and his arguments are largely consistent with Double R Grammar, although the use of the term “conceptual” is avoided in Double R Grammar since it carries much of the same conceptual (i.e. non-perceptual) baggage as the term proposition.

Double R Grammar adopts a variant of Paivio's (1986) dual-code hypothesis. Perceptual input is modality specific, but the real input modalities are auditory and visual—not verbal and imaginal. Written linguistic input is perceived via the visual modality in the same way as nonlinguistic visual input. Mental representations of written linguistic input have the same character as representations of nonlinguistic visual input. I can rotate a mental image of a written word as easily as I can rotate a mental image of a nonlinguistic object. It is the focus on spoken linguistic input that leads to the mistaken assumption that verbal representations are necessarily different from imaginal representations. Spoken linguistic input certainly differs from nonlinguistic visual input as do the mental representations of spoken linguistic input and nonlinguistic visual input, but spoken linguistic input and corresponding

mental representations also differ from written linguistic input and corresponding mental representations in the same modality dependent way. Over and above input modality differences, the primary difference between linguistic representations and nonlinguistic representations is the arbitrary association of representations of linguistic input with other representations (although such arbitrary associations are possible for nonlinguistic representations as well).

There is no suggestion in all of this that nonlinguistic representations provide an escape from the mental box (see Figure 1.1). Nonlinguistic representations are themselves symbolic. Wilks' (1988) **autonomy of symbolism** is certainly correct. The use of the term reference to refer to the relationship between linguistic representations and nonlinguistic representations is not meant to suggest an escape from the mental box. However, it is assumed that nonlinguistic representations are representational analogues of the real world, and that it is reasonable to talk about linguistic representations referring to such nonlinguistic representations.

Given the grounding of linguistic representations in nonlinguistic representations, it is assumed that nonlinguistic representations will form an important part of a complete theory of language comprehension—especially with respect to the representation of referential meaning. Johnson-Laird's **mental models** (1983) provide an approach to nonlinguistic representation which is highly compatible with Double R Grammar. According to Johnson-Laird (1983, p. 244) “the recovery of a propositional representation is a necessary precursor to the construction of a mental model.” In Double R Grammar, the linguistic representations of referential and relational meaning correspond to Johnson-Laird's propositional representations—although these linguistic representations contain ambiguous linguistic tokens and are not composed of unambiguous concepts. The referring expressions in these linguistic representations are ground in a **situation model** (adapted from Kintsch, 1998) which encompasses the linguistic representations as well as representations of the objects and situations which ground those linguistic representations. The section on situation models provides a preliminary investigation of the grounding of linguistic representations in nonlinguistic representations of objects and situations in presenting an ontology of nonlinguistic referential types. The ontology of referential types is in the spirit of Jackendoff (1983), without the commitment to his modality independent **conceptual structure hypothesis** which hypothesizes that

There is a *single* level of mental representation, *conceptual structure*, at which linguistic, sensory, and motor information are compatible (ibid, p. 17).

The grounding of a linguistic representation in a situation model contributes to resolving the meaning of the ambiguous linguistic tokens in the representation, as does the association of the linguistic representation with related linguistic representations. The meaning of linguistic tokens depends on the context of use and the associations that are made salient in that context of use (e.g. the meaning of “ran” in “the horse ran” and “the paint ran”) (cf. Kintsch, 2001), and not on the resolving of individual lexical items into abstract word senses or linguistic expressions into abstract propositions. Further, it may well be that a word such as “bitch” cannot be used to refer to a female dog without also evoking the derogatory sense of this word. That is, the wider context may intrude on the meaning of lexical items, whether or not that intrusion is intended (and may be a reason not to use taboo words in linguistic examples). In most of the discussion in this paper, the context of use of an expression will be left implicit and the inclusion of ambiguous lexical items in the representations of referential and relational meaning may appear problematic. The section on situation models begins to address the grounding of referential meaning, but no attempt will be made to tie in associated linguistic representations to fully resolve the sense of ambiguous lexical items. Attempting to do so would clutter up the discussion and

detract from the main focus (and is not worked out in any case). For those who are bothered by this, just assume that a lexical item corresponds to a network of contextually activated linguistic and nonlinguistic representations which resolve the meaning of the lexical item, or to an IOU to provide a mechanism for resolving the meaning of the lexical item (which is all that a conceptual representation like [DOG] amounts to in any case).

## 1.1 Historical Context

Double R Grammar is part of a larger theory called Double R Theory, which encompasses a theory of language processing in addition to language representation (Ball, 2003a). Double R Theory is being implemented as a computational cognitive model, called Double R Model (Ball, 2003b), using the Atomic Components of Thought – Rational (ACT-R) cognitive architecture and modeling environment (Anderson and LeBièrè, 1998). As a cross-disciplinary research endeavor, Double R Theory has numerous roots outside of Cognitive Linguistics. The early influence of Preference Semantics (Wilks, 1972, 1975a, 1975b, 1979) is acknowledged. The basic principles of Preference Semantics are consistent with many of the principles of Cognitive Linguistics on which Double R Grammar is founded (e.g. non-autonomy of syntax, focus on meaning), although Preference Semantics is an AI as opposed to a Cognitive Science (i.e. psychologically plausible) theory of language processing. The profound influence of Cognitive Linguistics on this research has already been noted. The shift from an AI/Computational Linguistic to a Cognitive Science/Computational Psycholinguistic/Cognitive Linguistic point of view was first motivated by Winograd (1983). The psycholinguistic influence of Kintsch (1974, 1977, 1988, 1998, 2001) and his Construction-Integration theory of language comprehension as well as his focus on propositional representation have guided this research. The Cognitive Psychological influence of Anderson (Anderson, 1976, 1983, 1984, 1993) has been important, especially his treatment of propositional representations and the more recent development of the ACT-R cognitive architecture and modeling environment which is being used for the implementation of Double R Model. Johnson-Laird's description of Mental Models (1983) has provided a foundation for grounding linguistic representations and his lexical semantic research with Miller (Miller and Johnson-Laird, 1976) has also been influential. Finally, Jackendoff's (1983, 2002) insightful account of linguistic semantics has motivated Double R Grammar in numerous ways. Of course, many other researchers have influenced the development of Double R Grammar in important ways. Although not listed in this short introduction, their contributions are acknowledged here and (hopefully) cited throughout this manuscript.

## 2. Description of Terms

The description of the encoding of referential and relational meaning makes use of commonly used terms from several different disciplines including linguistics, logic, and mathematics. Despite the risk of misinterpretation, these terms will not always be used with their commonly accepted definitions. That is, the meaning of these terms will be adjusted to fit into the theory of Double R Grammar to be presented. The basic assumption is that there is considerable merit in the common use of these terms, but that Double R Grammar improves on earlier formulations in various ways. For example, linguistic terms which are more commonly based on distributional considerations (i.e. syntactic) will be given meaning based definitions, and logic terms which are based in formal logic will be given linguistic readings. The goal is a meaning based definition of commonly used terms that supports the linguistic representation and integration of referential and relational meaning.



New terms will be introduced and defined at relevant points. The terms listed and defined below support the initial discussion of referential and relational meaning.

## 2.1 Non-Linguistic

**Object** – a perceptual experience viewed as a whole and distinct from other perceptual experiences

**Relation** – a perceptual experience of an action, state, process, event, property, or quality

**Situation** – a perceptual experience of a relation, including the participants in the relation.

## 2.1 Linguistic (Word Classes)

**Noun** – a word that describes a type of object or objectified relation

**Verb** – a word that describes a type of relation—especially an action or event

**Adjective** – a word that describes a type of relation—especially a state, property or quality

**Adverb** – a word that describes a type of relation—especially a property, quality or manner—that can modify a relation, predicate referring expression or situation referring expression

**Preposition** – a word that describes a type of relation—especially a locative or temporal relation

**Determiner** – a word that functions to specify a definite or indefinite object referring expression

**Auxiliary** – a word that functions to specify a finite or non-finite predicate referring expression and, in the case of modal auxiliaries, a measure of the certitude of the expression

## 2.3 Linguistic (Basic Functional Categories)

**Head** – a word or expression that functions to describe the **relational type** (e.g. object, action, state, process, quality, location, direction) of the expression in which it occurs (typically realized lexically as a noun, verb, adjective, or preposition). In referring to the relational type of a head, relational type encompasses objects as a base case, even though they are not relations

**Specifier** – (1) a word that functions to specify the referential type (e.g. definite, indefinite, finite, infinite) of a referring expression (typically realized lexically as a determiner or auxiliary)

**Specifier** – (2) a word that functions to specify the grammatical type (e.g. noun phrase, verb group) of the maximal projection of a phrase or clause (typically realized lexically as a determiner or auxiliary)

**Modifier** – a word or expression that functions to constrain the relational type of the head or modifier it modifies

**Complement** – a referring expression that functions as a participant in a relation

**Coordinator** – a word or expression that functions to conjoin, subjoin or disjoin two or more words or expressions

## 2.4 Linguistic (Functional Categories)

**Object (description)** – a word or expression that functions to describe a type of object or objectified relation (typically realized lexically as a noun)

**Referring Expression** – a word or expression that functions to refer

**Object Referring Expression** – a word or expression that functions to refer to an object or objectified relation (typically realized grammatically as a noun phrase)

**Relation (description)** – a word or expression that functions to describe a type of relation (realized lexically as a verb, adjective, preposition or adverb)

**Objectified Relation** – a relation that is grammatically viewed as an object

**Predicate Referring Expression** – a word or expression that functions to refer to a relation (typically realized grammatically as a verb group)

**Situation Referring Expression** – a word or expression consisting of a predicate referring expression and one or more arguments that functions to refer to a situation (typically realized grammatically as a clause)

**Objectified Situation Referring Expression** – a situation referring expression that is grammatically viewed as an object (typically realized grammatically as a complement clause)

**Relativized Situation Referring Expression** – a situation referring expression that is grammatically viewed as a modifier (typically realized grammatically as a relative clause)

## 2.5 Explanation of Terms

Note that the term “situation” is used in preference to “proposition” to de-emphasize any connection to truth-functional semantics along with any suggestion that the reference of a proposition is to a truth value, and to emphasize that situations are perceivable experiences that can be referred to in a manner similar to objects.

It is to be understood that the labels on the nodes in the representations to be presented reflect an expository intent to represent the meaning distinctions under consideration. While it is assumed that humans are capable of making the kinds of meaning distinctions that these representations reflect, it is not assumed that language comprehension necessarily implies the creation of such explicitly and fully explicated representations. Much of the meaning of an expression is conveyed by the words in that expression and humans may or may not realize the meaning distinctions conveyed by the grammatical encoding of referential and relational meaning over and above that contributed by the meaning of the words themselves.

The category labels used in the representations discussed in this paper are not psychologically real in the sense that humans construct representations of linguistic input containing such category labels. Rather, it is assumed that humans construct representations that group lexical items together in ways that are consistent with the representations being presented. The category labels make explicit the meanings of these groupings, but are otherwise **epiphenomenal**. This position is consistent with Chomsky's (1995) **Minimalist Program** (as I understand it) and MacWhinney's (1987) **Competition Model** and harks back to earlier constituency based analyses of language that group lexical items, but do not label the groupings.

### 3. Referential Meaning

The linguistic categories **specifier**, **head**, **modifier** and **complement** are key to the encoding of referential meaning. In Double R Grammar, they are given meaning based definitions having to do with their referential function. These categories show effects of prototypicality characteristic of basic human categorization such that determining the referential category of an expression is not always clear cut and unambiguous. By way of contrast, in **X-Bar Theory** (Chomsky 1970, 1995; Jackendoff, 1977), from which these categories are borrowed, the categories are motivated by distributional considerations which do not consider referential function and which are intended to capture a universal generalization about language structure which is not subject to considerations of prototypicality characteristic of normal human categorization. Double R Grammar's referential based definitions provide a firmer basis for understanding the function of these linguistic categories, without relying on their description in terms of ineffable linguistic universals.

#### 3.1 Specifier and Head

In Double R Grammar, the specifier, when it occurs, determines the type of a referring expression. There are two basic types of referring expressions: 1) **object referring expression**, and 2) **situation referring expression**. An object referring expression is a referring expression that functions to refer to an object. A situation referring expression is a referring expression that functions to refer to a situation. The head of a referring expression determines the relational type or category of thing being referred to, but does not determine the type of the referring expression (when a separate specifier occurs). Grammatically, referential type is closely associated with phrasal category (e.g. object referring expression corresponds to noun phrase; situation referring expression corresponds to clause) and relational type is closely associated with part of speech (e.g. object corresponds to noun, action corresponds to verb, property corresponds to adjective, manner corresponds to adverb). In contrast with X-Bar Theory, the unspecified head *does not project* the category of the referring expression, the specifier does. However, the specifier typically specifies a referring expression that is consistent with the semantic category of the head (e.g. object referring expression and object) and the head appears to project the referring category. On the other hand, when the specifier and the head contrast (e.g. object referring expression and action), the specifier dominates. The specifier combines with the head to form a **maximal projection** or full phrasal constituent (i.e. a constituent that is capable of referring). Without some form of specification, there is no maximal projection and no phrasal level constituent. However, some heads are inherently or morphologically specified. These include pronouns, proper nouns, deictic words, and tensed verbs. Such words are capable of functioning as referring expressions without a separate specifier and they do project the referential category of the referring expression.

Consider the expression

the man

in which the word “man” is the head and determines the relational type (i.e. object, or more specifically, man) to which the overall expression may be used to refer. On the other hand, the specifier “the” determines the type of the overall referring expression—an object referring expression.

In general, Double R Grammar assumes that a referring expression consists of both a specifier and a head—as a minimum—although a word or expression may function as an inherently or morphologically specified head. However, in informal discourse or child language, heads may be assumed to be referring without explicit specification. Given that a referring expression usually includes both a specifier and a head, it corresponds quite closely to the syntactic notion of a maximal projection or **major phrasal category** (using the terminology of Jackendoff, 1983). However, there is no assumption that a maximal projection (or referring expression) cannot be further modified, and even further specified in some cases. For example, “the books” is further specified by “all” in “all the books”; and “books” by itself can be used as a referring expression (i.e. it is morphologically specified), but can also be further specified (i.e. made definite) as in “the books”. Likewise, in “the book on the table”, “on the table” can function as a modifier of the referring expression “the book” and does not have to modify (or complement) “book” internal to the specifier “the” as is often assumed. A maximal projection acquires its privileged status in virtue of having the specification needed to function as a referring expression, and not on the basis of some unsustainable syntactic configuration.

Covering similar ground, Jackendoff’s **referentiality principle** (1983, p. 70) assumes that all major phrasal categories are referring so long as they “express conceptual constituents” and are not grammatically marked as non-referring. Jackendoff (ibid, p. 68-69) makes the strong claim that “what must be universal is (i) the distinction between lexical categories and major phrasal categories, and (ii) a system of subcategorization in which lexical categories subcategorize major phrasal categories.” Lexical categories (ignoring functional lexical items) are the types of constituents that can function as the heads of referring expressions, but are not themselves typically referring expressions, and relational lexical items subcategorize arguments that are assumed to be referring expressions (i.e. major phrasal categories). Thus, Double R Grammar is in general agreement with Jackendoff’s referentiality principle and his universalist claim. However, in the expression “the few usable pictures of Bill”, Jackendoff (ibid. p. 66) treats the adjective “usable” as an AP (i.e. the major phrasal category Adjectival Phrase) and the quantifier “few” as a QP (i.e. the major phrasal category Quantifier Phrase), suggesting that they are referring expressions. In Double R Grammar, only the specified expression “the few usable pictures (of Bill)” and the inherently specified “Bill” are referring expressions. “Few” is a modifier of “usable” or “usable pictures”. “Few” and “usable” are not referring expressions, in and of themselves, and are not considered to be major phrasal categories—although “few” does combine with “usable” or “usable pictures” to form a multiple lexical unit or **minor phrasal category**. Note that a minor phrasal category is assumed to have the same functional status as the head. That is, a modified head, still functions grammatically as a head and a modified object referring expression still functions grammatically as an object referring expression. On the other hand, a major phrasal category is distinctly different in grammatical function from its two basic constituents—either the specifier or the head. For example, given the expression “the book” as in “the book is on the table” neither “the” nor “book” is grammatically substitutable for the entire expression

\*the is on the table

\*book is on the table.

It is only in the atypical case of an inherently or morphologically specified head (e.g. pronoun, proper noun, tensed verb), that the function of the head and the major phrasal category coincide.

The distinction between specifier and head is important in numerous ways. For example, consider the expression

the murder

In this expression, the word “murder” functions as the head. The type of the referring expression is a (definite) object referring expression because of the specifier “the”, however, the type of thing that can be referred to by this expression is an action and not an object. The effect of having a specifier for an object referring expression combine with a word that expresses an action is to objectify the action. The **objectification** of actions has important grammatical consequences. In particular, in this expression, the objectification of the word “murder” leads to the non-expression of the objects which are involved in the action of murdering. That is, “murder” is a **relational** concept that expresses a relation between some object (typically animate) that is doing the murdering and some object (also typically animate) that is being murdered. But when “murder” is objectified, the act of murdering is brought into focus independently of the objects that participate in that relation.

As further evidence that it is the specifier that determines the type of a referring expression consider

**The** dance; **to** dance  
**The** drink; **to** drink  
**The** kill; **to** kill  
**The** splash; **to** splash  
**The** cat; **to** cat (about)  
**The** dog; **to** dog (someone)  
**The** father; **to** father  
**The** farm; **to** farm

In each contrasting expression, the head (e.g. “dance”, “drink”) has the same word form. As such, the head cannot be the determinant of the referential type of the expression. Rather, it is the specifier—either the determiner “the” or the infinitive marker “to”—that determines the type of the referring expression. The specifier “the” picks out an objective sense of “dance” and “drink” in forming an object referring expression, whereas the specifier “to” picks out an action sense of these words in forming a **predicate referring expression**. Further, even in the case of words which have a strong action preference, the specifier “the” forces an object reading as in the case of “the kill” or “the splash.” That is, “the” has the effect of **objectifying** the following head, often forcing action words to be interpreted as one of the typical participants in the action, rather than the action itself. Likewise “to” has the effect of **relationalizing** the following head. Thus, the words “cat” and “dog”—words which are almost always used in expressions that refer to particular kinds of objects—are relationalized by “to” and the base meanings of “cat” and “dog” as categories of objects are extended to support reference to relational attributes of those objects and not the objects themselves.

The ability of specifiers to objectify and relationalize words and expressions is a key reason for the difficulty in providing a meaningful basis for the definition of traditional parts of speech. If “murder” is necessarily a noun in “the murder” and “cat” is necessarily a verb in “to cat,” then the notional definitions of noun and verb are brought into question. However, if specifiers can objectify action words

and relationalize object words, allowing action words to function in object contexts and object words to function in relational contexts, then a meaningful basis for defining parts of speech can be maintained, albeit not on purely distributional grounds.

Specifiers have a function similar to that of many morphological markers. For example, the morphological marker “-ize” converts a noun into a verb by introducing the notion of a process into the meaning of morphologically marked word. Consider the word

humanize.

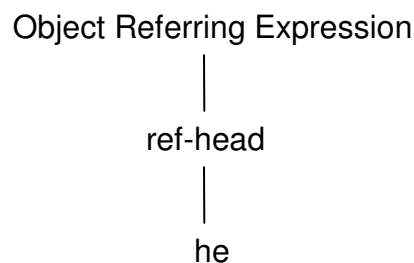
Despite the subordinate status of “-ize” with respect to the root word, it clearly specifies the part of speech of the entire word via a change in meaning. Whereas “-ize” is a part of speech “specifier” and occurs attached as a suffix to the word, “the” and “to” are phrase specifiers that occur at the beginning of the phrases they specify. Further, “-ize” changes the part of speech of the word it modifies, but does not determine the word to be a referring expression. On the other hand, the plural marker “-s” does have the ability to specify an object referring expression and functions very much like a morphological specifier as is the case for the word “books” in the expression

Books are fun to read.

The specifier and the head are the two **poles** of a referring expression, with the specifier functioning as the locus of referential meaning and the head functioning as the locus of relational meaning (which encompasses non-relations). Those elements of an expression which contribute to referential meaning are attracted to the referential pole (e.g. determiners, quantifiers, auxiliaries, negatives, modals, prepositions), and those elements which contribute to relational meaning are attracted to the relational pole (e.g. nouns, verbs, adjectives, prepositions).

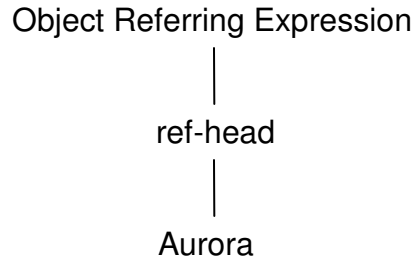
### 3.2 Referring Head

There are words in English that are inherently referring. Consider the pronoun “he” which is represented by the following:



The word “he” functions as a complete object referring expression—albeit one whose referent is to large extent contextually determined, since the word itself has limited descriptive semantic content (i.e. male, human) to help in establishing reference. The term **ref-head** (i.e. referring head) is used to describe such words.

Names are similar to pronouns in being inherently referring. Consider the name “Aurora” which is represented by

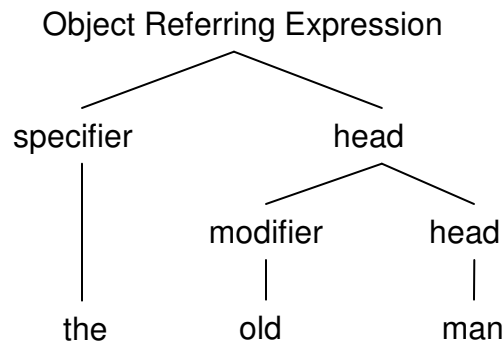


Names provide about as much descriptive content as pronouns for establishing reference. Referring heads behave as though they combine the specifier and head functions—that is, as if the referential and relational poles have come together to form a referring expression.

### 3.3 Modifier

While specifiers and heads are important (and necessary) determinants of the basic character of referring expressions, modifiers play a more peripheral and optional role. In particular, a modifier adds information that may serve to further refine the category of the head (and thereby help in determining the referent of the expression), but does not typically determine the base relational category or the referring category. For example, in the expression

the old man

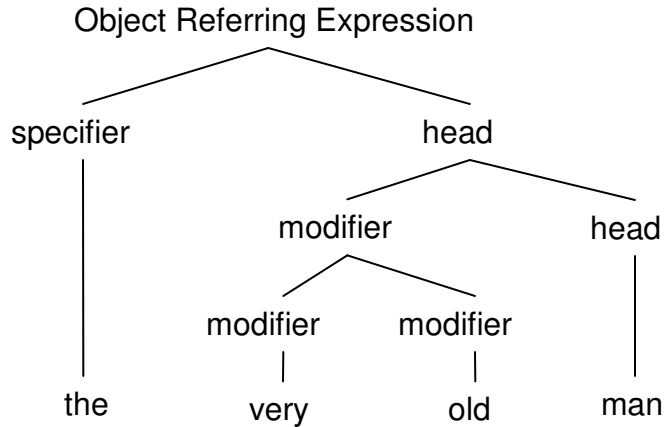


the modifier “old” further refines the category “man,” but does not establish that base category. Nor does the addition of “old” to “man” determine a referring expression.

There are types of words (e.g. **adverbs**) that can modify modifiers and in so doing they indirectly constrain the head of the expression. Consider

The very old man

in which the adverb “very” modifies the modifier “old” in further constraining the category to which this referring expression may refer. The four basic categories: head, modifier, specifier, and complement do not support a distinction between modifiers of heads and modifiers of modifiers.

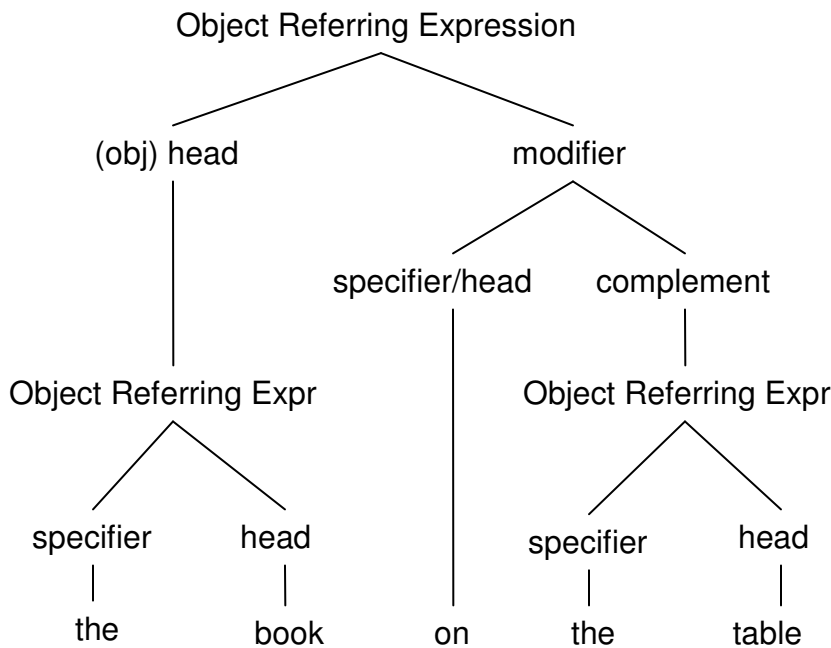


### 3.4 Complement

The final linguistically referential category is the complement. A complement is itself a referring expression. However, it is not the head or specifier of the larger expression in which it participates. That is, although a complement is a referring expression, it is not the determinant of the type of the overall referring expression (i.e. object referring expression or situation referring expression), nor is it the determinant of the type of thing to which the expression may refer. Consider the expression

The book on the table

in which the complement “the table” is an object referring expression that participates in a modifying role in the overall referring expression.

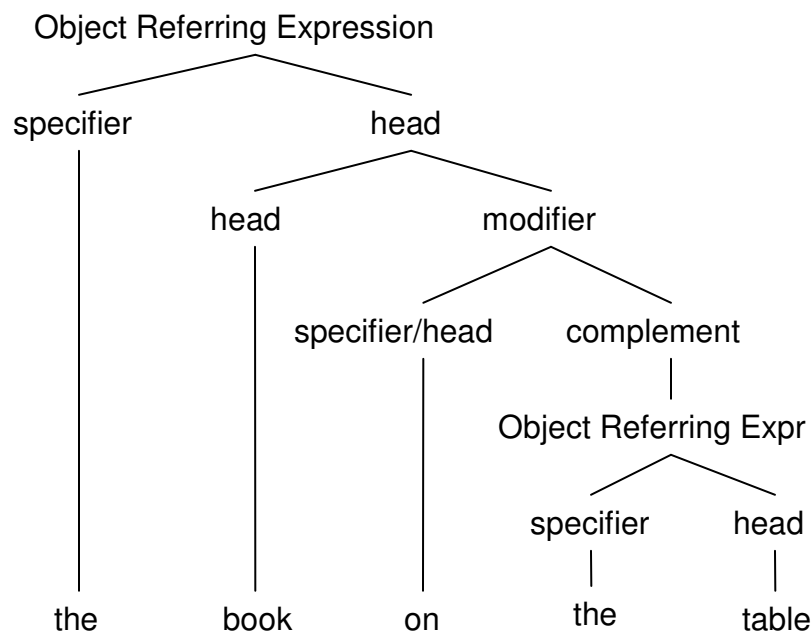




Note that the preposition “on” functions as both a specifier and a head in this expression, as well as sanctioning the occurrence of the complement “the table”. That is, “on” specifies the modifying relationship to the embedding expression in addition to functioning as the head of the embedded prepositional phrase. It is common in other treatments of the complement to treat the entire prepositional phrase as a complement and not just the object of the preposition. However, in Double R Grammar, prepositional phrases are treated as modifiers in object referring expressions. Modifiers and complements are similar in function (i.e. they both provide peripheral information), but complements are defined to be referring expressions and modifiers need not be. Further, modifiers may constrain the category of the head of a referring expression, whereas complements do not. Finally, modifiers are necessarily relational, whereas complements are either object referring expressions, or predicate or situation referring expressions viewed objectively.

A fuller explanation of the treatment of prepositions will be presented when the integration of referential and relational meaning is considered. As a hint of that discussion, consider that object referring expressions are nonrelational and do not take complements. In the relational domain, prepositions are relational and take two arguments (in this example the object referring expressions “the book” and “the table”) which contrasts with the prepositional phrase “on the table” being the complement of the object referring expression “the book”.

In the preceding example, the prepositional phrase “on the table” modifies the entire object referring expression “the book” and not just the head “book”. Although this is the preferred treatment, the prepositional phrase may also modify just the head, which is represented by



Note that this modification is internal to the combined specifier/head role filled by “the book.” Thus, modifiers may modify both specified and unspecified heads (as was also the case for “old” in “the old man”). The reason for preferring the treatment of “on the table” as modifying “the book” has to do with relational meaning, where a preference for the arguments to a relation to be referring expressions exists. Also, from a processing perspective, the words “the” and “book” are processed before “on” and are available to combine together to form a referring expression before combining with the prepositional phrase. Note that the latter representation requires waiting until the end of the prepositional phrase

before “the” can combine with “book on the table” to form an object referring expression. In general, the processing mechanism will need to wait for an arbitrary number of words and embedded expressions before the constituent can be constructed. Consider the expression

the book on the table by the chair in the living room...

From a processing perspective, it is preferable to construct constituents as soon as possible, rather than waiting until subsequent embedded expressions can be processed. Assuming this, the expression can be processed as follows:

(The book) – object referring expression created  
((The book) on the table) – modified object referring expression  
(((The book) on the table) by the chair) – doubly modified...  
((((The book) on the table) by the chair) in the living room) – triply modified...

The alternative requires delaying the construction of the object referring expression until the processing of all modifiers

The book – delay creation of constituent  
The (book (on the table)) – modified head  
The (book (on the table (by the chair))) – doubly modified head  
The (book (on the table (by the chair (in the living room)))) – triply modified head  
(The (book (on the table (by the chair (in the living room)))))) – object refer expr

Note that the determiner “the” cannot be combined with the head until all head modifiers are processed. In general, this is likely to cause problems for the processing mechanism which has a limited capacity short-term working memory available to store the partial products of language comprehension (Ball, 2003a).

### 3.5 More on Specifiers

It is suggestive that in English a specifier is the first element of the expression it specifies. Consider

**The** man       => object referring expression  
**Is** happy      => predicate referring expression  
**To** eat        => predicate referring expression  
**On** the table   => locative referring expression (see sections 3.6 and 3.7 below)

The surface position of specifiers in English allows them to function as markers for the expressions they specify and specifiers are important for marking referring expressions (in normal discourse). As such they are very frequently occurring elements. Because of their frequent use, they tend to be short words. The power of specifiers for language comprehension is revealed by examples like the following from Lewis Carroll’s poem Jabberwocky (1872):

Twas brillig and the slithy toves did gyre and gimble in the wabe

This sentence is full of specifiers (and other grammatical markers) which identify the referring expressions and make it possible to make some sense of the sentence despite the use of largely meaningless content words:

**Twas** brillig  
**The** slithy toves  
**Did** gyre and gimbal  
**In the** wabe

### 3.6 Prepositions as Specifiers

Prepositions share several properties of specifiers: 1) they tend to be short frequently occurring words, 2) they are members of a closed class part of speech, and 3) they are the first element of a prepositional phrase. However, they are not typical specifiers. The preposition in a modifying prepositional phrase specifies a modifier and not an object referring expression or situation referring expression. The preposition also functions as the head of a prepositional phrase, whereas specifiers are typically not the head of the expressions they specify.

The assumption that a preposition specifies a modifier when embedded in an object referring expression runs counter to the definition of a specifier as a word or expression that determines a referring expression. Taylor (1998) argues that a prepositional phrase is in fact a referring expression, with an expression like “on the table” referring to a location. Considering the correspondence between prepositional phrases like “on the table” and the explicitly **deictic** (or referential) adverb “there,” the referential nature of “on the table” is more apparent. The existence of deictic words to refer to location (e.g. there), direction (e.g. up) and time (e.g. now), suggests the addition of these types to Double R Grammar’s ontology of referring expressions. Jackendoff (1983) includes location, direction and time referring expressions in his ontology of referential types (along with a few others). By extension, if prepositional phrases can refer to locations, then the preposition does in fact specify a referring expression and the definition of specifier as determining a referring expression can be maintained.

The main problem in treating prepositions as specifiers of referring expressions is that it contrasts with their basic relational meaning. A preposition like “on” typically functions relationally to establish a relationship between two objects, e.g. “(the book) on (the table)”, or between an event and an object, e.g. “(he sat) on (the table)”. Simultaneously accounting for the referential and relational meaning of prepositions is a key challenge for Double R Grammar.

### 3.7 Wh-words

The **wh-words** in English can be used as a basis for identifying the possible types of referring expressions as follows (Jackendoff 1983, presents a similar analysis):

- Who – (human) object referring expression
- What – object referring expression, predicate referring expression, situation referring expression
- Where – location referring expression, direction referring expression, path referring expression
- When – time referring expression
- Why – objective or goal referring expression
- How – manner referring expression, direction referring expression

- How much/many/often – measure referring expression

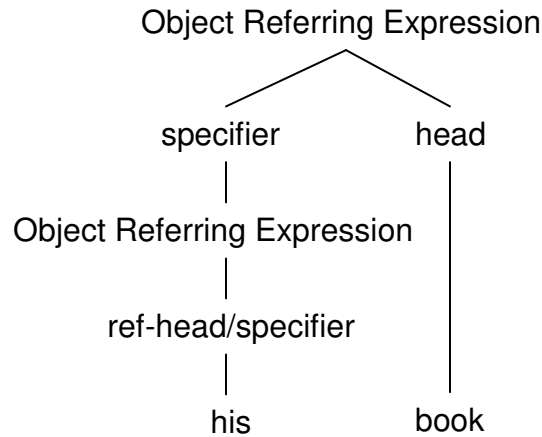
Allowing for these additional types of referring expressions, the prepositional phrase “on the table” in “the book on the table” can be viewed as a location referring expression. However, it does not necessarily follow that this prepositional phrase fulfills the role of a complement in this expression. That is, “on the table” may nonetheless function as a modifier of “the book” and not a complement. On this view, “on the table” constrains the category of thing to which the full expression may refer. The reasons for not treating prepositional phrases like “on the table” as complements will become apparent when the encoding of relational meaning is considered. The basic notion is that complements function as the arguments of relations. Since the expression “the book” is not relational, it does not take arguments. Thus, “on the table” modifies, but does not complement “the book”.

### 3.8 Possessive

An earlier example showed a pronoun functioning as the referring head of an object referring expression. **Possessive pronouns** take on the additional role of specifying a second object referring expression. Consider the expression

His book

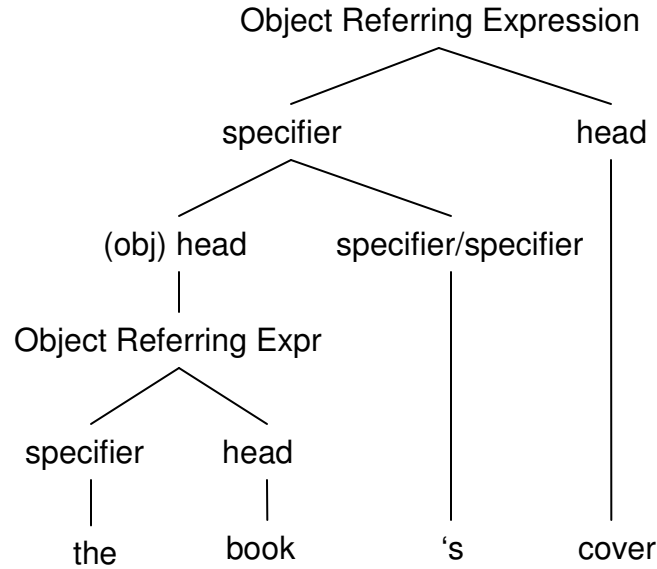
whose referential meaning is represented by



Thus, “his” functions as the referring head of one object referring expression and the specifier of a second object referring expression. The **possessive marker** ‘s behaves similarly. Consider

The book’s cover

whose referential meaning is represented by



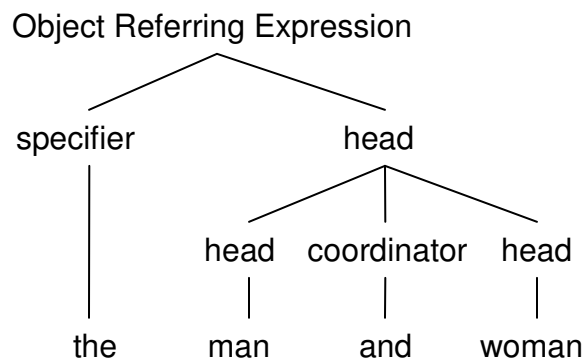
In this example, the possessive marker combines with the object referring expression “the book” to form a specifier. The possessive marker has the effect of specifying a specifier and the expression “the book’s” functions as a specifier of the overall object referring expression. This contrasts with the pronoun “his” where the specifying relationship between the possessive marker and pronoun is encoded in a single lexical item and is therefore not marked grammatically.

### 3.9 Coordination

Up to this point it has been assumed that there is a single specifier and head on a given level of representation in any referring expression—although there may be multiple complements and modifiers. However, the possibility of conjoining, subjoining and disjoining specifiers and heads represents a special case. Consider the expression

The man and woman

which is represented by



In this expression, the two heads “man” and “woman” are conjoined by the coordinator “and” on a single level of representation. Handling conjunction, subjunction and disjunction requires the introduction of a new linguistic category to capture this functionality. This category is called a **coordinator**. The meaning of a coordinator is primarily relational and coordinators do not fit neatly into the referential schema that is characterized by the bipolar asymmetry of the specifier and head.

## 4. Relational Meaning

The previous section considered the representation of referential meaning in object referring expressions using the linguistically referential categories **head**, **modifier**, **specifier** and **complement**. Words and expressions which take on these functional roles combine to form two basic (or prototypical) types of referring expressions: 1) object referring expressions, and 2) situation referring expressions. The preceding discussion focused on the representation of object referring expressions, since the representation of situation referring expressions requires a consideration of relational meaning. The need for a few additional types of referring expressions corresponding to location and direction referring expressions and perhaps manner and reason referring expressions was also considered. A range of different object referring expressions was considered, and for the most part, the four linguistic categories proved adequate for representing referential meaning. To handle coordination of linguistic elements, a **coordinator** category was also added.

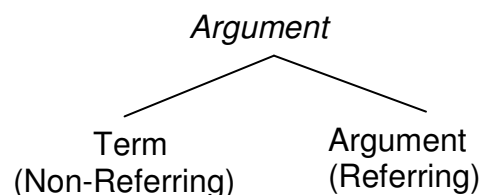
In this section, the integration of relational meaning with referential meaning begins with the consideration of a similarly limited set of linguistically relational categories consisting of **predicate**, **function**, **argument**, and **term**.

### 4.1 Definition of Terms

**Term** – (subtype of *argument*) a word or expression that describes a type or category of object or objectified relation and that functions as the head of an object referring expression, but is not, in and of itself, a referring expression.

**Argument** – (subtype of *argument*) a word or expression that functions as an argument of a relation and is a referring expression.

*Argument* – arguments and terms. Italics will be used when this definition is intended.



**Predicate** – (subtype of relation) a word or expression that describes a relation that functions as the head or a modifier of the head of a situation referring expression

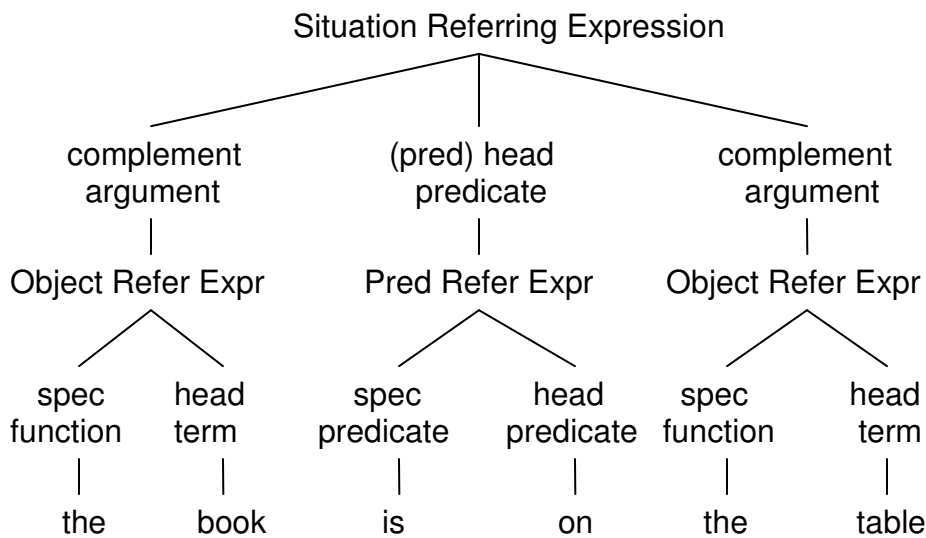
## 4.2 Discussion

**Predicate** and **function** are subcategories of **relation**. A relation is a word or expression that can be used to describe an association between two or more objects or situations, or a property, state or quality of a single object or situation. That is, in the absence of a more general term, the term relation will be used to encompass properties, states and qualities of a single object or situation as well as associations between objects and situations. Predicates are relations that head predicate referring expressions and are **asserted**. Functions are relations that function as modifiers in object referring expressions and are **presupposed**. The object and situation referring expressions that are associated via a relation are called the *arguments* of the relation. When they are referring expressions they will be called **arguments** and when they are non-referring expressions they will be called **terms**. It is assumed that only object referring expressions allow terms. That is, the arguments of a predicate are always referring expressions.

Consider the expression

The book is on the table

which can be used to express the relation “on” (occurring in the present) between the object “the book” and the object “the table.” An integrated referential/relational representation for this expression is given by

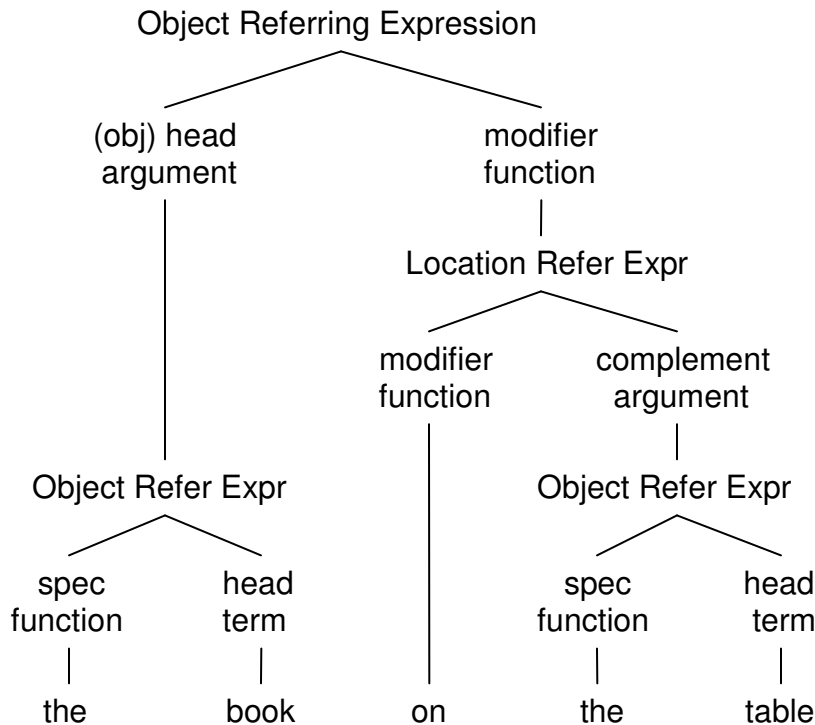


In this example, the word “the” combines with the word “book” to form an object referring expression. From a relational perspective, “the” is a function and “book” is a term. From a referential perspective “the” is a specifier and “book” is a head. Similarly, the word “the” combines with the word “table” to form an object referring expression. The word “is” combines with the word “on” to form a predicate referring expression “is on”. From a relational perspective, “is” and “on” are both predicates. From a referential perspective, “is” is a specifier and “on” is a head. From a relational perspective, the predicate referring expression “is on” functions as a predicate in the overall situation referring expression with “the book” and “the table” functioning as the arguments of the predicate. From a referential perspective, “is on” functions as a predicate referring expression which combines with the complements “the book” and “the table” to form a situation referring expression.

An important claim of Double R Grammar is that object referring expressions as well as situation referring expressions encode relational meaning. Thus, there is a close correspondence in relational meaning between the above situation referring expression and the object referring expression

The book on the table

whose integrated referential/relational meaning is represented by



The primary difference in meaning between these two expressions is not relational—it is referential. In the situation referring expression, the encoding of referential and relational meaning are both accommodated since the head of the situation referring expression is a relation. In the object referring expression, the encoding of relational meaning is subordinated to the encoding of referential meaning since the head of the expression is not a relation. As a result, the relational meaning of “on” is not encoded on a single level of representation. On one level “on” combines with “the table” to form a location referring expression, and on a different level “on the table” combines with “the book” to fulfill the relational status of “on”. Thus, the relational meaning of “on” is composed across two levels of representation, corresponding to a functional composition of two functions, each of which takes a single argument (e.g.  $f(g(b))$ ), as opposed to a predicate taking two arguments (e.g.  $p(a,b)$ ).

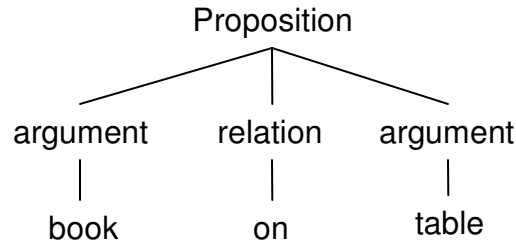
Since object referring expressions describe objects which are inherently nonrelational, whereas situation referring expressions describe situations which are inherently relational, one should expect that the encoding of relational meaning will be less transparent in object referring expressions than in situations referring expressions. That is, referential considerations are likely to cloud the encoding of relational meaning in object referring expressions.

With respect to the relational status of “the” and “is,” consider that the occurrence of the word “the” invokes the expectation “the what?” and the occurrence of “is” invokes something akin to “Someone or



something is what?” or “Someone or something is where?” That is, although these words are not prototypical relations, they do not stand alone, and there is some support for treating them as relations.

In Double R Grammar words like “the” and “is” are not simply ignored on the way to the creation of a nonlinguistic propositional representation like



While such representations simplify considerations of relational meaning, they abstract away from important dimensions of meaning, including referential meaning. For example, they provides no means of representing referential distinctions like definite vs. indefinite reference in expressions like

The book is on the table  
A book is on the table  
The book is on a table

nor do they provide a means of representing temporal distinctions like

The book is on the table  
The book was on the table  
The book will be on the table

and without additional machinery, they cannot distinguish

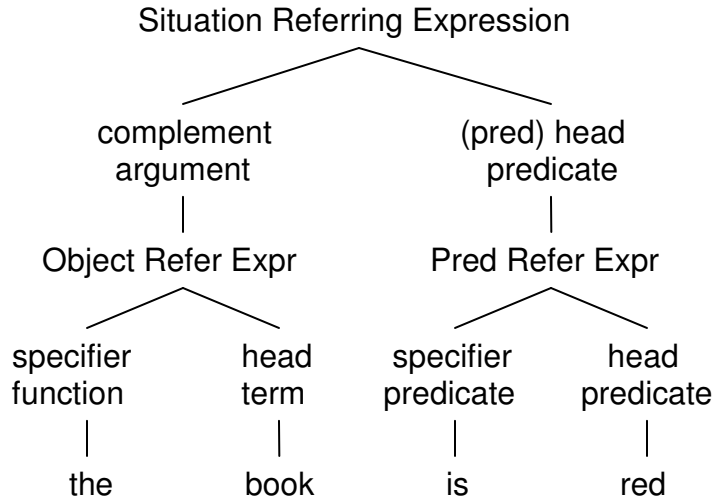
The book on the table  
The book is on the table  
The book that is on the table.

Such meaning distinctions may well be important and abstract propositional representations which fail to capture these distinctions will run into problems. Further, simplifying along a single dimension like relational meaning actually complicates the integration of meaning across dimensions, since that integration relies on a similarity in representational structure across those dimensions.

As an example of a situation referring expression which may be used to describe a property of an object consider

The book is red

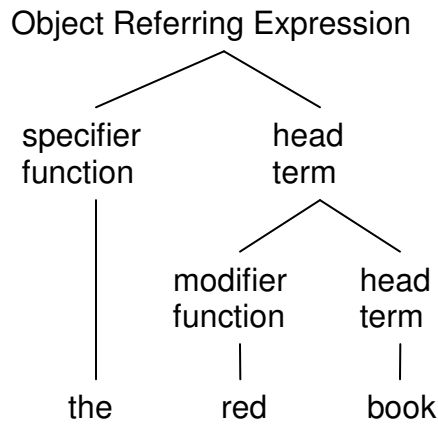
whose combined referential/relational meaning is represented by



In this example, the predicate “is red” asserts a property of redness of the argument “the book.”  
The corresponding object referring expression

The red book

is represented by

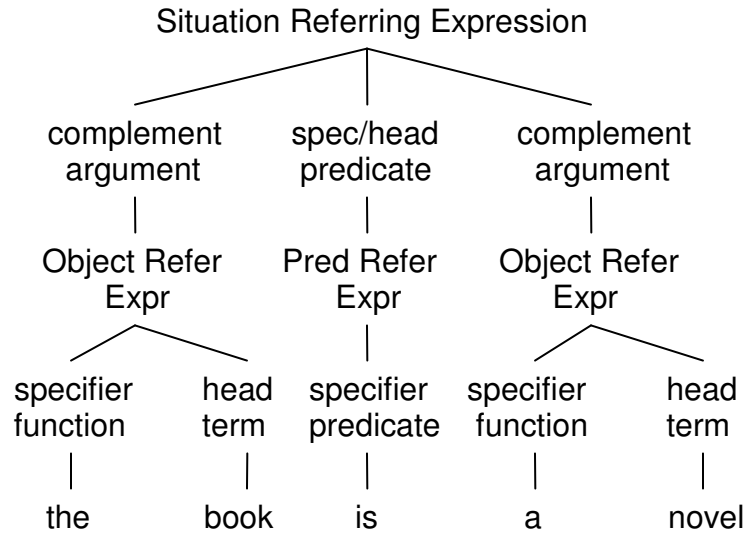


In both the situation and object referring expressions, “red” is a relation. However, in the situation referring expression “the book is red”, “red” combines with “is” to form a combined predicate that takes the object referring expression “the book” for an argument, whereas, in the object referring expression “the red book”, “red” combines with the term “book” and forms a combined term. In the situation referring expression there is an object referring expression “the book” about which the property of being red is asserted, whereas in the object referring expression, “red” is part of the referring expression itself and is presupposed of the object being referred to rather than being asserted of that object. Once again, there is a referential difference intruding on the relational encoding of meaning. That is, the differences in the meaning of “the book is red” and “the red book” are primarily referential and not relational—although those differences have considerable effect on the encoding of relational meaning and the overall structure of the expressions.

In “the book is red”, “is” combines with “red” to form a combined predicate. In English “is” can also function as a predicate by itself. Consider

The book is a novel

which can be represented as



Although “is” functions as a predicate which combines with the arguments “the book” and “a novel”—essentially establishing the equivalence of these two object referring expressions—the difference in the referential status of “the book”, a definite reference, and “a novel”, an indefinite reference, has the effect of assigning the descriptive content of “a novel” to the object referred to by “the book”. Thus, although the relational meaning of this expression is straightforward, its integration with referential meaning complicates the overall meaning in an interesting way. This complication leads to the suggestion that the expression “is a novel” as a whole is being **predicated** of “the book” despite the fact that “a novel” is clearly an (indefinite) object referring expression and not a relation.

### 4.3 Object Referring Expressions – Reconsidered

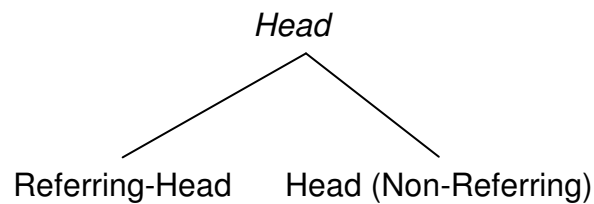
This subsection considers the grammatical encoding of referential and relational meaning in object referring expressions in more detail. The integration of referential and relational meaning is facilitated by correspondences between referential and relational categories which are made explicit below.

Complement  $\approx$  Argument (where  $\approx$  means “corresponds to”)

Referring Head = Head that is a referring expression  
 $\approx$  Argument  $\approx$  maximal projection

Head (Non-Referring) = Head that is not a referring expression  
 $\approx$  Term  $\approx$  non-maximal projection

*Head* = This is the previous definition of head which includes referring and non-referring heads and italics will be used when this definition is intended.



In addition to the correspondences above, three additional referential categories are introduced to capture referential meaning distinctions and to facilitate the integration with relational meaning:

Specifier-specifier = a specifier that specifies a specifier

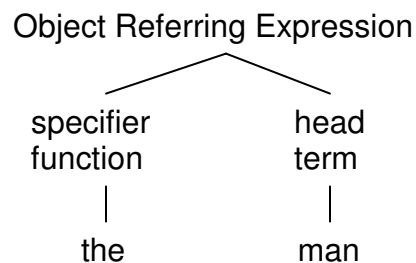
Modifier-modifier = a modifier that modifies a modifier

Specifier-modifier = a modifier that modifies a specifier

Consider the expression

The man

which is represented by



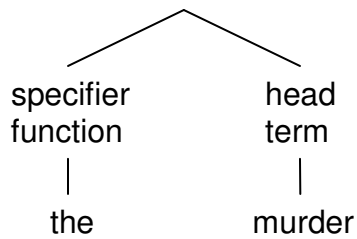
In this representation, the word “the” has been referentially categorized as a specifier and is relationally categorized as a function and that the word “man” is relationally categorized as a term that functions as the (non-referring) head of the overall object referring expression. The relational category “function” captures the use of non-head relations in object referring expressions. The relational content of object referring expressions is often overlooked in other treatments. The treatment of “man” as a (non-referring) head and term recognizes its referential role as the head of the object referring expression and its relational role as a term (i.e. argument) of the function “the”.

The category “term” is a functional category. It says nothing about the basic part of speech of the word or expression that functions in this role. The prototypical word that functions as a term is a noun. However, words that are not nouns may also function as terms. Consider the expression

The murder

which is represented by

## Object Referring Expression



The word “murder” describes an action, not an object. However, in the context of the function-specifier “the”, the action expressed by the word “murder” is objectified. The question of whether or not “murder” is a noun in this expression is an interesting one. On distributional grounds, one can argue that it is a noun. It occurs after a determiner. It can be pluralized as in “the murders.” It can be modified by an adjective as in “the horrible murder”. Nonetheless, in this expression the word “murder” still describes an action. In the context of this expression, that action is objectified and treated as an object. Two basic treatments of objectified actions are suggested—either they retain their base part of speech and verbs are allowed to function as the heads of object referring expressions, or words like “murder” are allowed to be nouns as well as verbs. It is probably the case that action words like “murder” which frequently occur in object referring expressions come to have the status of nouns in this use. However, for action words or expressions that seldom occur in object referring expressions, a process of objectifying the action when it does occur in an object referring expression is suggested. Consider the expression

### The **cheering up** of the crowd

Most people have probably not experienced the use of “cheering up” as the head of an object referring expression frequently enough to have a representation of this expression as an objectified action. Thus, they must rely on a process of objectifying such expressions in the context of a function-specifier, rather than retrieving a previously stored objectified version. Indeed, even in the case where a person has experienced the use of an action word or expression in an object referring expression and may have a representation of this use, if the word or expression is more frequently used as the head of a situation referring expression, then some mechanism for retrieving the objectified version rather than the non-objectified version is still needed. That mechanism may depend on the occurrence of a function-specifier to indicate the objectified action.

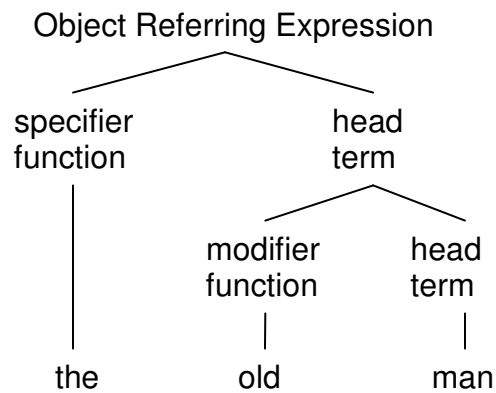
Accepting that most action words can be objectified and used in object referring expressions provides a basis for a meaningful definition of what it means to be a noun. A noun is a word that describes a category of object or objectified action (or objectified relation more generally). This is essentially what dictionaries do in defining the use of action words as nouns by beginning the definition with the phrase “the act of...”. In fact it is difficult to find an instance of an action word that does not have a noun entry in a good dictionary, unless there happens to be an alternative noun form that differs from the verb form (e.g. “destruction” and “destroy”). The objectification of action words is highly productive and deciding whether an action word is being used as an objectified action or not depends on the grammatical context and, in particular, the specifier in that context. In the absence of a specifier or grammatical context (e.g. in a psychological experiment testing the ability of subjects to classify the parts of speech of words), it is assumed that the core meaning of a word will dominate and action words will predominantly be classified as verbs and object words will predominantly be classified as nouns.

## 4.4 Function-Modifier

As an example of an object referring expression containing a modifier consider the expression

The old man

which is represented by

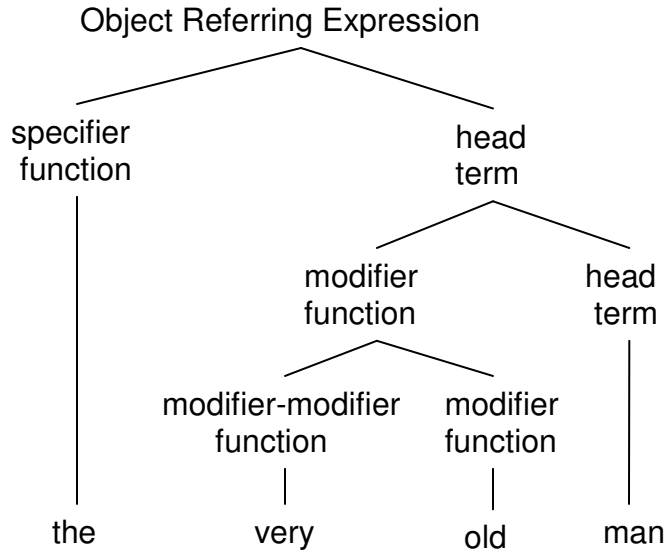


In this example, the modifier “old” combines with the head “man” to form the head “old man” which is a non-referring expression. At the same time the function “old” combines with the term “man” to form the term “old man” which is nonrelational. The function-specifier “the” then combines with the non-referring head and term “old man” to form the object referring expression “the old man”. The correspondence in the grammatical encoding of referential and relational meaning facilitates this integration.

Adding the adverb “very” to the above expression gives

The very old man

which is represented by



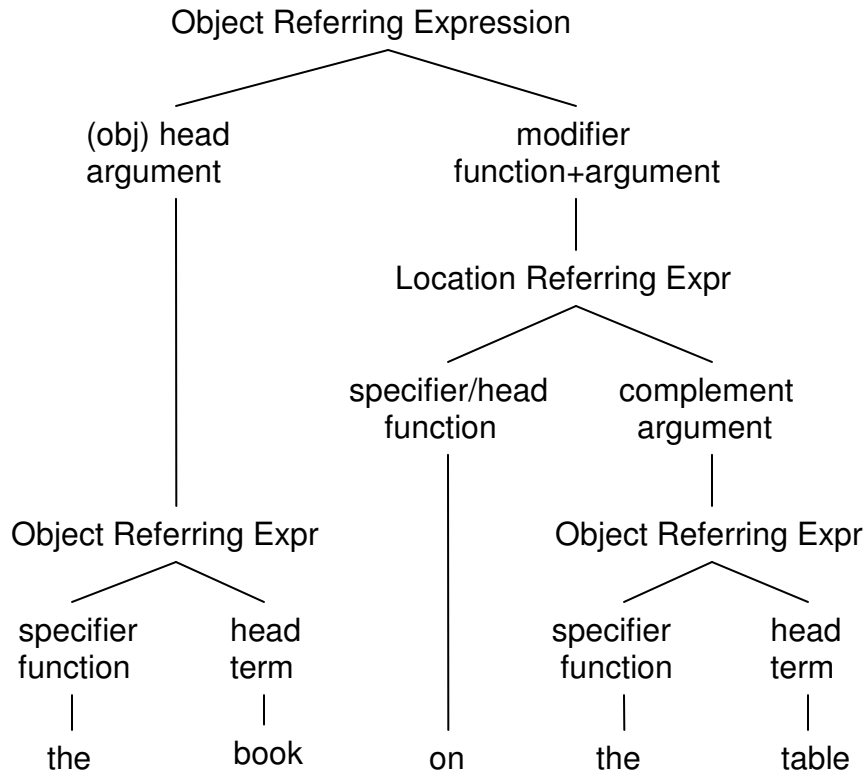
In this example, the adverb “very” fills the referential role of a **modifier-modifier** and the relational role of a function (that takes a function for its argument). The category modifier-modifier supports the distinction between words and expressions that modify heads (typically adjectives in object referring expressions) and words and expressions that modify modifiers of heads (typically adverbs in object referring expressions).

#### 4.5 Complement

For an example of an object referring expression which includes a modifier and complement, consider the expression

The book on the table.

It is clear that this expression expresses a locative relationship “on” between the object referred to by “the book” and the object referred to by “the table.” It is just as clear that the overall expression refers to a book (that happens to be located on a table). A representation that captures relational and referential meaning will need to reflect both these dimensions of meaning:



This combined referential/relational representation has the disadvantage of not explicating the relationship of the arguments to the function “on” on a single level of representation, but it may be that the relational nature of prepositions like “on” in such expressions is made less transparent by the requirements for encoding referential meaning. Indeed, it is surprising (to me) how many other linguistic treatments of the meaning of prepositional phrases totally ignore the basic relational meaning of prepositions in treating prepositional phrases as modifiers or complements of heads in such expressions with no indication of their relational association with the head.

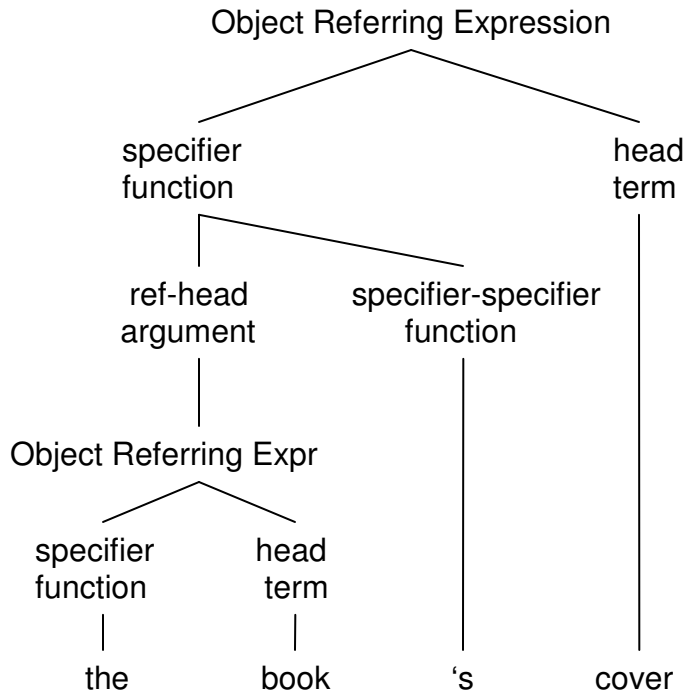
#### 4.6 Possessive

The possessive marker is unique in taking a first argument that is an argument (i.e. referring expression) and a second argument that is a term (i.e. non-referring expression). Consider the expression

The book’s cover

which is represented by





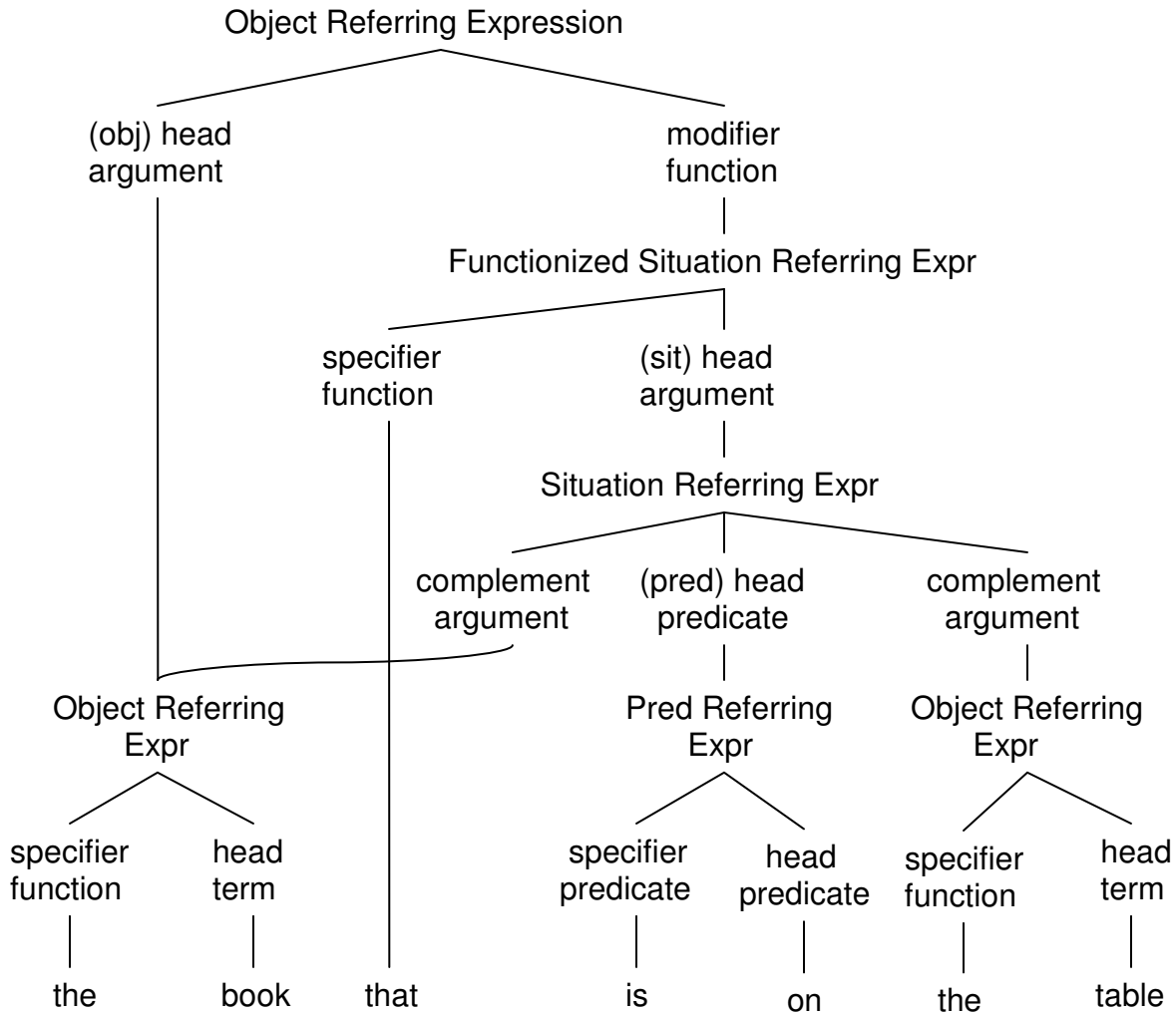
It is only in considering both referential and relational meaning that the role of the possessive marker becomes fully apparent. And once again exigencies of encoding referential meaning make the encoding of relational meaning less transparent, especially since the first argument to the possessive relation is an object referring expression which then participates with the possessive marker in the specification of an object referring expression. In the representation above, the relational status of the possessive marker is unique in that it combines with an argument to form a function that then takes a term for a second argument. That is, the possessive marker is bi-relational in establishing a relationship with “the book” that differs from the relationship it establishes with “cover”. Referentially, the possessive marker fulfills the role of a specifier that specifies a specifier. That is, it has the effect of converting an object referring expression “the book” into a specifier. From a relational perspective, the possessive marker **functionizes** the object referring expression “the book”, allowing the resulting expression to take on the role of a function in the overall expression.

## 4.7 Relative Clause

The relative clause provides a classic example of considerations of referential meaning complicating the representation of relational meaning. Essentially, an entire situation referring expression functions to establish reference to an object that participates in the situation described by the situation referring expression. Consider the expression

The book that is on the table

which is represented by



From a relational perspective, the relative pronoun “that” **functionizes** the situation referring expression “(the book) is on the table” allowing it to fulfill the relational role of a function. From a referential perspective, the specifier “that” specifies the modifying role of the relative clause with respect to the object referring expression “the book” in creating a “relativized” situation referring expression.

## 4.8 Situation Referring Expressions

This section considers the representation of situation referring expressions in more detail. In these representations, both referential and relational meaning are explicitly represented. The representations are also compared to the seven clausal patterns presented in Quirk et al. (1972):

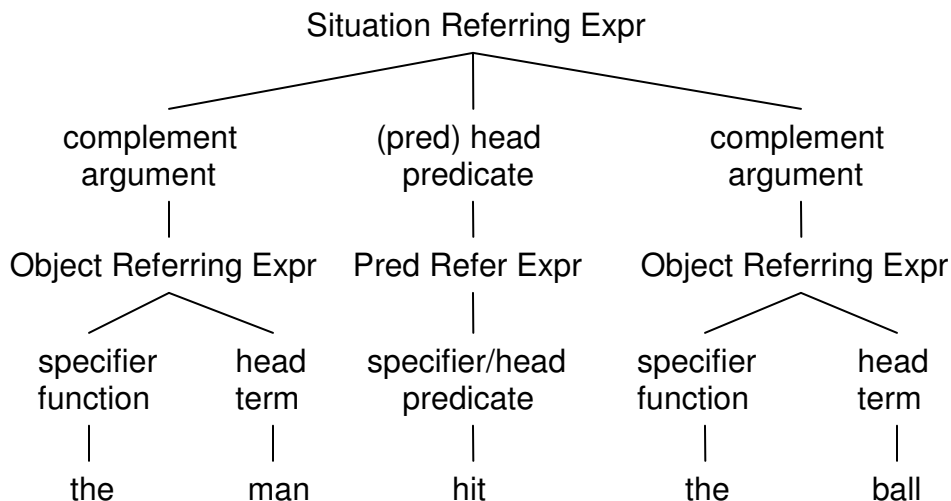
- SV** – Subject Verb
- SVO** – Subject Verb Object
- SVC** – Subject Verb Complement
- SVA** – Subject Verb Adverbial
- SVOO** – Subject Verb (Indirect) Object (Direct) Object
- SVOC** – Subject Verb Object Complement
- SVOA** – Subject Verb Object Adverbial

According to Quirk et al., these seven clausal patterns cover the structure of simple sentences—sentences with a single clause and no optional elements—in English. In their terminology a complement is a functional component that completes the meaning of another functional component—either the subject (subject complement) or an object (object complement). That is, it does not refer to a separate object, but to the same object as the functional component it complements. Also, an adverbial is a necessary element of the sentence. Without the adverbial, the sentence is not grammatical. Note that the **Verb** function in Quirk et al. is distinct from verb as a part of speech and the work of Jackson (1990) which derives from that of Quirk et al., uses the term **Predicator (P)** instead of Verb to describe this function.

The relational structure of situation referring expressions is generally less affected by the encoding of referential meaning than is the case for object referring expressions. Consider the expression

The man hit the ball

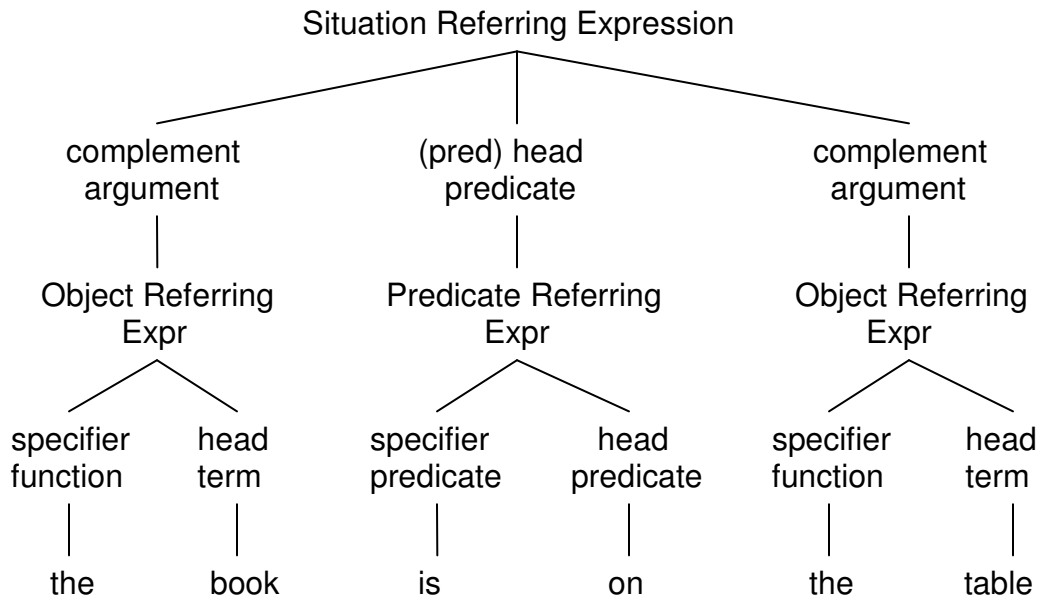
which is represented by



In this example, the encoding of relational and referential meaning aligns closely. This representation corresponds to the **SVO** (Subject-Verb-Object) pattern of Quirk et al. A similar alignment of referential and relational meaning occurs for the expression

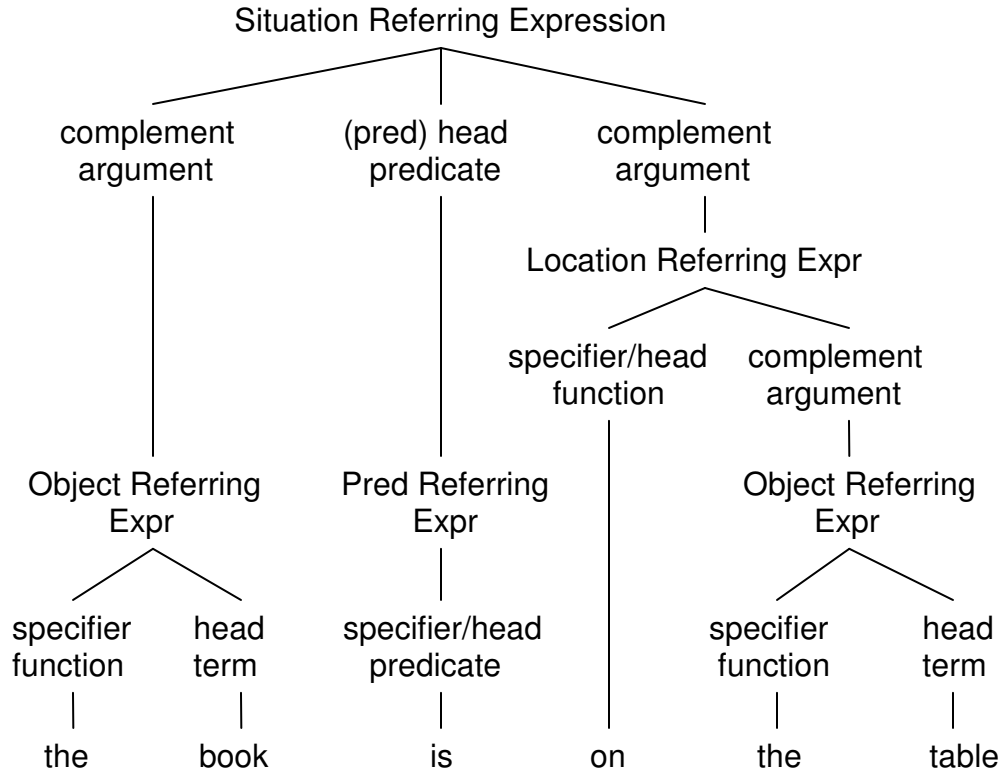
The book is on the table

which is represented by



In this example, the relational nature of the preposition “on” is explicit as is its referential contribution to the situation referring expression. Further, the relational meaning of “on” is reflected on a single level of representation. This is in contrast to the expression “the book on the table” in which the relationship of the arguments to the relation “on” occurred on different levels of representation due to considerations of the encoding of referential information. Thus, one might expect the relational nature of “on” to be more transparent when “on” is used as a predicate, than when it is used as a function. That is, when “on” is predicated of two objects, it is the focus and its relational meaning is emphasized, however, when “on” participates in a modifying prepositional phrase, the relational meaning of “on” is subordinated to considerations of reference.

The suggestion that “on” combines with “is” before combining with “the table” runs counter to most other treatments in which the prepositional phrase is treated as a constituent. For example, Quirk et al. would assign this sentence to the **SVA** (Subject-Verb-Adverbial) pattern with “is” functioning as the Verb and “on the table” functioning as an adverbial. A representation which retains the more normal treatment is shown below

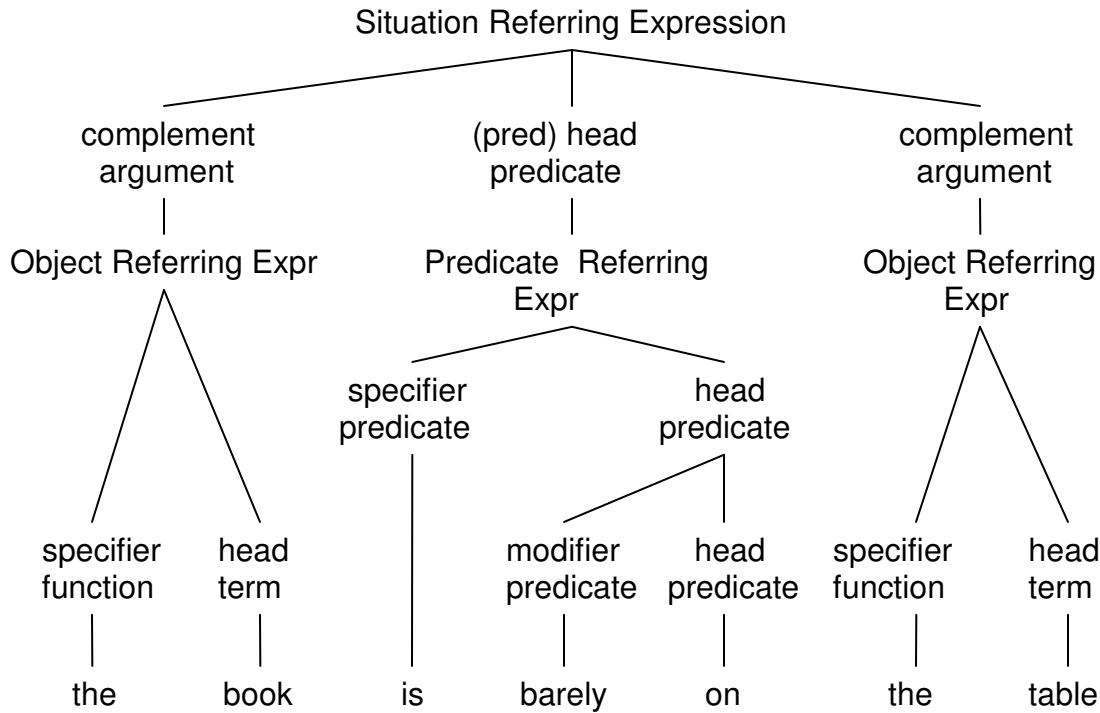


Unfortunately, this representation completely ignores the relational meaning of “on” with respect to “the book” in treating the prepositional phrase “on the table” as an argument of the predicate “is”. In general, representations which explicitly represent the relational meaning of prepositions are preferred in Double R Grammar, although Quirk et al. (1972) take the opposite tack in assigning the **SVA** (Subject-Verb-Adverbial) pattern to such expressions.

Adding an optional adverb to the expression gives

The book is barely on the table.

(Note that Quirk et al. do not consider optional adverbs—or optional elements more generally—in their basic clausal patterns.) Assuming the explicit representation of the relational meaning of “on” this can be represented as



In this example, the predicate-modifier “barely” modifies the predicate “on” internal to the combination of the predicate “barely on” with the predicate-specifier “is”.

#### 4.9 Simplified Representation

As noted in the introductory section, the category labels used in Double R Grammar representations are epiphenomenal. Rather than continuing to use dual referential and relational labels which result in rather cumbersome representations, simplified representations which combine referential and relational categories will be introduced and used henceforth. The referential and relational category labels will be combined as follows:

Relational Category	Referential Category	Combined Category
Relation	Modifier	Relation-Modifier
Predicate	Modifier	Predicate-Modifier
Predicate	Specifier	Predicate-Specifier
Predicate (above PRE)	Head	Predicate
Predicate (below PRE)	Head	Head
Predicate (below PRE)	Specifier/Head	Specifier/Head
Predicate (above SRE)	Modifier	Situation-Modifier
Predicate (below PRE)	Specifier-Modifier	Predicate-Specifier-Modifier
Function	Specifier	Specifier
Function	Specifier/Head	Specifier/Head
Function	Modifier	Modifier
Function	Modifier-Modifier	Modifier-Modifier or Relation-Modifier

Function	Specifier-Specifier	Specifier-Specifier
Argument (above ORE)	Complement	Subject, Object, Indirect Object, or Complement
Argument (below ORE)	Referring-Head	Referring-Head
Argument (below ORE)	Specifier/Head	Specifier/Head
Term	Head	Head

Note that there is a preference for using relational terms to describe situation referring expressions and a preference for using referential terms to describe object referring expressions. However, it is understood that the use of relational terms in situation referring expressions does not discount the importance of referential meaning, nor does the use of referential terms in object referring expressions discount the importance of relational meaning. Note, also, that the relational head of a situation referring expression is now called a predicate at the level above Predicate Referring Expression (i.e. as a daughter of a Situation Referring Expression) and a head at the level below Predicate Referring Expression.

The functional categories **subject**, **(direct) object**, **indirect object** and **complement** are also introduced as subtypes of argument, with complement being the default argument subtype. These categories are used to describe arguments that are sisters of a predicate (i.e. the function of a Predicate Referring Expression). On the other hand, the referential categories referring-head and specifier/head are used to describe the functional components of Object Referring Expressions.

Specifiers are further classified as follows:

- Object-specifier
- Predicate-specifier
- Complement-specifier
- Relative-clause-specifier
- Modifier-specifier
- Specifier-specifier

Object-Specifier will often simply be called Specifier (the more general term). Complement-Specifiers are specifiers that specify complements (e.g. complementizers). Relative-clause specifiers are specifiers that specify relative clauses. Modifier-Specifiers are specifiers that specify modifiers (e.g. prepositions, relative pronouns). Specifier-Specifiers are specifiers that specify specifiers (e.g. the possessive marker). Additional subtypes of specifier will be introduced as needed. For example, predicate-specifiers can be further categorized as follows:

- Finite-predicate-specifier
- Nonfinite-predicate-specifier

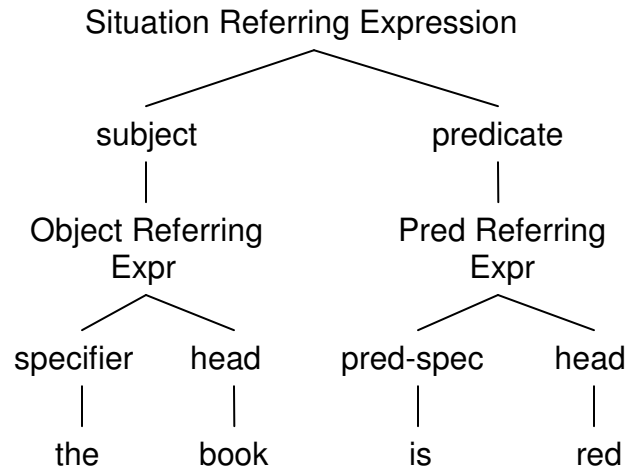
where auxiliary verbs typically function as finite predicate specifiers and the infinitive marker “to” functions as a nonfinite predicate specifier.

## 4.10 Predicate Adjective

Using the combined referential and relational categories and subtypes of argument, consider the expression

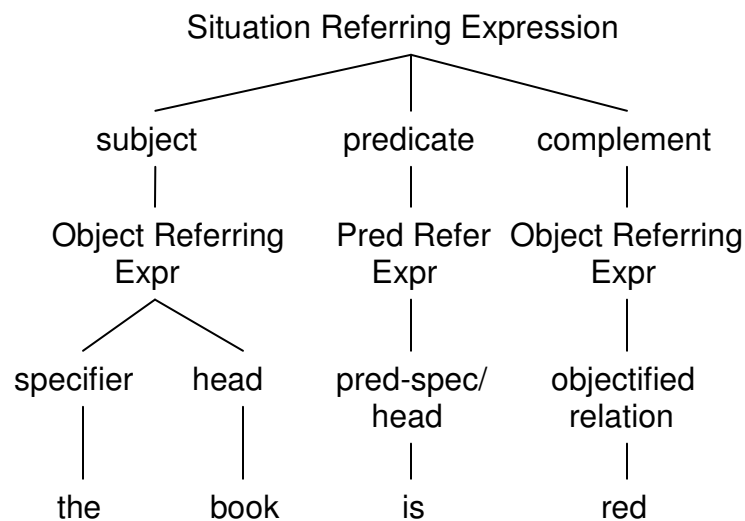
The book is red

which is represented by



In this representation it is understood that the subject argument “the book” is a complement of the head “is red” since arguments are always complements and predicates are always heads unless explicitly marked as specifiers or modifiers.

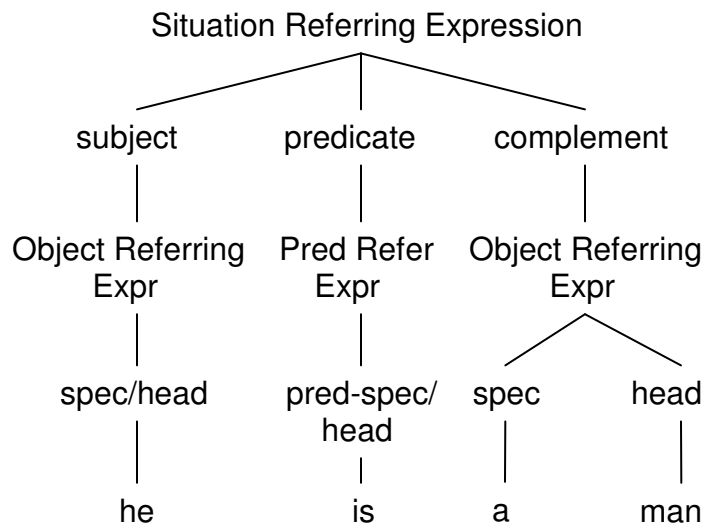
Quirk et al. treat **predicate adjectives** like “red” above as **subject complements** following the **SVC** (Subject-Verb-Complement) pattern with “is” functioning as the verb and “red” functioning as a complement that completes the meaning of the subject “the book.” They also treat **predicate nominals** like “a man” in “he is a man” as subject complements. If the auxiliary verb “is” is allowed to objectify “red” the result is a representation like



However, Double R Grammar assumes that auxiliary verbs typically function as predicate-specifiers that predicatize rather than objectify and for this reason the predicate adjective treatment is preferred. With regard to the predicate nominal, while the auxiliary verb “is” has a predicatizing function, the object-



specifier “a” has an objectifying function and these two influences compete in determining the status of the predicate nominal. Assuming that the object-specifier “a” dominates leads to



which corresponds to the Quirk et al. treatment of predicate nominals as complements and parallels their treatment of predicate adjectives.

The above examples are the first examples containing an explicit **subject**. The treatment of the subject in Double R Grammar differs from other current linguistic treatments. In particular, the subject functions as an argument of the predicate in a situation referring expression. The subject is not treated as a specifier as is now common in many X-Bar Theoretic approaches (e.g. Chomsky, 1995, Stowell, 1989) and HPSG (Sag and Wasow, 1999). Given the function of specifiers in establishing referentiality, the subject makes a poor choice of specifier. The subject says nothing about the referential status of a situation referring expression. In providing a semantic basis for the function of specifiers, the inappropriateness of having subjects function as specifiers is made obvious.

Not only is the subject not treated as a specifier, it is not treated as an **external argument**, either. In fact, it is assumed that the subject typically combines with the head of a situation referring expression before any objects and not after them. The main argument here is a processing one. The subject is processed before the predicate and is available to be combined with the predicate before any objects are processed. Delaying the combining of the subject with the predicate is likely to cause processing difficulties stemming from the increased likelihood of exceeding the capacity of short-term working memory. Further, consider the processing of an imperative expression like

Give me the book!

Since the subject is not even expressed in this expression, being only indicated by the second person marking of the verb and the imperative sentence structure, it is hard to see how the subject can be external to the object in such expressions. In languages like Spanish, where the subject is also typically omitted in declarative sentences where a pronominal subject could be optionally used, as in

(tu) eres (2 person sing) leyendo el libro – you are reading the book  
 (ella) esta (3 person sing) leyendo el libro – she is reading the book

the unexpressed subject is once again only reflected in the person marking on the verb, which suggests a closer relationship of the subject to the verb than any objects. Finally, the existence of conjoined expressions like “he hit and she kicked the ball”, where the subject and predicate “he hit” and “she kicked” are conjoined prior to expression of the object “the ball”, argues against the necessity of having external subjects.

Admittedly, the treatment of objects as internal arguments of the verb and the subject as an external argument of the verb is deeply entrenched (at least for analyses of English). In part, this is based on the occurrence of subjectless constructions like gerunds and infinitive clauses which suggest the existence of verb phrase constituents. Clearly, there is some merit to this position. Further, it may be that there are pragmatic reasons for treating subjects as distinguished from other objects (e.g. topicalization, saliency, etc). However, from a relational perspective, subjects and objects are all arguments of the predicate with equal relational status, and they are treated as such in Double R Grammar. To the extent that the notion of an external subject is legitimate, it is presumably tied to dimensions of meaning like topicalization and saliency, or to processing considerations which are not currently addressed in Double R Grammar.

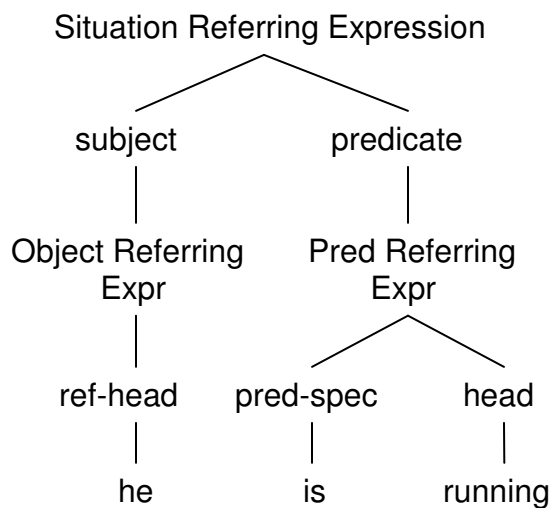
It is also worth noting at this point that the **predicate** in Double R Grammar corresponds to the verb group (i.e. the verb—or other relational head—and any specifiers or modifiers, Quirk et al., 1972) and not the entire verb phrase (which encompasses the non-subject complements of the verb, but, at least in some treatments, not the first auxiliary). Again, this is largely the result of the relational focus of Double R Grammar and the assumed orthogonality between relational structure and referential structure.

#### 4.11 Present Participle

Verbs, adjectives, and prepositions are the three typical relations that function as predicates. Verbs are further distinguished from adjectives and prepositions since they can be morphologically marked for tense and do not require the inclusion of an auxiliary verb to specify the predicate. Of course there are verb forms which do require an auxiliary verb. Consider, the expression

He is running

which is represented by



In this example, the **present participle** “running” behaves very much like an adjective in relying on the auxiliary verb “is” to provide its specification. On distributional grounds one might argue that “running” is an adjective. However, “running” describes an action and is clearly derived from the verb “to run” via addition of the morphological marker “-ing”—the fully productive grammatical mechanism for the creation of present participles. To argue that “running” is an adjective is to conflate two easily distinguished parts of speech—adjectives and present participles (of verbs). This conflation results from the failure to distinguish the function of words in particular grammatical contexts from their inherent part of speech. That is, adjectives and present participles both function as predicates and functions, and they do so because they both describe relations and those relations participate in object referring expressions as well as situation referring expressions. However, an adjective is typically used to describe a relation that endures through time relatively unchanged, and a present participle is typically used to describe an action that progresses through time. This progression through time is indicated by adding the “-ing” suffix to the verb stem and is categorized as a form of verb **aspect**.

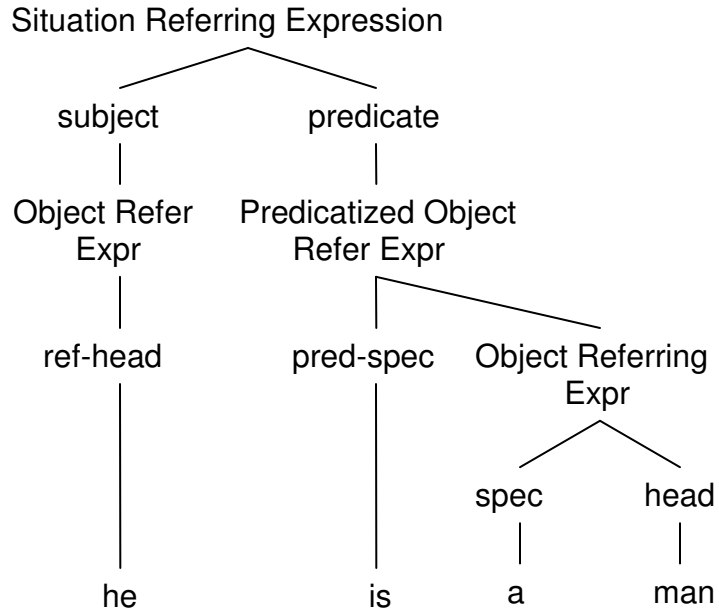
Interestingly, Quirk et al. treat present participles in combination with auxiliary verbs as a combined verb in assigning an **SV** pattern to such sentences. Thus, according to their functional representations, predicate adjectives, predicate prepositions and present participles following auxiliary verbs are functionally distinct—despite their grammatical similarity—with predicate adjectives functioning as complements (SVC), predicate prepositions functioning as adverbials (SVA), and present participles functioning as Verbs (SV). On the other hand, Quirk et al. treat predicate nominals like predicate adjectives, giving them the functional role of complements (SVC). In Double R Grammar, predicate adjectives, predicate prepositions and present participles of verbs are all treated as predicates and predicate nominals may either function as complements or predicates (see below).

#### 4.12 Predicate Nominal (an Oxymoron?)

It has been noted that the specifier is the primary determinant of the grammatical type of an expression in which it occurs. In an expression containing a predicate-specifier like “is”, the head following “is” may be treated as a predicate regardless of the form of that head. Consider the expression

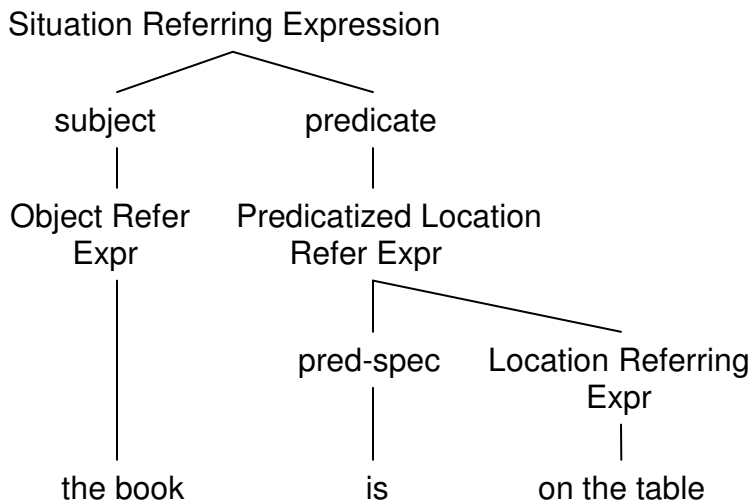
He is a man.

It may be that “is” functions as a predicate-specifier and that the expression “a man” is effectively **predicativized** by “is” and treated as a predicate. Assuming that “is” can predicativize an object referring expression leads to a representation of the form

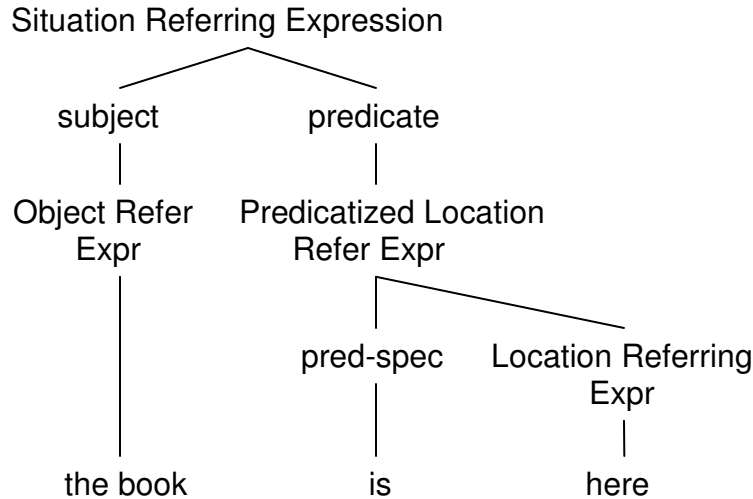


In this example, the object referring expression “a man” is predicativized and combines with “is” to form a combined predicate. The ability of a predicate-specifier to predicativize its head parallels the ability of a function-specifier-specifier (e.g. possessive marker) to functionize its head. In this manner, nonrelational expressions can be relationalized and used as though they were relational.

The ability of a predicate specifier to predicativize its head suggests an alternative treatment of predicate prepositions in which the prepositional phrase as a whole is predicativized and not just the preposition. For the expression “the book is on the table” this is represented (in reduced form) as



This representation has the advantage of retaining the structural integrity of the prepositional phrase “on the table”, but, once again, at the expense of the relational meaning of “on”. The predicativizing function of predicate specifiers also allows for the possibility of adverbs functioning as predicates as in “the book is here” which is represented straightforwardly as

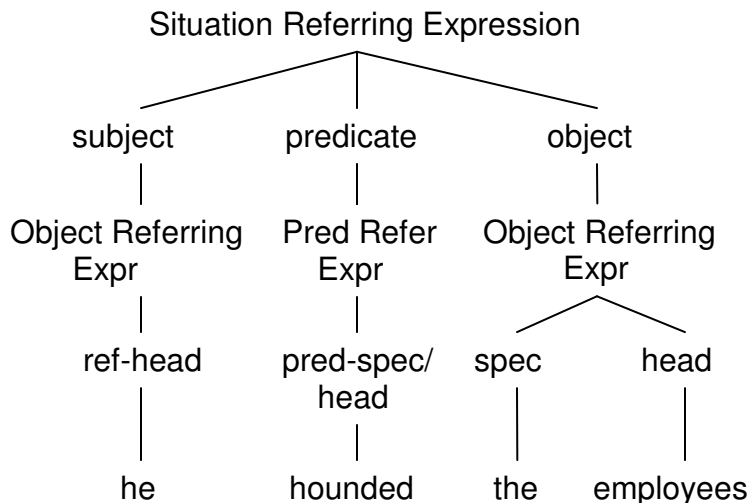


It may be that this capability is largely restricted to adverbs that can function as referring expressions. All these representations are consistent with the referential function of predicate specifiers, although they require some relaxing of the representation of relational meaning. Essentially, it is the predicate specifier that determines a predicate referring expression, regardless of the type of the head. That head is typically a relation, usually a verb, adjective, or preposition, and occasionally an adverb, but it may also be a full prepositional phrase or nominal expression.

The ability to predicativize a non-relation is not limited to predicate specifiers. This is essentially what happens when a word that typically refers to an object is used as a predicate. Consider the expression

He hounded the employees

which is represented by



In this example, it is the position of “hounded” in the expression and the addition of the “-ed” tense marker that indicates its use as a predicate and not the explicit occurrence of a predicate-specifier (unless we consider the tense marker to be a predicate-specifier). It is also clear that the meaning of “hounded”

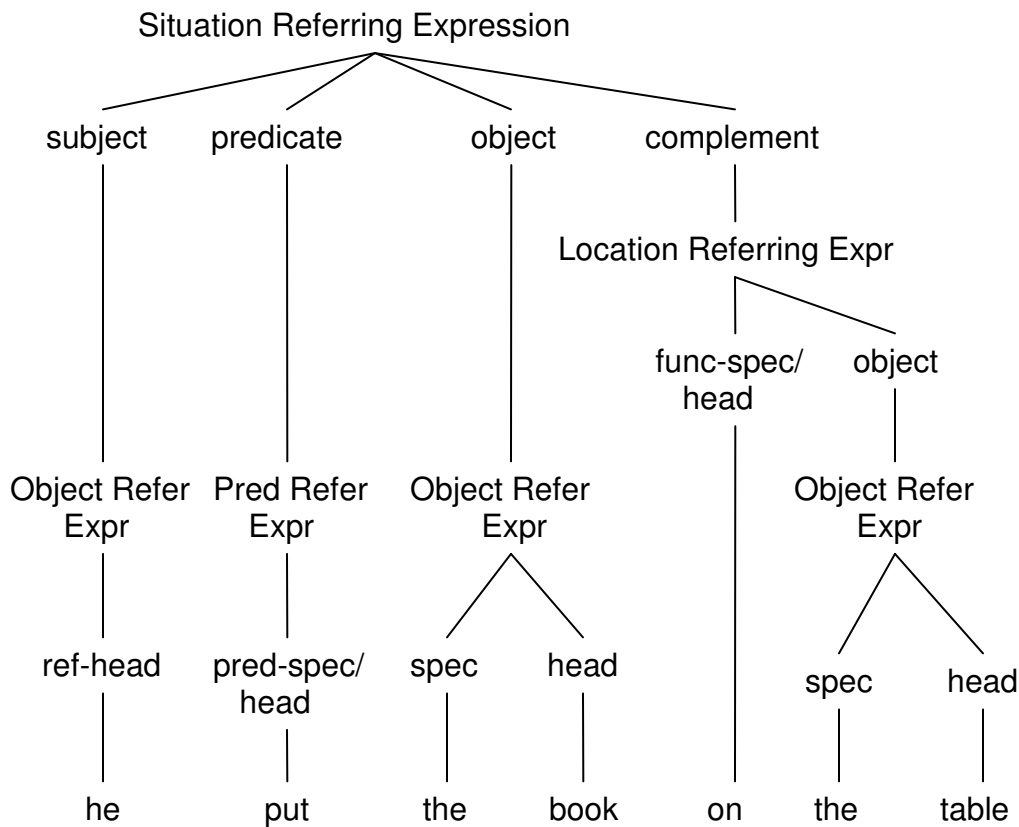
is not a hound object, but an attribute of hounds (e.g. their annoying persistence) that is asserted by the situation referring expression. That is, predicatizing the word “hound” shifts the focus from the object category to some relevant relational category associated with the object category. This differs from the process of objectification in which it is possible to objectify a relation without essentially changing its meaning. Given the change in meaning as a result of predicatizing a word that is typically a noun, the affected word is likely to be separately available in memory. That this predicatizing functionality is very productive is demonstrated by the creation of nonce expressions like “he porched the newspaper” (H. Clark, 1983), referring to the throwing of a newspaper on a porch. One can just as easily say “he doorstepped the newspaper” or “he chaired the newspaper”, adding a manner element to the act of throwing which reflects the final location of the object thrown, and leaves the act of throwing implicit.

### 4.13 Complement

As an example of an expression containing a location referring expression functioning as a complement, consider

He put the book on the table

which is represented by



In this example, the expression “on the table” functions as a complement in the overall expression and the full relational meaning of “on” is not explicitly represented. However, the meaning of this

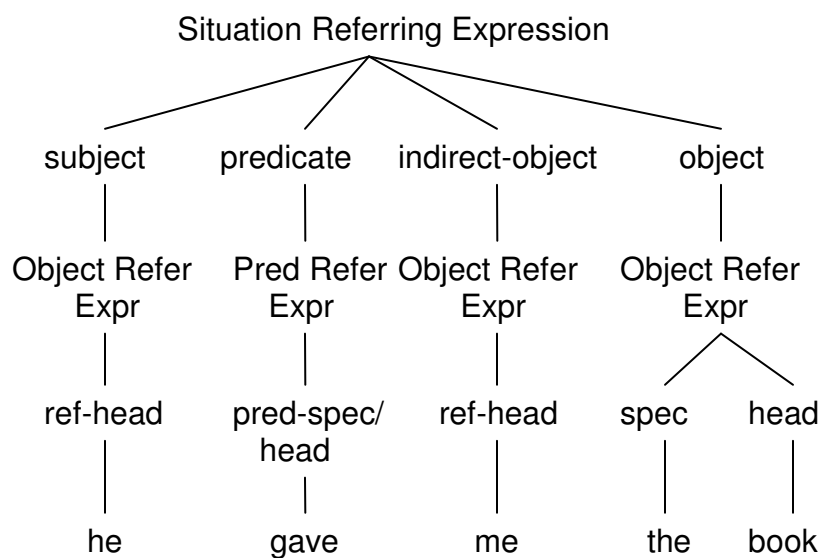
expression is such that there is a direct implication that follows from the use of the expression—namely that “the book is (or comes to be) on the table.” It may be that this direct implication leads to the addition of this situation to the **situation model**—using Kintsch’s (1998) term—to represent this fact. That is, although the book being on the table is not directly reflected in the representation of “he put the book on the table” it is represented in the situation model which contains elaborations of textual meaning—especially, elaborations that are directly implied by that text. This representation corresponds to the **SVOA** pattern (i.e. Subject-Verb-Object-Adverbial) of Quirk et al. where the adverbial “on the table” is an obligatory element of the construction. Double R Grammar does not distinguish adverbials from complements, treating both as complements.

#### 4.14 Indirect Object

The following example contains a double object construction

He gave me the book.

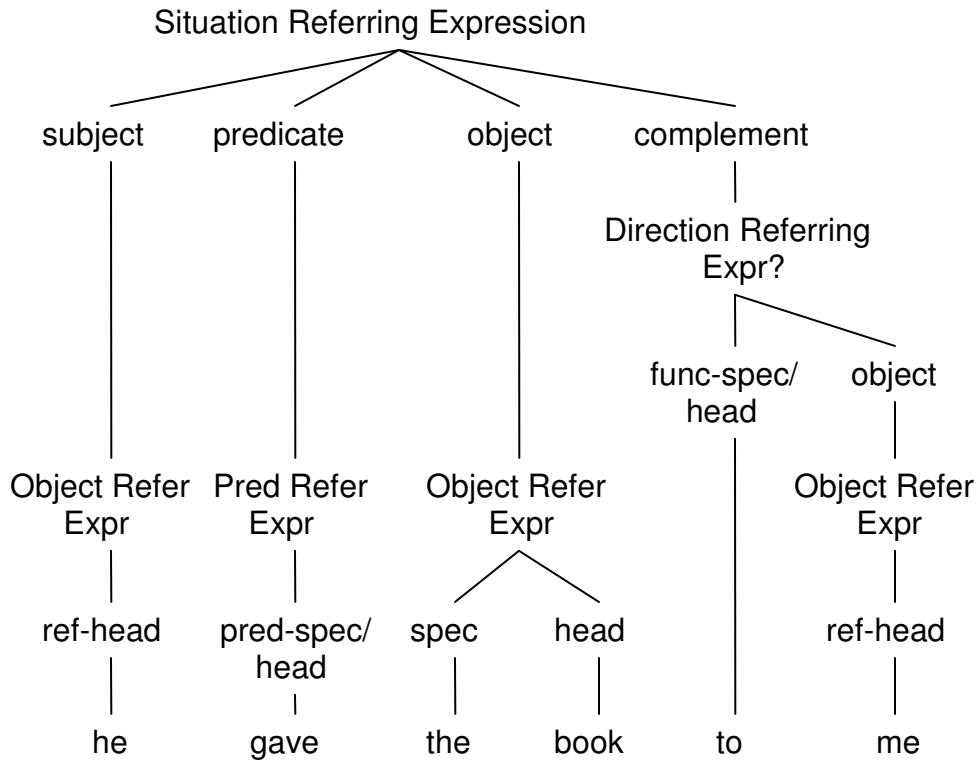
It is straightforwardly represented as



The only distinguishing feature of this example is the addition of a third argument. Quirk et al. use the **SVOO** pattern to represent the clausal structure of such expressions. The corresponding adverbial form is representationally more challenging. Consider

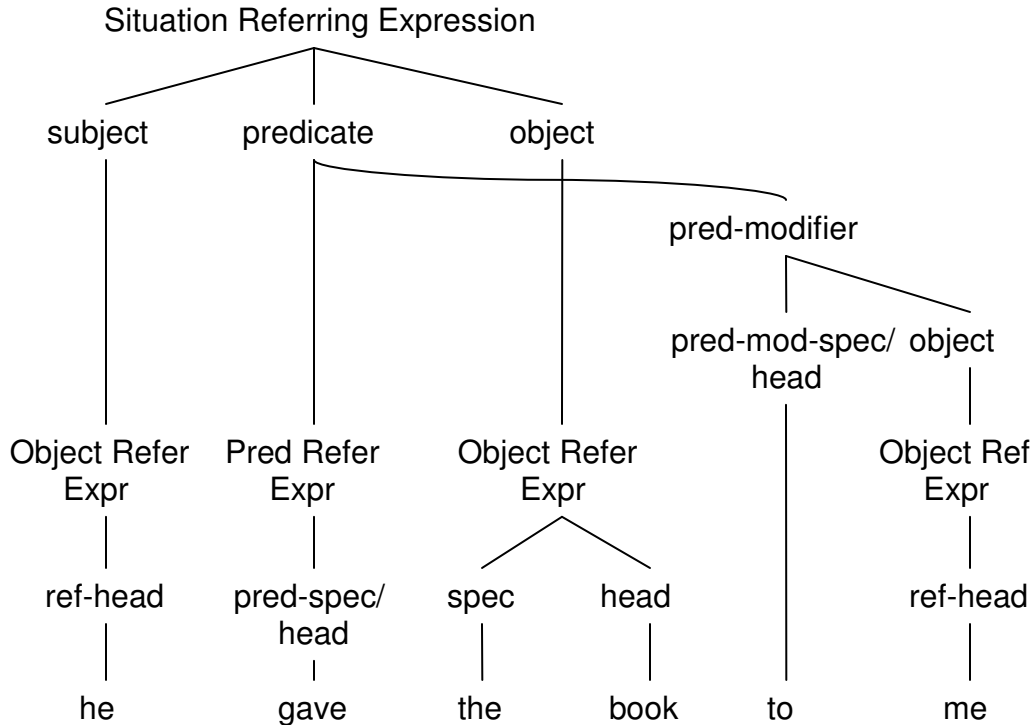
He gave the book to me

where the prepositional phrase “to me” is an obligatory element of the sentence and Quirk et al. use the **SVOA** pattern to represent it. But if the arguments of the predicate are referring expressions, what kind of a referring expression is “to me.” One possibility is to treat it as a **direction referring expression** leading to



This is another example of a preposition whose relational meaning is not fully expressed. And “to me” is not your prototypical direction referring expression. An alternative which has not been considered to this point is to allow prepositional phrases to function to modify predicates. Allowing this possibility leads to the following representation:





In this representation, the preposition “to” combines with the argument “me” to form a predicate-modifier with “to” functioning as a predicate modifier specifier. Modifier specifiers can be further subcategorized as:

- Object-Modifier-Specifier
- Predicate-Modifier-Specifier
- Situation-Modifier-Specifier

based on the relational category that gets modified. The predicate-modifier “to me” combines with the predicate “gave” to form the compound predicate “gave to me” which takes the two arguments “he” and “the book” and forms a situation referring expression. Clearly, prepositional phrases can function as predicate-modifiers as in the expression

He went on foot to the store.

where “on foot” modifies the predicate “went”. However, the obligatory nature of the prepositional phrase “to me” in “he gave the book to me” argues against its treatment as a predicate modifier since predicate modifiers are typically optional. Further, the interposing of the argument “the book” between the predicate “gave” and the predicate-modifier “to me” makes the predicate-modifying function of “to me” less transparent, but there are other places where the components of the predicate are separated by intervening constituents (especially in question formation).

Again, this is a situation where (at least) two different representations are possible and the context of use may determine which representation is most appropriate. The second representation more explicitly represents relational meaning, whereas the first representation focuses on the referential character of the prepositional phrase “to me” at the expense of the relational meaning of the preposition “to”. That

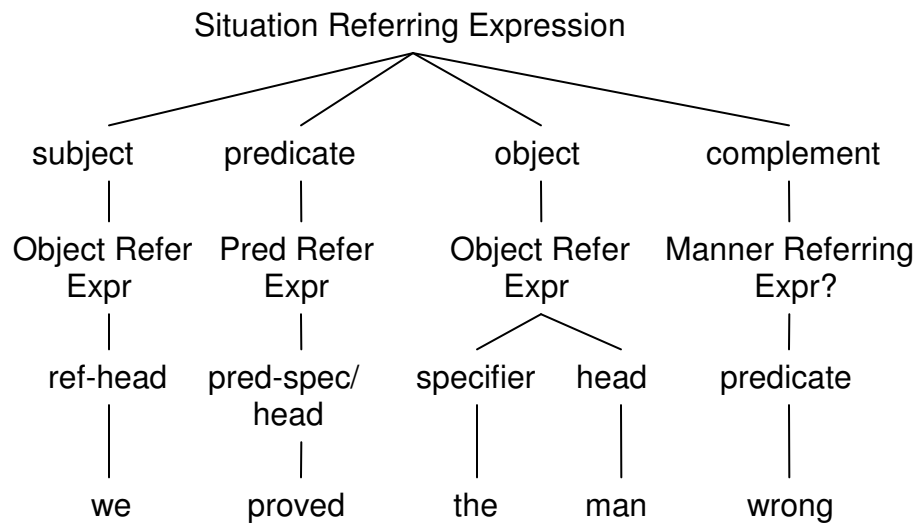
multiple representations are possible is not surprising given the assumption that humans have a large stock of schemas at multiple levels of abstraction and generalization available to support language comprehension. Any number of competing schemas may support the understanding of a particular text. Which schemas get selected for use on any particular occasion depends on the context of the use of the text and on the processing mechanism which controls the selection and integration of schemas.

#### 4.15 Object Complement

The final clausal pattern described by Quirk et al. is the **SVOC** (Subject-Verb-Object-Complement) pattern. Consider the expression

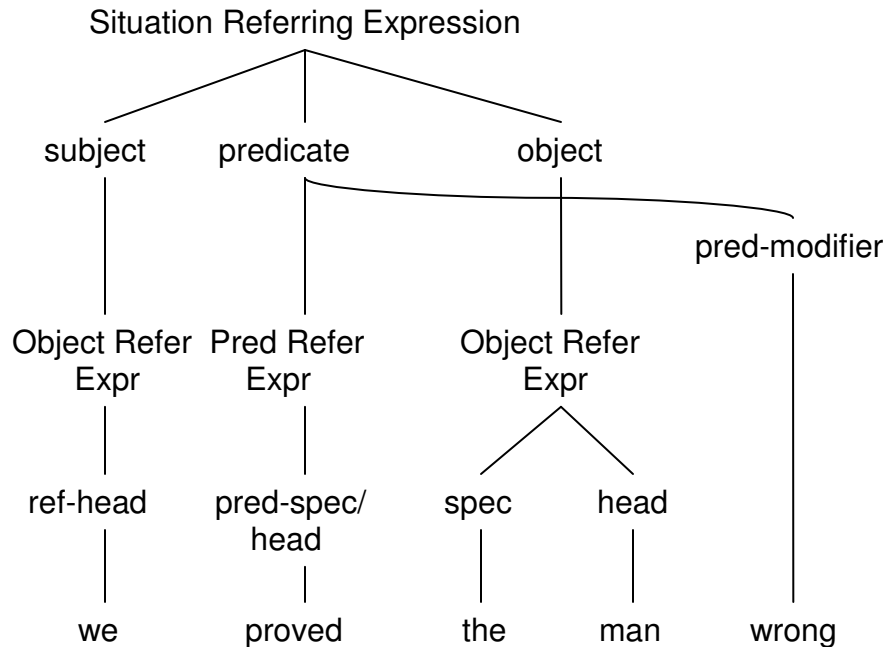
We proved the man wrong

Following Quirk et al. leads to a representation like



According to Quirk et al. “wrong” complements the object “the man” which makes it an **object complement**. But if arguments are referring expressions, what is the nature of the referring expression “wrong” in this example? Is it a **manner referring expression**? This may be another example where the situation model comes to include the situation “the man is wrong” which is implied, but not explicitly stated, by this expression.

Alternatively, allowing “wrong” to function as a predicate-modifier leads to



That is, “wrong” combines with “proved” to form the combined predicate “proved wrong” which takes the arguments “we” and “the book” and forms a situation referring expression. Treating “wrong” as a predicate-modifier accords well with its relational nature, although adjectives (unlike prepositional phrases and adverbs) do not typically modify predicates. Further, in the expression

We proved the man a fraud

the expression “a fraud” has the form of an object referring expression and treating it as a predicate-modifier rather than a complement has less grammatical support, although nouns often function as modifiers in object referring expressions.

#### 4.16 Interim Summary

In sum, as the preceding examples show, there is some tension between the encoding of referential and relational meaning in situation referring expressions such that multiple representations are possible and context may determine which representation is more appropriate. Thus, if the focus is on the referential nature of an adverbial or complement, that adverbial or complement may be objectified and treated as an argument, whereas if the focus is on the relational modification role, they may be treated as predicate-modifiers. An important goal of Double R Grammar is to achieve a unified representation for the encoding of referential and relational meaning, however, that goal has not been uniformly achieved across different clausal forms. Further, it is expected that humans will vary in the representations they construct based not only on the context of use of a text, but also on their background experience and available knowledge of language.

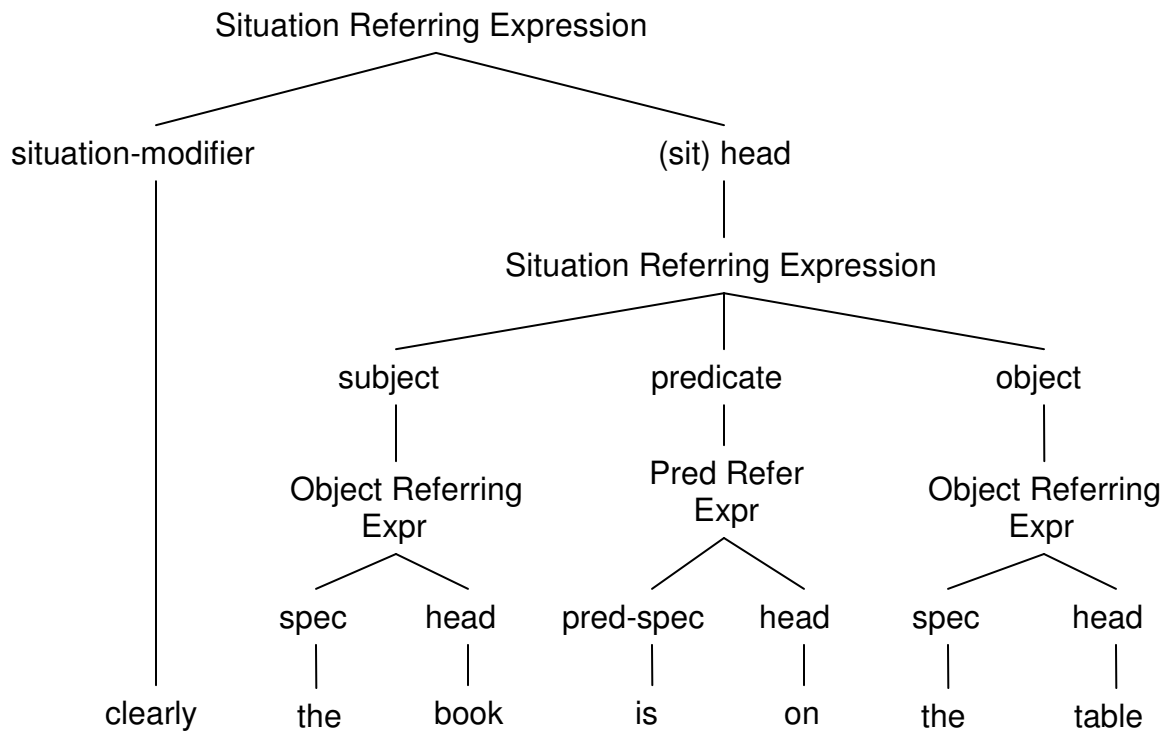
All seven of the basic clausal patterns of Quirk et al. have now been considered and the correspondence to representations of referential and relational meaning has been explored. Subsequent examples will look at clausal modification and embedding—structural variations which are not covered by the seven clausal forms.

## 4.17 Situation Modifier

An example of a predicate-modifier modifying a predicate has already been shown. Predicate-modifiers may also modify entire situation referring expressions and, when they do, they are called situation-modifiers. Consider

Clearly, the book is on the table

which is represented by



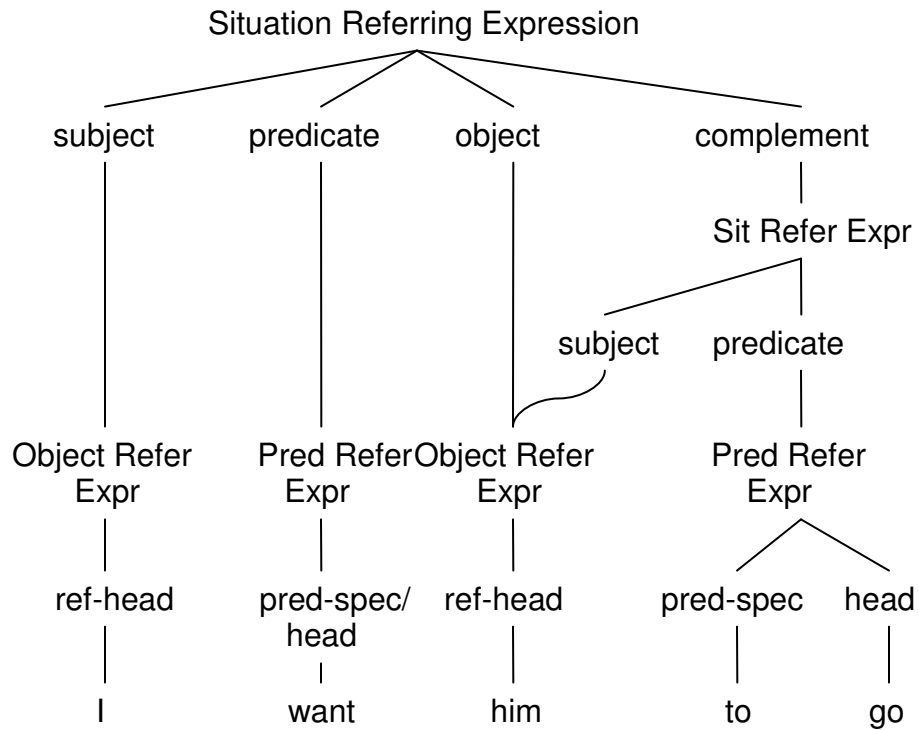
This example introduces the use of a predicate-modifier to modify a situation referring expression (i.e. **situation-head**) and not just a predicate. Since “clearly” is functioning as a modifier, the overall situation referring expression inherits its specification from the predicate “is on.” The scope of predicate-modifiers (i.e. predicate or situation scope) impacts meaning in interesting ways—especially when more than one predicate-modifier or situation referring expression occurs. The notion of scope will be considered in more detail in a subsequent section.

## 4.18 Dual Functional Roles

Pronouns in English are marked for case, which—besides word order—is one of the grammatical means for distinguishing subjects and objects. When pronouns fill more than one argument role, case marking will only reflect one of those roles. Consider the expression

I want him to go

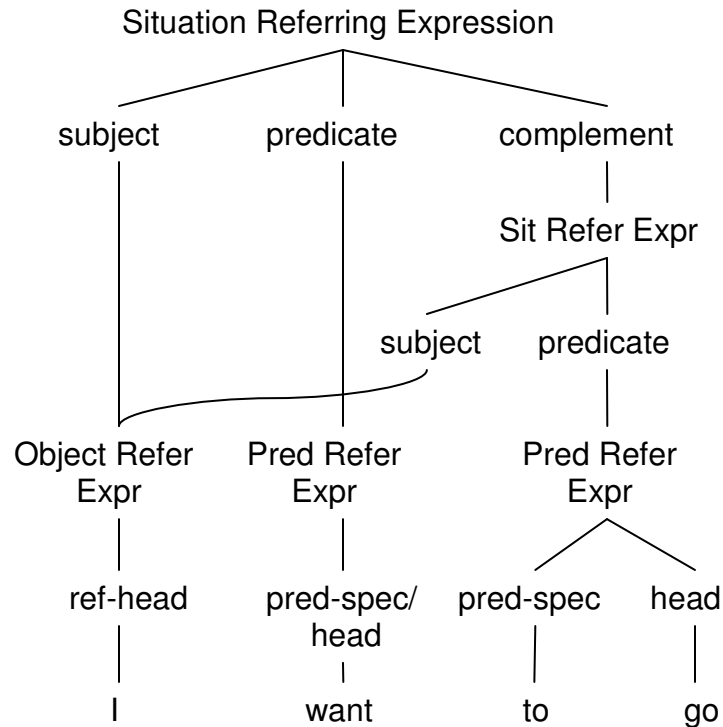
which is represented as



In this example, the pronoun “him” functions as both the object of the verb “want”—taking on objective case marking to reflect this function—and the subject of the embedded situation referring expression “(him) to go”. Note that “him” functions as the subject of “to go” despite its objective case marking. Without the pronoun “him”, consider

I want to go

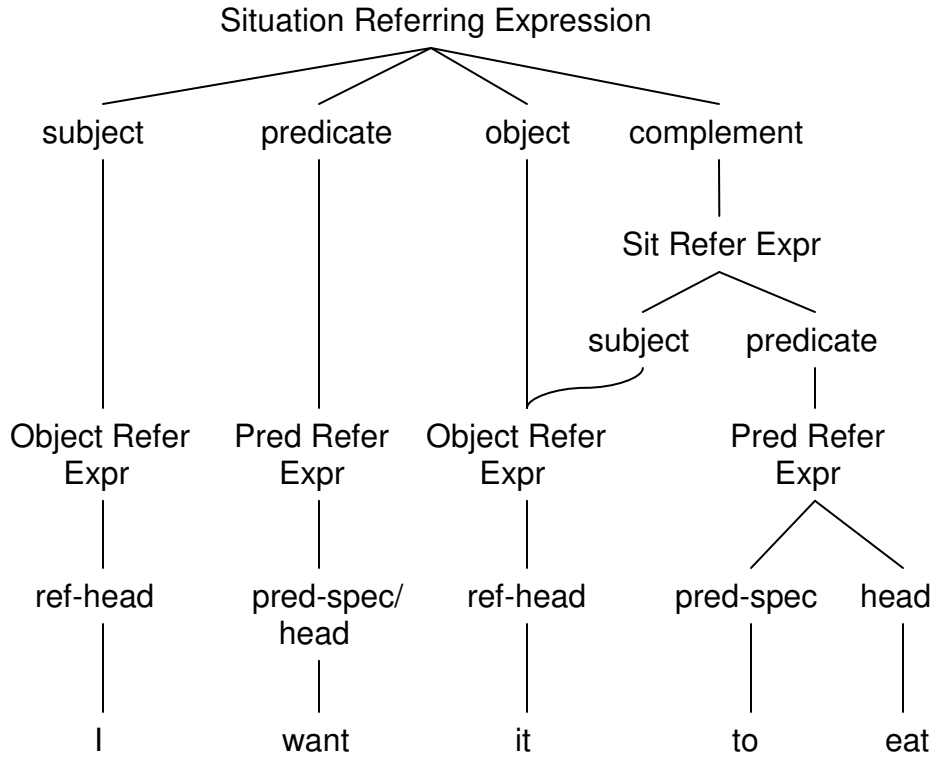
which is represented by



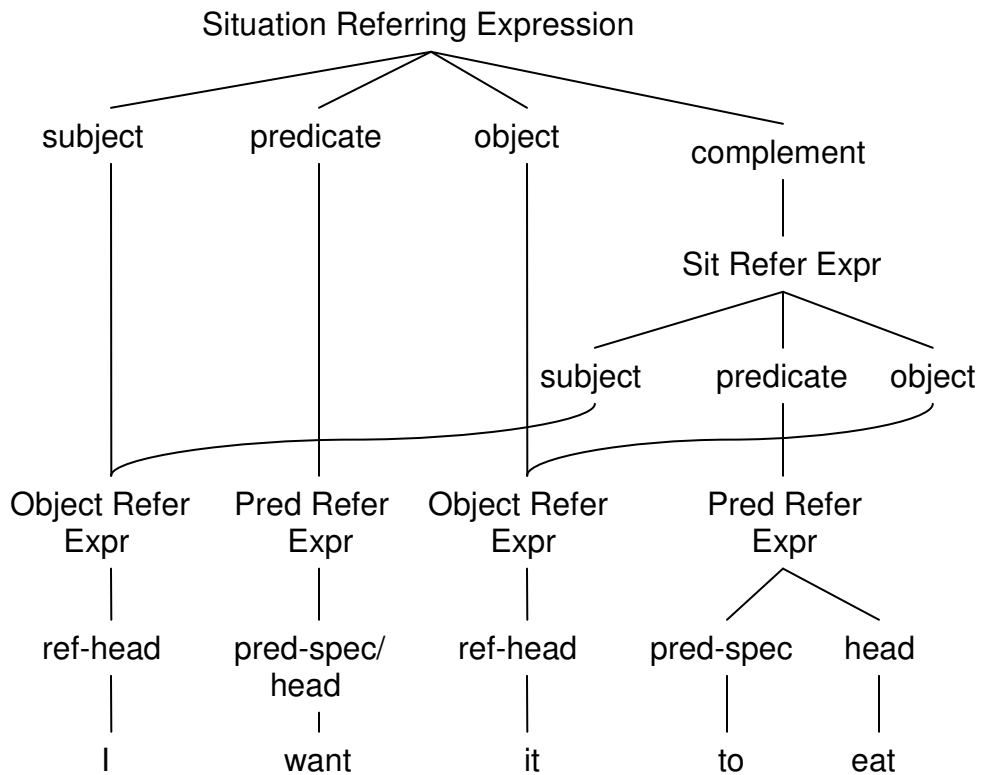
In this example, the pronoun “I” fulfills the subject role of both the embedded situation referring expression “(I) to go” and the overall situation referring expression “I want to go” and the subjective case marking of “I” is consistent with both these roles. Ambiguity results when it is unclear what relational roles are being filled by the object referring expressions in an expression. Consider the expression

I want it to eat

which has two possible representations



In this first version, the pronoun “it” is the subject of “to eat” and the expression is understood to mean that the person referred to by “I” wants the animate object referred to by “it” to eat.



In this second version, the pronoun “I” is the subject of “to eat” and “it” is the object. This second version is understood to mean that the person referred to by “I” wants to eat the object referred to by “it”. This ambiguity can be avoided by placing the pronoun “it” after “to eat” as in “I want to eat it.”

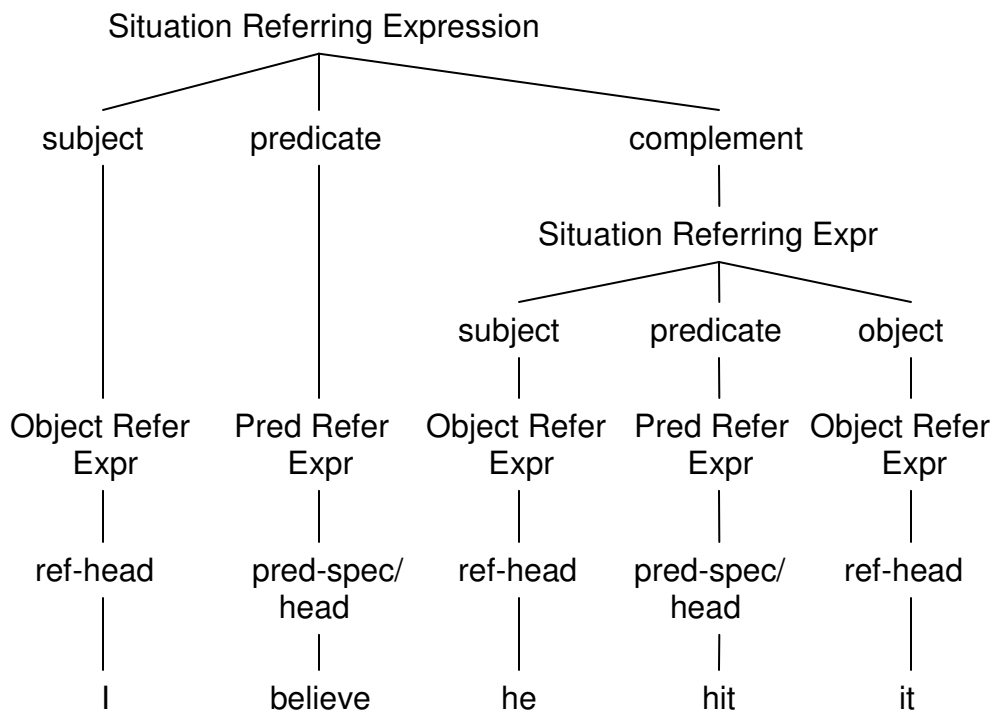
Several examples where multiple argument roles are filled by a single object referring expression have now been considered. In the last example, two such multiple argument object referring expressions occur in a single expression. One might ask what the benefit of having multiple role referring expressions is. If these referring expressions were separately encoded, then it would be necessary to determine that they refer to the same object. Allowing a referring expression to fill multiple roles avoids this computation at the expense of making the relational meaning less transparent and in the last example even making the determination of the relational meaning ambiguous.

### 4.19 Propositional Modality

Several examples of situation referring expressions functioning as an argument have already been shown. Perhaps the classic example of a situation referring expression functioning as an argument occurs with verbs that are called **propositional modalities** in logical treatments and perceptual or cognitive verbs in psychological terms. Consider the expression

I believe he hit it

which is represented by



The representation of this expression is straightforward due to the close correspondence between referential and relational meaning. Although straightforwardly represented in terms of their referential



and relational structure, there are many known complications and conundrums in providing a complete account of the meaning of such expressions.

## 4.20 Section Summary

In this section, the grammatical realization of referential and relational meaning has been considered. It has been shown that a small number of referential and relational categories are generally adequate for the representation of referential and relational meaning. Various trade-offs in the joint encoding of referential and relational meaning have been considered. Object referring expressions are inherently referential, but encode relational meaning as well. Situation referring expressions are inherently relational, but encode referential meaning as well.

The encoding of referential and relational meaning in situation referring expressions has been compared to the seven basic clausal patterns described in Quirk et al. (1972). There is a close correspondence between the patterns of Quirk et al. and the representations described in this paper, however, where referential and relational meaning contrast, Quirk et al. have chosen to give referential meaning priority, sometimes ignoring relational meaning (although they do not use these terms), whereas Double R Grammar has proposed alternative representations that encode relational meaning more explicitly.

## 5 Schemas

Double R Grammar makes use of **schemas** (using Langacker’s terminology) for the representation of knowledge of language. In Double R Grammar there is an abstract schema of the form **|subj pred obj|** (**subj** is short for object referring expression filling the subject role, **pred** is short for predicate and **obj** is short for object referring expression filling the object role) which represents knowledge about the linear encoding, number and type of arguments which are associated with transitive predicates. There is also likely to be a more concrete schema of the form **|subj hit obj|**, reflecting specific knowledge about the transitive verb “hit”. And even more concrete schemas like **|subj hit the nail on the head|** are possible. Thus, Double R Grammar assumes the existence of schemas at multiple levels of abstraction and generalization. Figure 5.1 lists some possible schemas for the verb “hit”.

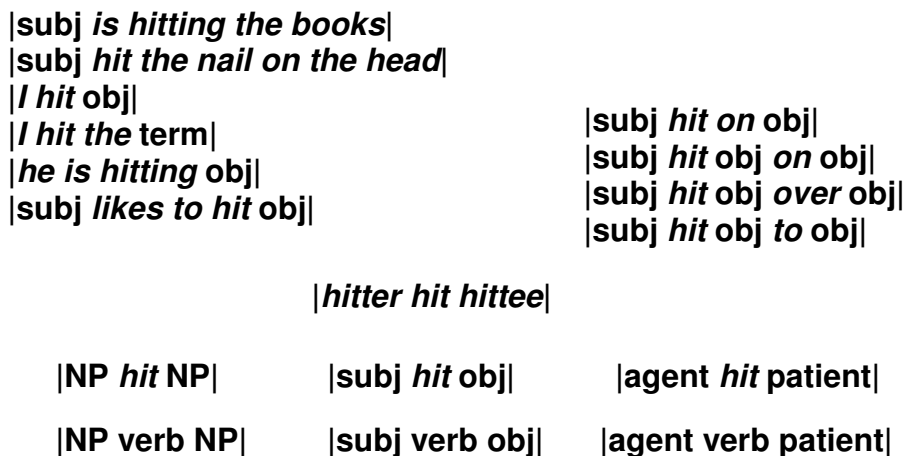


Figure 5.1: Some Possible Schemas for the Verb *Hit*

Of interest to note is that a schema which contains specific lexical items might be said to be part of the lexicon (assuming the schema is addressable via the lexical item it contains), whereas a schema which does not contain any specific lexical items might be said to be part of the grammar (Jackendoff, 2002, makes a similar point). But if abstract schemas like **lsbj pred objl** are directly associated with specific lexical items, this distinction loses its force.

Although all these schemas (and more) are possible, Double R Grammar assumes that more concrete schemas like **lsbj is hitting the booksl** take precedence over more abstract schemas like **lsbj pred objl** in language comprehension since they will be more strongly activated by matching inputs as when a sentence like “he is hitting the books” is processed. Abstract schemas take on a more important role when processing novel expressions not previously experienced and unknown words. Double R Grammar also assumes that schemas containing functional role categories like subject and object are preferred over schemas containing syntactic categories like NP and VP. This follows from Double R Grammar’s assumption that functional categories like subject and object are meaning based and not purely syntactic and from the priority of semantics assumption. Finally, Double R Grammar assumes that schemas containing functional categories which are grammatically marked (e.g. *hitter*, *hittee*, subject and object) will be more easily abstracted from and matched to inputs than schemas containing categories which are not grammatically marked (e.g. agent and patient).

## 5.1 Schema Acquisition

In terms of how we acquire schemas, Double R Grammar agrees with Langacker (1987). An individual is exposed to specific instances of language use and initially acquires rather specific schemas corresponding to those instances. Based on repeated exposure to similar instances with minor differences, he or she is able to abstract away from the differences, forming abstract schemas which capture the similarities and abstract away from the differences. Abstraction then provides the mechanism for producing or recognizing new instances to which the individual has not been exposed. For example, the abstract schema **lsbj hit objl**, in which the specific linguistic form of the subject and object is unspecified, could be used in the production or recognition of an infinite number of situation referring expressions (subject to practical limitations). Thus, schemas allow for the kind of productivity that is apparent in natural language. Under this scenario, abstract schemas are learned and are not innate, and it is not a question of having abstract schemas available innately and then specifying parameters for specific languages (Berwick & Weinberg, 1984; Chomsky, 1981, 1982). In an interesting article entitled *Language Acquisition: Schemas Replace Universal Grammar*, Arbib and Hill (1988) put forward a similar position. Further, it does not seem reasonable from a psycholinguistic perspective to suggest that once an abstract schema has been learned, the more specific schemas on which it was based become unavailable for use. Nonetheless, numerous researchers have made proposals which would have just this effect. For example, Hudson’s (1984, p. 29) **Linguist’s Economy Principle** states that a linguist should

Never record any property more than once in relation to any entity. That is, once you (the linguist) have decided there is a generalization to be made, you make it in relation to the relevant general category...and then suppress any mention of it in more specific entries which can inherit the information from the general one.

Similarly, in a model of semantic memory, Collins and Quillian’s (1969) **Cognitive Economy Principle** assumes that properties of objects are associated directly with the most general category to which they

apply and only indirectly with the more specific categories. The psychological validity of this principle in models of semantic memory has already been challenged by Conrad (1972) and Collins and Loftus (1975). As well, the focus on generalization and universality in grammar has led to the creation of very general linguistic categories and to the relegation of idiosyncratic details to the lexicon. However, the more general the categories become, the greater the amount of idiosyncratic detail which must be relegated to the lexicon.

Arguing against such principles, Langacker (1987, p.28) introduces the **Exclusionary Fallacy**, noting that

The gist of this fallacy is that one analysis, motivation, categorization, cause, function, or explanation for a linguistic phenomenon necessarily precludes another.

Double R Grammar accepts the validity of Langacker's **Exclusionary Fallacy** and suggests that the above principles commit this fallacy in the name of efficiency and economy of representation. But they ignore the possibility of a trade-off between economy of representation and efficiency of processing. Redundancy in the encoding of information in the internal lexicon at different levels of abstraction is accepted as the norm and improves processing efficiency. This redundancy is functional in that it is not possible to directly encode all values, but the direct encoding of frequently used values reduces considerably the amount of computation required on average.

## 5.2 How Many Arguments in a Schema?

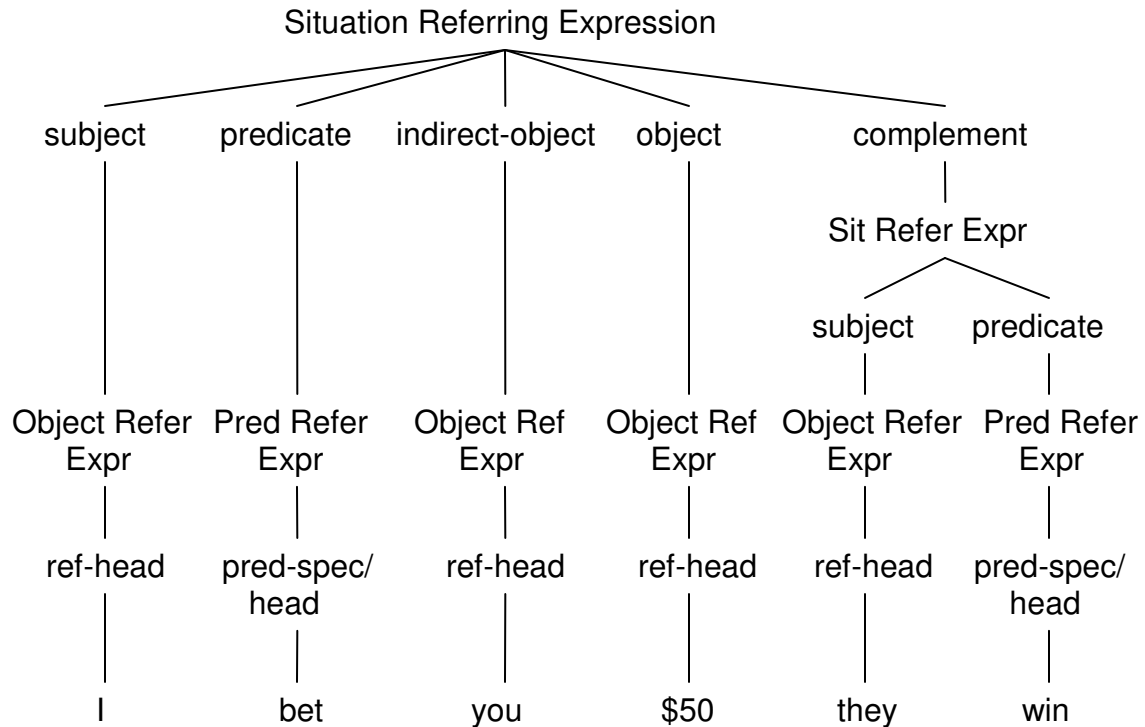
I used to think that the maximum number of arguments that a predicate could take in English was three—corresponding to the subject, indirect object, and direct object in verbs like “give” and “sell”. However, Steedman (2000) points out the verb “bet” and notes that it takes four arguments as in

I<sub>1</sub> bet you<sub>2</sub> \$50<sub>3</sub> they win<sub>4</sub>

Fortunately, the exact number of arguments that are maximally allowed is not crucial, although there does appear to be a fairly small limit. That limit can be motivated on psychological grounds with respect to the number of separate elements that can occur in a schema. If a schema corresponds to the psychological notion of a chunk (e.g. Miller, 1956, Anderson 1993), then the number of separate elements that can be maintained in a schema is limited to somewhere in the range of 3 to 5—Miller's  $7 \pm 2$  notwithstanding. Assuming the verb “bet” has a schema like

**|Subj *bet* Iobj Obj Compl**

then the existence of schemas with five separate elements is supported (i.e. four arguments and the predicate itself). The sentence above can be represented as



If there is a limit to the number of separate elements that can occur in a schema, then how do we represent situations involving more elements than can be supported by a single schema? By hierarchical nesting of schemas within other schemas. Or by embedding chunks corresponding to schemas within other chunks. For instance, consider the sentence

He sold me the car for \$5000.

This sentence contains four participants “he,” “me,” “the car” and “\$5000” and a schema of the form

**|Subj sold Iobj Obj Compl**

is suggested. However, the sentence contains two relational elements “sold” and “for”, with “for” invoking its own schema

**|Pred<sub>for</sub> Obj|** or even **|Subj Sell<sub>pred</sub>for Obj|**

where **Pred** is a predicate and “for” combines with **Obj** to function as a predicate-modifier. Further, the prepositional phrase “for \$5000” is optional in this sentence in the sense that the sentence would be grammatical without its occurrence as in

He sold me the car

This latter sentence maps to a schema for “sold” of the form

**|Subj sold Iobj Obj|**

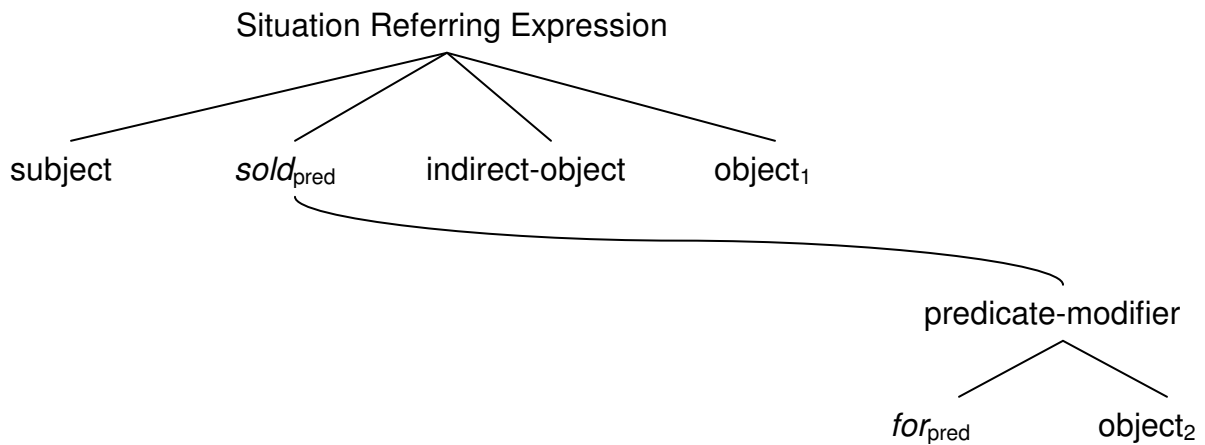
An alternative to positing a single schema containing four arguments and the predicate “sold” for “he sold me the car for \$5000” is to posit the integration of the two schemas |Subj sold Iobj Obj| and |Pred for Obj| leading to

|Subj *sold*<sub>pred</sub> Iobj Obj<sub>1</sub>|  
*for*  
 Obj<sub>2</sub>

or

||Subj *sold*<sub>i</sub> Iobj Obj<sub>1</sub>| Pred<sub>i</sub> *for* Obj<sub>2</sub>|

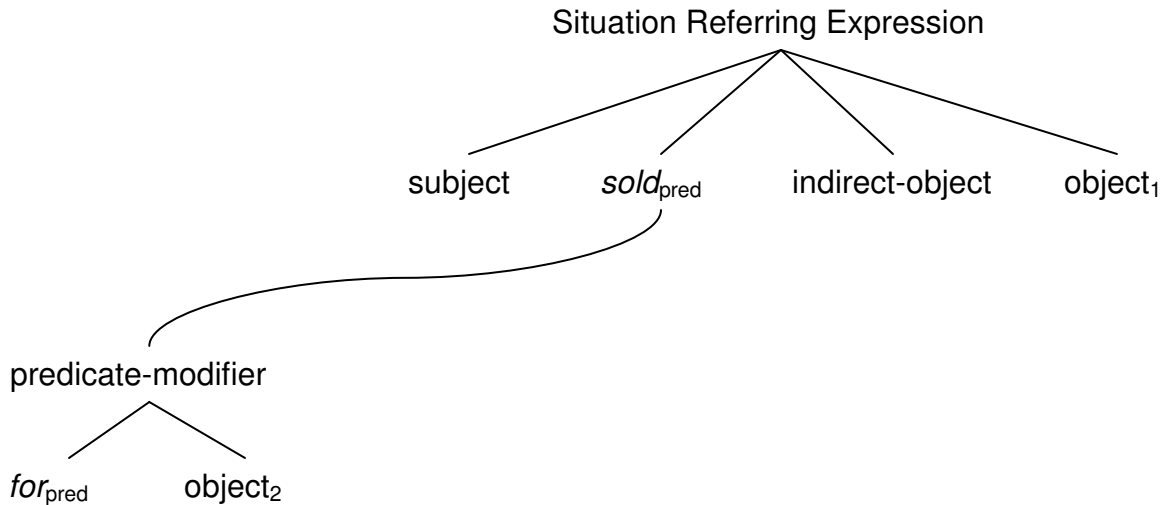
Unfortunately, both of these integrated schema representations are awkward. The first representation abstracts away from the linear order of the elements, using the vertical dimension to represent the modifying relationship of “for Obj” to “sold.” The second representation requires an indexed notation to reflect that modifying relationship. The basic problem is that the modifying relationship is orthogonal to the relational encoding of the arguments to “sold”. Encoding these two different dimensions of meaning in a single linear dimension is problematic. Two dimensional hierarchical representations overcome this problem as in



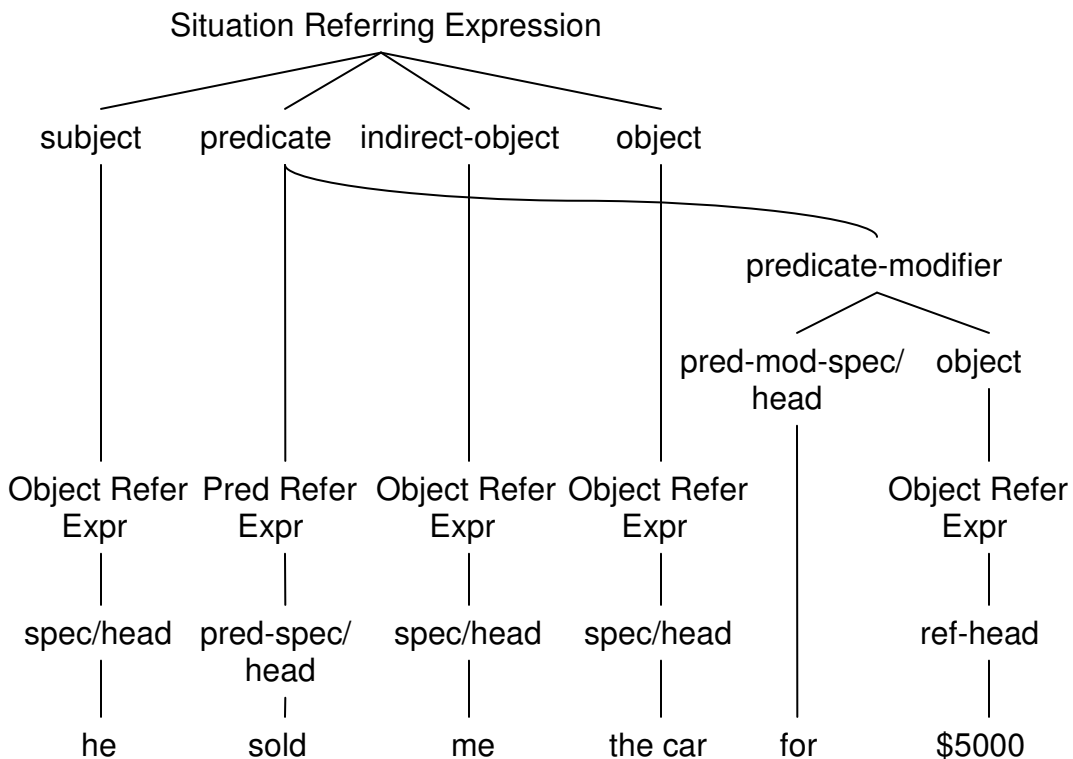
where linear order is maintained (left to right). Such representations suggest flexibility in the linear order of the predicate-modifier with respect to the arguments of the predicate as in

For \$5000, he sold me the car.

which can be represented schematically by



That is, the linear order of the predicate-modifier with respect to the predicate varies independently of the linear order of the arguments to the predicate. Filling out the integrated schemas with representations of the arguments, the sentence “he sold me the car for \$5000” can be represented as



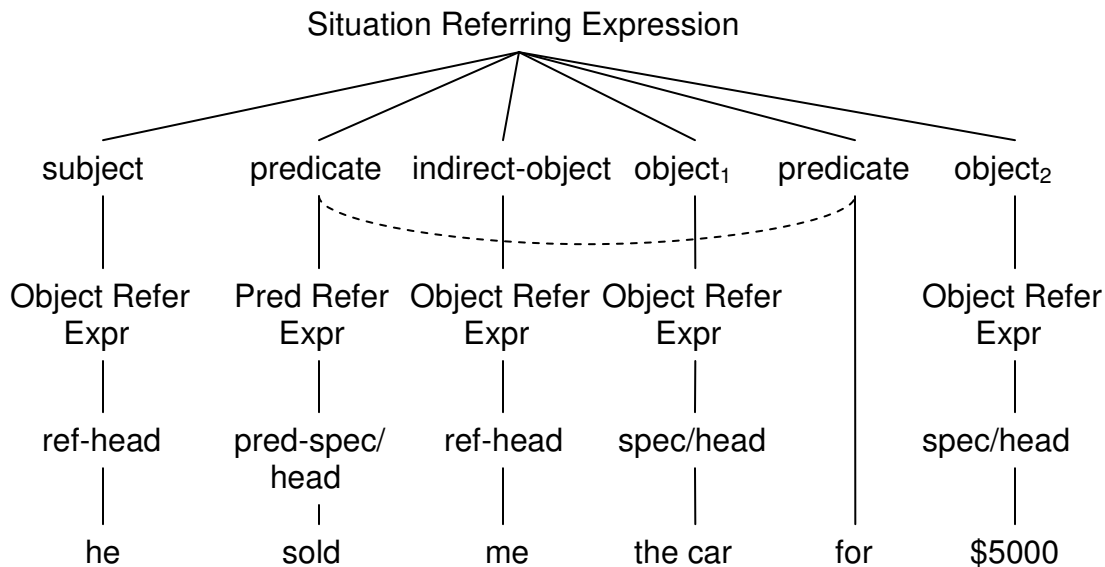
This representation runs counter to other approaches (e.g. Fillmore, 1977a) which treat “for \$5000” as an complement of “sold.” It is common in such approaches to make reference to the underlying situation in arguing that a sales transaction involves (at least) four participants (i.e. the seller, the buyer, the thing being sold, and the price). However, the grammatical realization of the price of the sales transaction as a prepositional phrase and not an object referring expression suggests that although there are four potential

participants, only three of those participants are directly associated with “sold” with the fourth participant exhibiting a less direct relationship to “sold” as expressed by the relation “for”. The set of participants which are directly associated with “sold” obtain a saliency from that association which does not hold for the peripherally associated participant “\$5000”. Fillmore (1977a) refers to this asymmetry in the saliency of participants as a **perspective on the scene** and Langacker (1987) makes use of the related notion **profiling**, in describing such asymmetry.

The treatment of “for \$5000” above is a borderline case in that “sold” could take a fourth argument—assuming that the relational meaning of “for” is suppressed—without stretching the limit on schema size too much. Further, the existence of schemas with multiple relational elements is not precluded and a schema of the form

**|Subj sold Iobj Obj<sub>1</sub> for Obj<sub>2</sub>|**

is possible—although such a schema begins to stretch the limit on the number of separate elements in a schema. This schema can be viewed as having a combined predicate “sold for” that takes four arguments. Schemas with combined predicates are needed to handle verb particle combinations (e.g. “stand up,” “sit down,” “go away”) and may extend to verb prepositional phrase combinations (e.g. **|Subj put Obj<sub>1</sub> on Obj<sub>2</sub>|**). Assuming such a schema leads to the following representation



If the notion of schemas with a limited number of elements is valid, then at some point modifying adverbs and prepositional phrases cannot be accommodated within a single schema. Consider

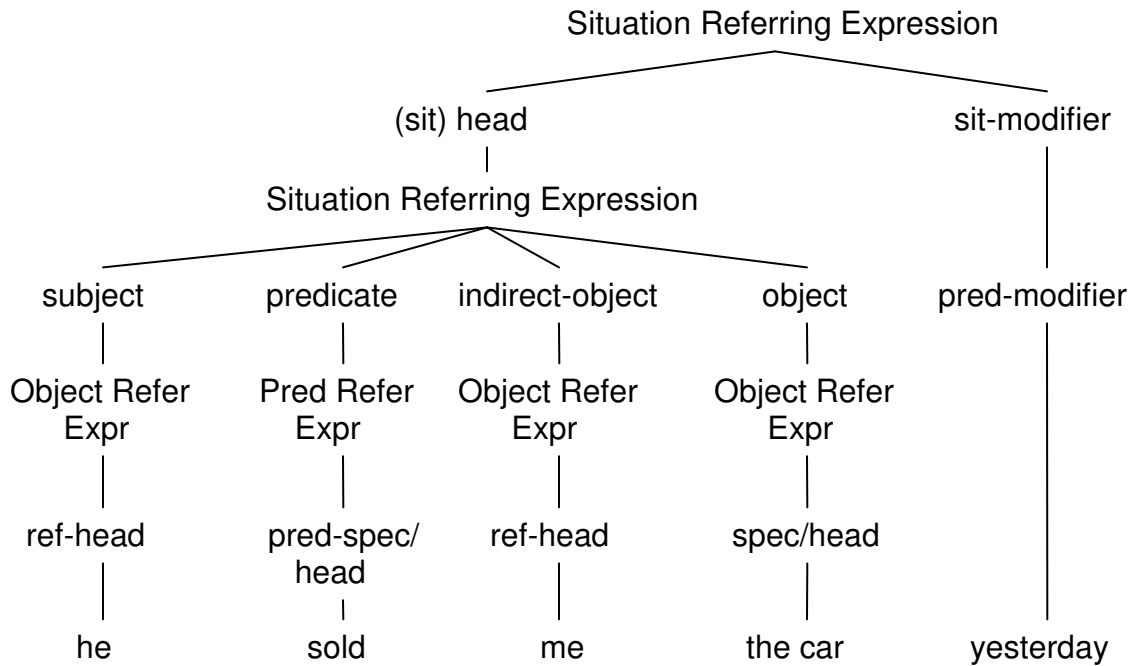
He sold me the car yesterday in his house with a handshake.

In this sentence, the adverb “yesterday” adds a temporal element, the prepositional phrase “in his house” adds a locative element, and the prepositional phrase “with a handshake” adds a manner element. Such elements can be added to most any predicate expressing an action. Should schemas for predicates allow for their occurrence, or can they be better handled via the integration of separate predicate and/or situation modification schemas? The occurrence of a relational element in each of these modifying

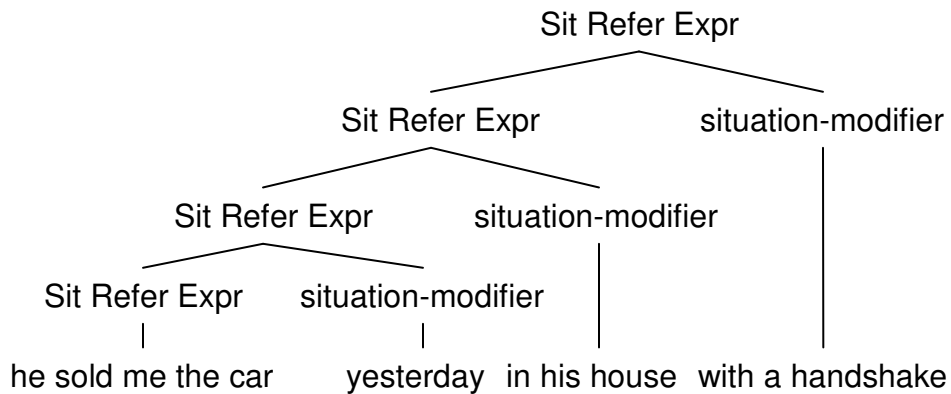
expressions suggests the latter. Assuming that “yesterday” modifies the entire situation referring expression “he sold me the car,” a schema of the form

**|Sit-head yesterday|**

where **Sit-head** represents a situation referring expression, is suggested. Ignoring—for the moment—the last two prepositional phrases we can represent this as



In the context of a situation referring expression, the predicate-modifier “yesterday” takes on the role of a situation modifier. The situation referring expression “he sold me the car yesterday” can then function as a argument of “in his house” forming a situation referring expression which can function as the argument of “with a handshake.” This can be represented by



Note that despite the fact that “with a handshake” is higher in this hierarchical representation than “he sold me the car”, it is still the predicate “sold” (i.e. the head) which determines the relational type of the



overall situation referring expression, with “with a handshake” only functioning to modify that relational type.

### 5.3 Conjunctions and Schemas

Before discussing the number of arguments that conjunctions (and disjunctions) can take, it should be noted that the treatment of conjunctions in Double R Grammar differs markedly from logical treatments. Unfortunately, the logical treatment of conjunctions violates Jackendoff’s (1983) **Grammatical Constraint** in several respects and, where this is the case, Double R Grammar deviates from such treatments. For example, logically, conjunctions conjoin propositional arguments (i.e. arguments which take on truth values). However, grammatically, conjunctions conjoin all grammatical types—including, but not limited to, situation referring expressions for which truth values are possible. Consider

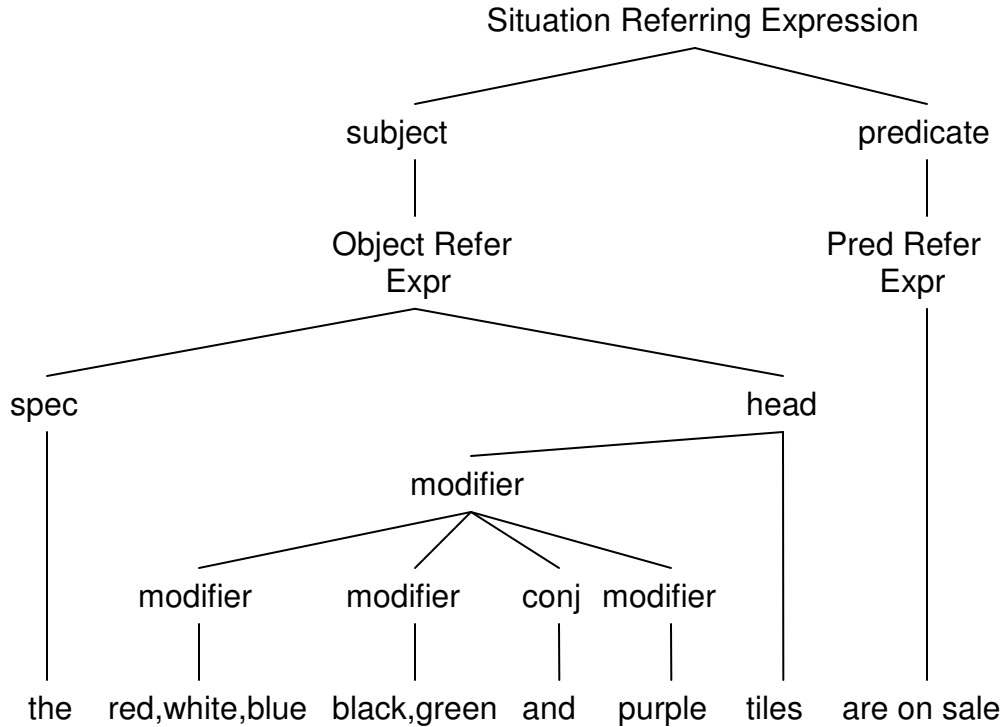
The man, woman, and child	=> conjoined heads
The man, the woman and the child	=> conjoined object referring expressions
He hit and kicked the door	=> conjoined verbal predicates
The red, white and blue flag	=> conjoined modifiers
The quickly and quietly tendered resignation	=> conjoined modifier-modifiers

Based on grammatical evidence, it is assumed that conjunctions may conjoin any grammatical type, but that the conjuncts are typically of the same type.

Logically, conjunctions and disjunctions can take an unbounded number of arguments. Psychologically, somewhere around four arguments is plausible. For conjunctions of more than four arguments, some internal chunking of arguments is suggested. For example, consider

The red, white, blue, black, green and purple tiles are on sale

Assuming an internal chunking mechanism, this sentence can be represented by



where the internal chunking mechanism combines “red,” “white” and “blue” into a chunk, and “black” and “green” into a second chunk. Presumably the internal chunking mechanism would combine sublists of long lists of elements together to facilitate comprehension. Schematically, we can represent this by

**|GC<sub>1</sub> (GC<sub>2</sub>) (GC<sub>3</sub>) and GC<sub>4</sub>|** or  
**|List-of-GC and GC<sub>n</sub>|**

where ( )’s suggest optional elements, **GC** (Grammatical Category) ranges over all the grammatical types—subject to the constraint that the grammatical category is the same for all the conjuncts, and **List-of-GC** reflects an internal chunking mechanism. A schema containing optional elements is a generalization of a collection of schemas where the possible combinations of elements are explicitly represented as in

**|GC<sub>1</sub> and GC<sub>2</sub>|**  
**|GC<sub>1</sub> GC<sub>2</sub> and GC<sub>3</sub>|**  
**|GC<sub>1</sub> GC<sub>2</sub> GC<sub>3</sub> and GC<sub>4</sub>|**

The existence of schemas containing optional elements and fully explicated schemas are both supported in Double R Grammar since the generalized schema is assumed to be based on the fully explicated schemas and allowing for both types of schemas avoids succumbing to Langacker’s **Exclusionary Fallacy**.

The **List-of-GC** element corresponds to schemas of the form

**|GC<sub>1</sub> GC<sub>2</sub>|**

$|GC_1 GC_2 GC_3|$   
 $|GC_1 GC_2 GC_3 GC_4|$

where there is no explicit relational element to indicate the nature of the relationship between the elements.

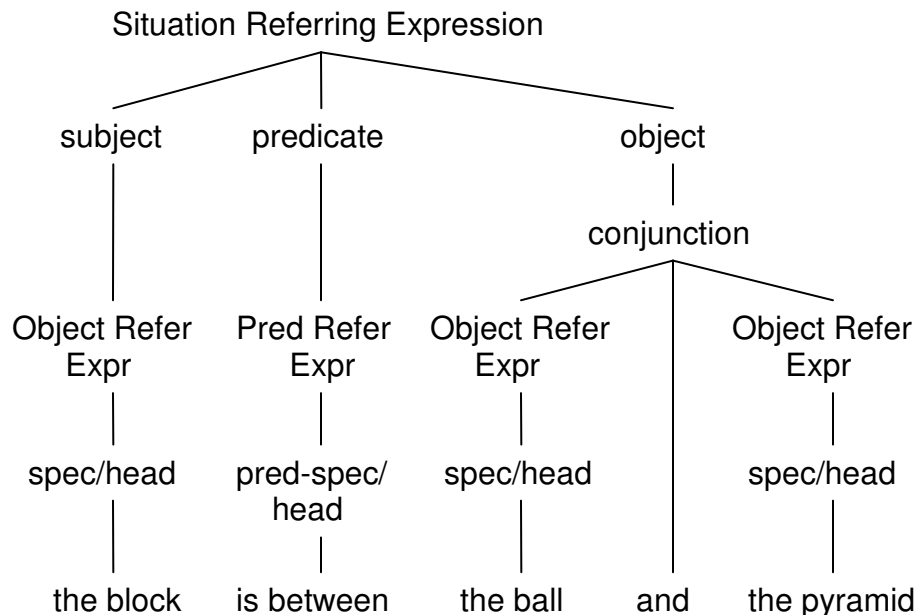
## 5.4 Prepositions and Schemas

Typically prepositions establish a locative relationship between two arguments, with the first argument being an object referring expression, a predicate or a situation referring expression and the second argument being an object referring expression.

An example of a preposition which is frequently assumed to take three arguments in logical treatments is the preposition “between”. However, a closer examination of English texts in which it occurs reveals that it actually only takes two object referring expressions, with the second object referring expression frequently including a conjunction. Consider the sentence

The block is between the ball and the pyramid.

While there are clearly three objects referring expressions in this sentence—“the block,” “the ball” and “the pyramid”—it is not the case that the predicate “between” directly establishes a relationship between these three object referring expressions. Rather, “between” establishes a relationship between the object referring expression “the block” and a conjunction of object referring expressions. This is represented by



The bivalent nature of “between” is made even more explicit in

The pillow is between the sheets

where the object referring expression “the sheets” refers to multiple participants via use of the plural form of “sheet”. Thus, it does not appear that “between”—and prepositions more generally—are capable of taking three arguments. When used as a predicate, “between” participates in the following schema

**|Subj Pred-Spec *between* Obj|**

where **Pred-Spec** is itself a schema for the predicate-specifier and supporting predicate specifier modifiers (e.g. |**(Modal) (Have) Bel** ). More generally for prepositions used predicatively is the schema

**|Subj Pred-Spec Prep Obj|**

Traditionally, prepositional phrases are treated as a grammatical unit corresponding to a schema of the form

**|Prep Obj|**

with a single argument. It has already been argued that this schema suppresses the relational meaning of prepositions. Nonetheless, the schema may be used in referential contexts in which the prepositional phrase refers to a location and the locative referring expression functions as a complement of a verb like “put” as in

He put the book on the table.

However, by correspondence with the sentence

He put the book down

where an argument that “down” functions as a predicate-modifier and not a complement can be made, Double R Grammar supports the treatment of “on the table” as a predicate-modifier as an alternative to treating it as a complement of “put”. Schemas with multiple predicates as in

**|Subj *put* Obj<sub>1</sub> *on* Obj<sub>2</sub>|**

**|Subj *put* Obj<sub>1</sub> *down*|**

are also supported as an alternative to the treatment of “on the table” as a complement of “put”.

In sum, prepositions are assumed to take two arguments and typically establish a locative relationship between those arguments. Suggestions that there are prepositions like “between” which take three arguments are argued against. The standard treatment of prepositional phrases as distinct grammatical units is also argued against, although there may be contexts in which suppression of the first argument of the preposition occurs.

## **6 Predicate Modification, Predicate Specification and Scope.**

Words corresponding to several of the traditional parts of speech function as predicate modifiers and specifiers—including auxiliary verbs, modal auxiliaries, adverbs, negatives, verb particles, the infinitive

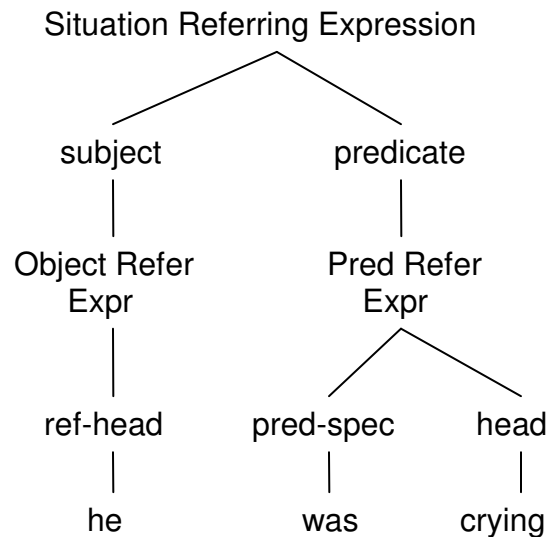
marker “to,” and wh-words. Words in these grammatical categories can modify relations, modify or specify predicates, modify predicate specifiers, or modify entire situation referring expressions.

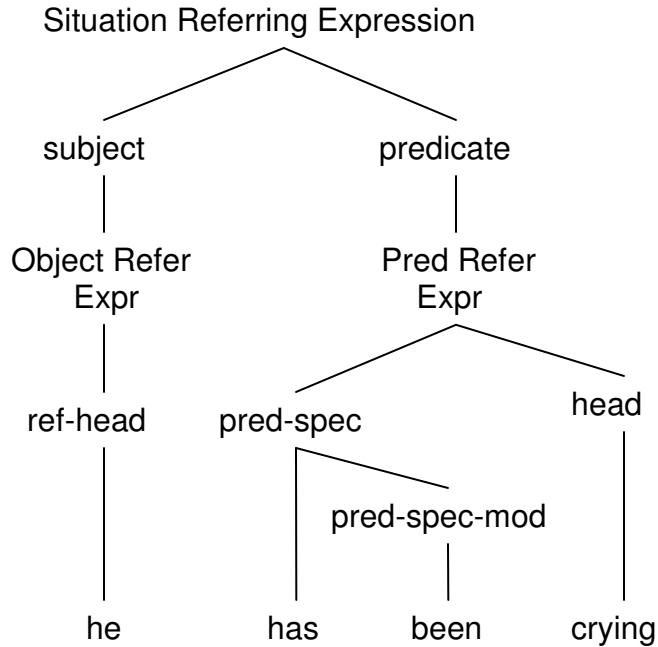
## 6.1 Auxiliary and Modal Verbs

Auxiliary and modal verbs modify predicates by providing information about tense, aspect, and modality that serve to specify the predicate and help in establishing reference. For grammatical reasons which were discussed earlier and will be discussed further below, it is assumed that the first auxiliary or modal verb functions as a predicate specifier with additional auxiliary and modal verbs taking on a modification role (typically modifying the predicate specifier). Thus, the sentences

He was crying  
He has been crying

are represented by

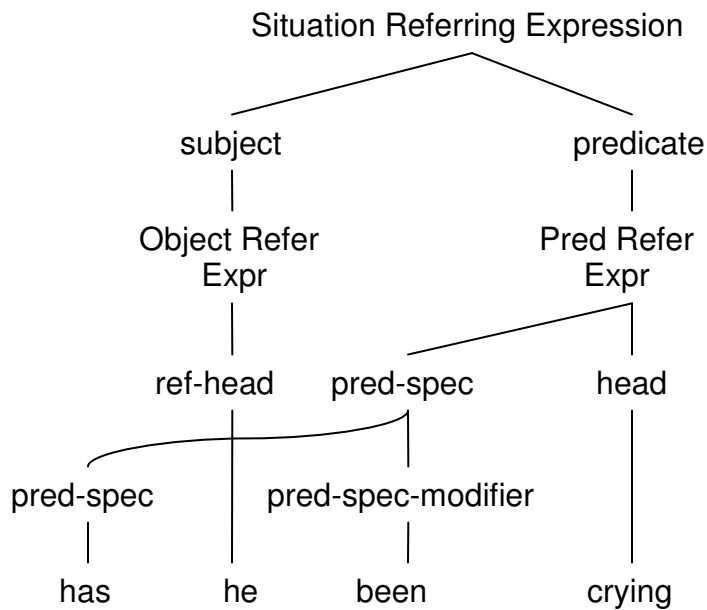




Note especially that the auxiliary “been” modifies the predicate specifier “has”. This is the first example of a predicate specifier modifier. The treatment of the first auxiliary or modal verb as the predicate specifier simplifies the handling of question forms like

Has he been crying?

which is represented by



Schematically, we can represent the combination of modals and auxiliaries with verbal predicates (following Garnham, 2001) as

<b> Be<sub>pres</sub> Pred<sub>pres-part</sub> </b>	He is crying
<b> Be<sub>past</sub> Pred<sub>pres-part</sub> </b>	He was crying
<b> Have<sub>pres</sub> Pred<sub>past-part</sub> </b>	He has cried
<b> Have<sub>past</sub> Pred<sub>past-part</sub> </b>	He had cried
<b> Have<sub>pres</sub> been<sub>past-part</sub> Pred<sub>pres-part</sub>  </b>	He has been crying
<b> Have<sub>past</sub> been<sub>past-part</sub> Pred<sub>pres-part</sub>  </b>	He had been crying
<b> Modal Pred<sub>inf</sub> </b>	He could cry
<b> Modal be<sub>inf</sub> Pred<sub>pres-part</sub> </b>	He could be crying
<b> Modal have<sub>inf</sub> Pred<sub>past-part</sub> </b>	He could have cried
<b> Modal have<sub>inf</sub> been<sub>past-part</sub> Pred<sub>pres-part</sub> </b>	He could have been crying

Note the parallelism between the form of the auxiliary verb and predicates more generally. For example, modals are followed by an infinitive form—whether the infinitive of “be,” “have” or a predicate more generally.

Such schemas need to be integrated with relational schemas like

**|Subj Cry<sub>pred</sub>|**

where **Cry<sub>pred</sub>** is a schema for the verb “to cry” to represent sentences like those above. Of course, more explicit schemas with specific lexical items like

**|Subj *is crying*|**  
**|Subj *cried*|**  
**|Subj *could have been crying*|**

are likely to be available to facilitate language comprehension (and production) and the more abstract schemas may only come into play in the processing of more creative texts like

He could hardly have ever been really crying!

An alternative to the above schemas containing explicit auxiliaries and verbs are schemas of the form

**|Subj *could have been* X|**  
**|Subj *should have been* X|**  
**|Subj *may have been* X|**

which contain explicit auxiliaries, but generalize the rest of the expression. What is the functional category of X in such schemas? Consider the following possible instantiations of X:

He could have been **sad** (predicate adjective)  
He could have been **eating the cake** (present participle + object)  
He could have been **given the book** (passive participle + object)  
He could have been **on the table** (prepositional phrase)  
He could have been **a contender** (predicate nominal)

Such examples suggest the basis for creation of a functional category corresponding roughly to the **predication** of Quirk et al., 1972, p. 35, although they would include “have been” in the predication as well. However, such schemas obscure the relational meaning of the predicates (e.g. “sad”, “eating”, “given”, “on”) in these expressions. At one point in the evolution of Double R Grammar, the possibility that the auxiliary established a relation between the subject and the predication was considered, having a schematic form like

### **|Subj Aux Predication|**

and a predicate argument form like

### **Aux(Subj,Predication)**

However, these forms are inconsistent with the basic meaning of an auxiliary which functions to specify the predicate (i.e. establishing tense and/or modality) and not to establish a relation between the subject and predication. One might argue that this contrast reflects a difference in syntactic and semantic structure, but that is not a position adopted in Double R Grammar. However, note that auxiliaries also function as predicates, and when they do a schema of the form

### **|Subj Pred<sub>Aux</sub> Obj|**

is suggested. In this schema, the auxiliary functioning as a predicate does establish a relationship between the subject and the object. Given the availability of this schema, it may be that the initial processing of an expression like

He is sad

evokes this schema and leads to the instantiation of “he” as the subject of “is” giving the partially instantiated schema

### **|he is<sub>pred</sub> Obj|**

but when the adjective “sad” is subsequently processed, this schema turns out to be inappropriate and a new schema is evoked

### **|subj is<sub>pred-spec</sub> sad<sub>pred</sub>|**

This new schema must be integrated with the prior context in a process called accommodation in Double R Process—the theory of language processing that motivates and coincides with Double R Grammar



(Ball, 2003a). That accommodation leads to the instantiation of “he” as the subject of “sad” in the latter schema. Effectively, the subject of “is”, when “is” is initially assumed to be functioning as a predicate, is passed down to the actual predicate “sad”, when “sad” is processed, and “is” takes on the predicate specifier function instead of functioning as a predicate. Note that at each stage of processing, basic relational and referential schemas are involved, but in the transition from one schema to another the auxiliary effectively establishes a temporary relation between the subject and the predication. If this explanation has any validity, then it follows that processing considerations can have important consequences for the representational system.

## 6.2 Abverbs and Negatives

Adverbs and adverbial phrases modify predicates and situation referring expressions by providing information about the manner, location or time of events or states. In a logically based treatment of adverbs, Thomason and Stalnaker (1973) suggest that there are two basic types of abverbs: **predicate modifiers** and **sentential modifiers**. For example, they claim that the adverb “slowly” in

He walks slowly

is a predicate modifier, whereas the adverb “probably” in

He is probably walking

is a sentential modifier. According to Thomason and Stalnaker, the basic difference is that the subject as well as the predicate (where they use the term **predicate** to mean the entire verb phrase) is within the scope of a sentential modifier, whereas only the predicate (or verb phrase) is within the scope of a predicate modifier. This distinction does appear to have some validity. In the first sentence, it seems plausible to suggest that the predicate modifier “slowly” has the predicate “walks” within its scope, whereas in the second sentence, the predicate modifier “probably” appears to have the entire situation referring expression “he is walking” within its scope. Thus, Double R Grammar is in general agreement with Thomason and Stalnaker. However, the treatment of predicate modifiers differs in Double R Grammar in that predicates do not include any arguments and the scope of predicate modifiers is restricted to the predicate and not the entire verb phrase. Further, the possibility of adverbs modifying the relational head of a predicate referring expression within the scope of the predicate specification is also introduced. Finally, it will be argued later that “probably” need not have sentential scope in the above example, although it may as a marked construction.

The rest of this section discusses implications of the distinction between relational head, predicate and sentential modifiers in sentences containing more than one situation referring expression, predicate or relation modifier. The **Main Predicate Proximity Principle** is put forward as a basis for determining the scope of such modifiers. According to this principle, situation referring expression, predicate, and relation modifiers which are closer (in surface position) to the main predicate have smaller scope than modifiers which are further away from the main predicate and on the same side of the predicate (i.e. either to the right or left of the main predicate). Essentially, it says that the closer the situation referring expression, predicate, or relation modifier is to the main predicate, the closer the relationship between the modifier and the predicate. This principle is closely related to Givon’s (1991, p. 89) **Proximity Principle**:

1. Entities that are closer together functionally, conceptually or cognitively will be placed closer together at the code level, i.e. temporally or spatially...
2. Functional operators will be placed closest, temporally or spatially at the code level, to the conceptual unit to which they are most relevant.

In support of the Proximity Principle, Givon states

The cognitive basis of [the] principle...is fairly transparent. The temporal code-contiguity of conceptually-contiguous or conceptually relevant mental entities reflects the general requirements of associative memory, spreading activation and priming. One cannot for the moment guarantee that conceptually-closer mental entities are stored at contiguous locations in the brain. However, if the activation of a concept indeed primes the activation of closely related concepts, then to code related concepts at contiguous times would in fact guarantee faster processing, given associative memory and priming. (Givon 1991, p.92)

While Givon's cognitive explanation of the Proximity Principle resonates with my own best intuitions, his explanation appears more suggestive than definitive. Further, there are at least two reasons why the Proximity Principle may not always hold. First, there are likely to be marked constructions in which linear order does not correspond to conceptual relatedness. Consider

He, unfortunately, left.

In this sentence, a sentential adverb "unfortunately" is interposed between the subject and the verb. On the assumption that the subject and verb are more closely related conceptually than are the sentential adverb and verb, the Proximity Principle fails to hold. However, since this construction is clearly a marked construction (as is suggested by the punctuation), the Proximity Principle may still be maintained for the unmarked case. Second, while the Proximity Principle may generally hold along a given dimension, it is important to remember that the linear form of written English encodes meaning along many different and often orthogonal dimensions. Two such dimensions are concerned with (a) the encoding of tense, aspect and modality and (b) the encoding of argument structure. While tense, aspect and modality tend to be encoded by auxiliary verbs in closer proximity to the main verb than subject arguments in English, such information may also be encoded in adverbials which tend to be further from the main verb than subjects and objects. Indeed, many logical treatments insist on just this possibility, treating negation and modality as sentential operators and relying on marked constructions like

It is not true that the man hit the ball

as paraphrases for the more familiar unmarked case

The man did not hit the ball.

If Givon's Proximity Principle is generally true for the unmarked case along all dimensions of meaning, then tense, aspect and modality are more closely associated with predicates than are arguments and the cognitive validity of such logical treatments is brought into question. On the other hand, if the Proximity Principle does not apply to the positional encoding of information along orthogonal dimensions, then the

cognitive validity of the logical position can be maintained (although it is not a position that is adopted in Double R Grammar).

In what follows, the validity of the Main Predicate Proximity Principle will tentatively be assumed. This principle is primarily concerned with the relative surface position of predicate specifiers and relation, predicate and situation referring expression modifiers and it is assumed that that positioning is largely orthogonal to the positioning of subjects and objects. Further, the Main Predicate Proximity Principle is not without its problems (some of which will be discussed in due course). However, its acceptance reduces significantly the number of possible representations for sentences containing multiple situation referring expression, predicate, and relation modifiers and simplifies the processing mechanism considerably. In short, Double R Grammar accepts the principle as generally valid, but subject to exception (with exception often marked by punctuation in written English). To see how the principle works, consider the sentence

He is obviously slowly walking

In this sentence, the adverb “slowly” is closer to the main predicate “walking” than is adverb “obviously”, and, therefore has smaller scope. On the other hand, in the sentence

He is obviously walking slowly

The relative scoping of “obviously” and “slowly” is undetermined by this principle, since they are not on the same side of the main predicate. Of course, the adverbs themselves may have preferences for relation, predicate or sentential modification. In this example, “obviously” probably has a preference to be a sentential modifier whereas “slowly” does not as is suggested by the awkwardness of “he is slowly obviously walking”.

Thomason and Stalnaker (1973) argue that the adverb “slowly” is always a predicate modifier. However, Chafe (1970) disagrees. He provides the sentences

Bob spoke slowly  
Slowly Bob spoke

and argues that “slowly” functions as a sentence adverb in the latter sentence. According to Chafe (1970, p. 307), this sentence means “that the total event was slow in unfolding, not just that the speaking was slow.” There does appear to be a difference in meaning here which is even more obvious in

He stopped walking slowly  
Slowly, he stopped walking

In the first sentence “slowly” may either modify the predicate “walking” (my preferred reading) or the entire situation referring expression “he stopped walking,” whereas in the second sentence “slowly” appears to modify the entire situation referring expression. The dispreferred reading of the first sentence can be reinforced by punctuation. Consider

He stopped walking...slowly.

By delaying the appearance of the adverb, it may be possible to convert it into a sentential modifier. While this is essentially a processing consideration, it can be seen that the delay following the verb

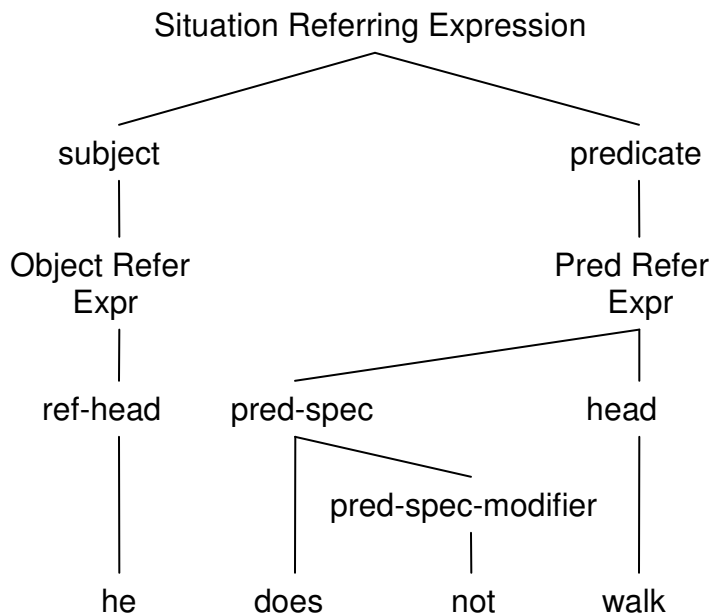
“walking” might signal the system to proceed with the processing of the verb without waiting to see if the subsequent word is a predicate modifier. Thus, when the adverb “slowly” is finally encountered, the verb “walking” will have already been incorporated as the argument of “stopped” and it will not be separately available for the adverb to modify.

Adverb fronting has a similar effect. Since there is no predicate available for the adverb to modify at the time it is processed, its processing must be delayed. Further, since the subject of the main predicate occurs between the adverb and the predicate, the subject is likely to be instantiated into the main predicate forming a situation referring expression before the relationship between the adverb and predicate is established. Fronting should therefore have the effect of converting adverbs which might otherwise be predicate modifiers into sentential modifiers.

Besides the Main Predicate Proximity Principle, the combining of predicate specifier modifiers with the predicate specifier has an important influence on the scoping of relation, predicate and situation modifiers. For example, consider the sentence

He does not walk.

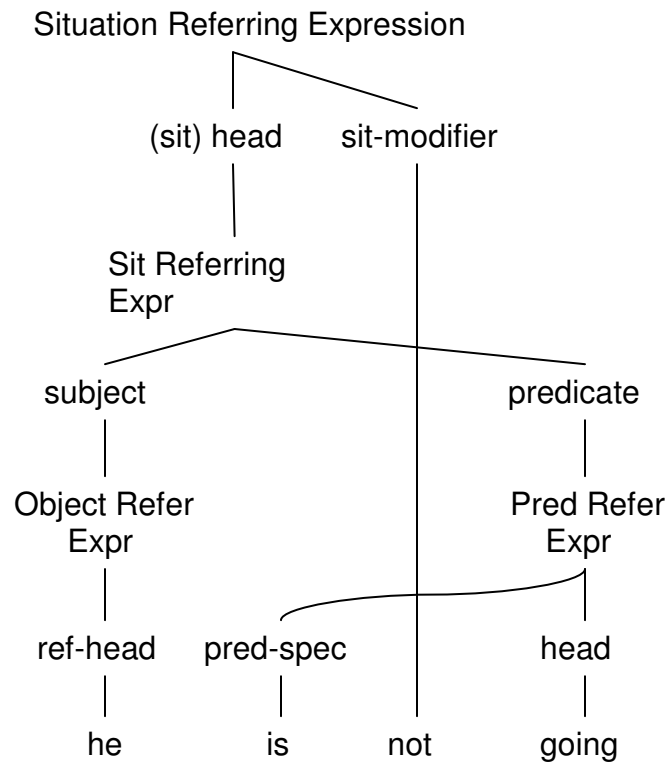
If “not” is a predicate specifier modifier, then there is only one representation for this expression:



Of course, this contradicts the logical treatment of negation as a sentential operator, but the grammatical structure of English strongly supports the treatment of “not” as a predicate specifier modifier and argues against its treatment as a sentential operator. For example, the cliticized forms of negation (e.g. “doesn’t”, “wasn’t”, “can’t”) suggest the combining of the negative with the auxiliary. Further, the requirement for **do-support** in English suggests a strong connection between the predicate specifier and the negative (i.e. “he not walk” is ungrammatical in English because of the lack of do-support). On the other hand, do-support is not required in expressions containing an auxiliary verb. Consider the expression

He is not going

where the negative occurs between the auxiliary “is” and the verb “going”. Allowing for the possibility that the negative has sentential scope, we might represent this sentence as



where the scope of the auxiliary is within the scope of the negative. However, there are two basic arguments against this position. In the first place it violates Jackendoff’s **Grammatical Constraint** (as well as Givon’s **Proximity Principle**). If negatives always have scope over auxiliaries, why do they occur between auxiliaries and main predicates and not vice versa? In other words, why isn’t the preferred surface order in English

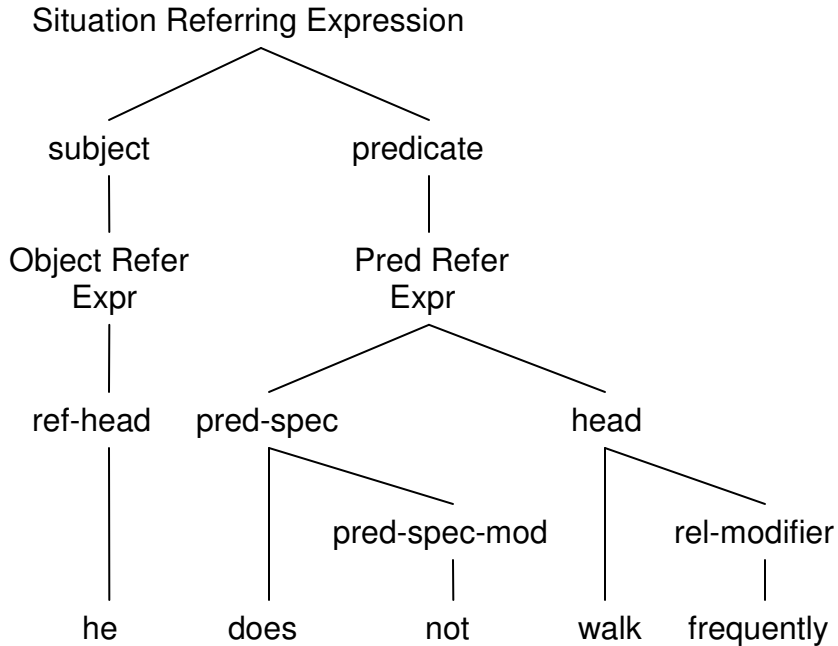
He not is going (or “Not he is going” or even “He is going...not!”)

where the closer relationship between the auxiliary and verb is captured in the surface structure? Second, English provides for the very sort of non-sentential negation that logical approaches disallow in any case. Negation may be morphologically marked as it is in the adjective “unhappy” or it may be an inherent part of the meaning of a lexical item as it is for the verb “to lose”. In sum, the grammatical support for treating negation as a modifier of the predicate specifier and not as a sentential modifier is quite substantial.

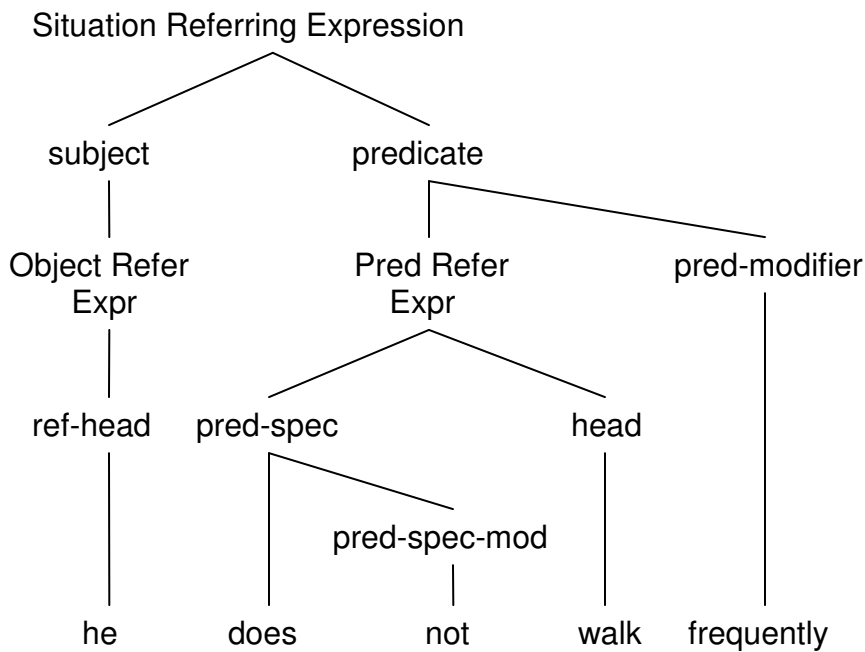
The usefulness of the distinction between relation, predicate and sentential modifiers in conjunction with the Main Predicate Proximity Principle and the representation of predicate specifier modifiers becomes apparent when we consider sentences containing multiple adverbs and negation on both sides of the predicate. In such sentences, the scope of the adverbs with respect to each other must be determined. Consider the sentence

He does not walk frequently.

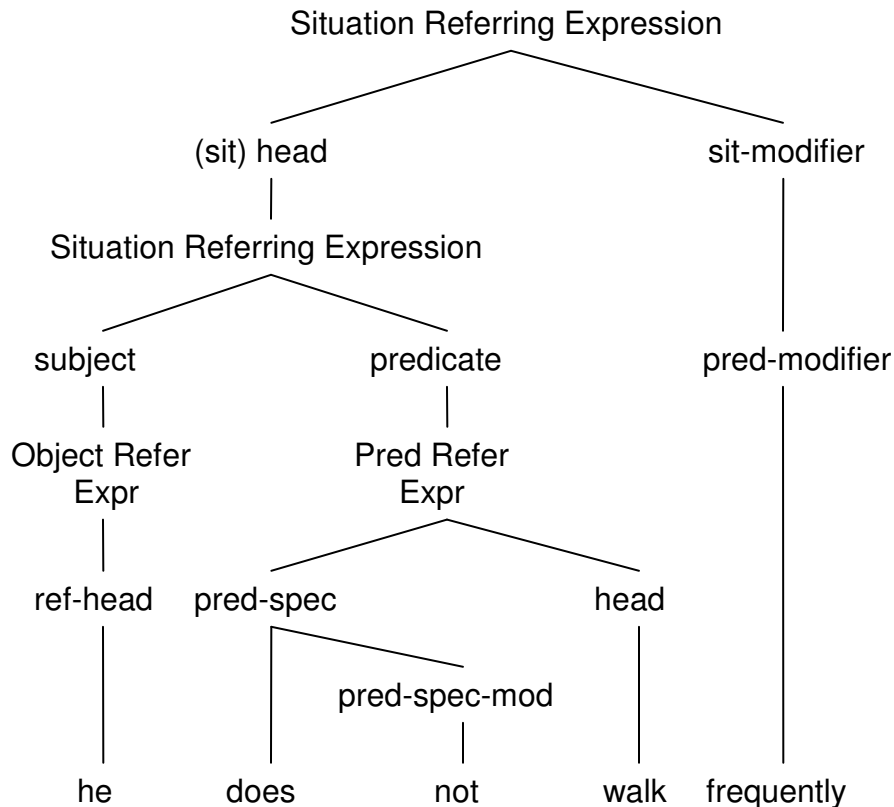
Since “does” and “not” occur to the left of the main predicate and “frequently” occurs to the right where it can be relation, predicate or a sentential modifier, there are at least three possible representations



where “frequently” is inside the scope of “does not” and functions as a relational modifier of the head “walk”,



where “frequently” is a predicate modifier outside the scope of “does not walk”, and

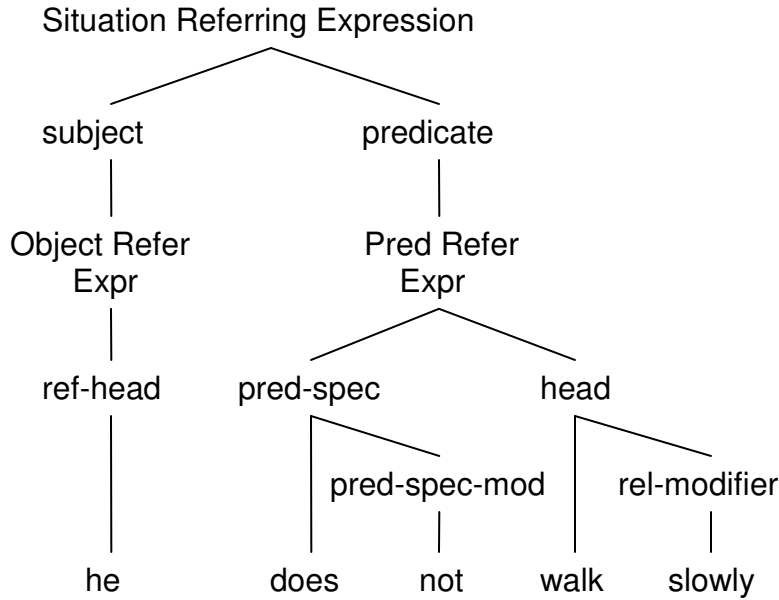


where “frequently” is a sentential modifier outside the scope of “he does not walk”. The first representation corresponds to a reading in which the person referred to by “he” is not a frequent walker, and the second and third representations correspond to a reading in which this person frequently does something other than walking. In this example, there does not appear to be a difference in meaning between “frequently” functioning as a predicate or sentential modifier, both of which are external to the negative “not”. This apparent lack of a difference in meaning suggests that the key to a meaning difference is whether or not the adverb is within the scope of negation, not whether it is a predicate or sentential modifier. That is, the difference between predicate and sentential modification is primarily concerned with whether the subject and object(s) combine with the predicate before the modifier, but these are largely orthogonal dimensions of meaning which do not typically interact.

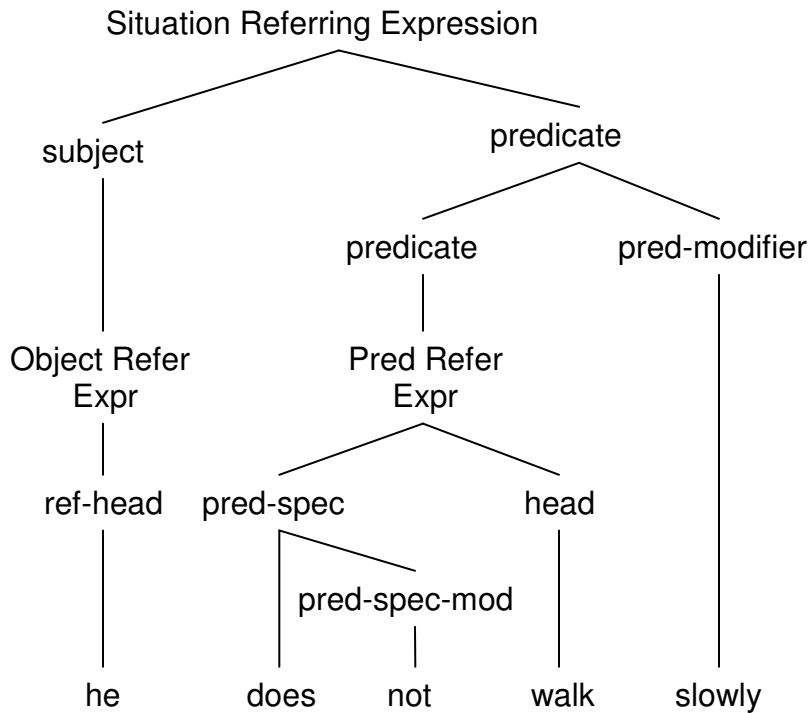
For the sentence

He does not walk slowly

“slowly” functions as a relation modifier within the scope of the negative (on my preferred reading), and not as a predicate modifier as Thomason and Stalnaker suggest. This can be represented by



The alternative reading in which “slowly” has wider scope than “does not” (but is still a predicate modifier) leads to



However, it is unclear how to interpret this representation (i.e. can one slowly not do something?).

There are constructions in English which suggest the need to relax the Main Predicate Proximity Principle. Consider the sentence

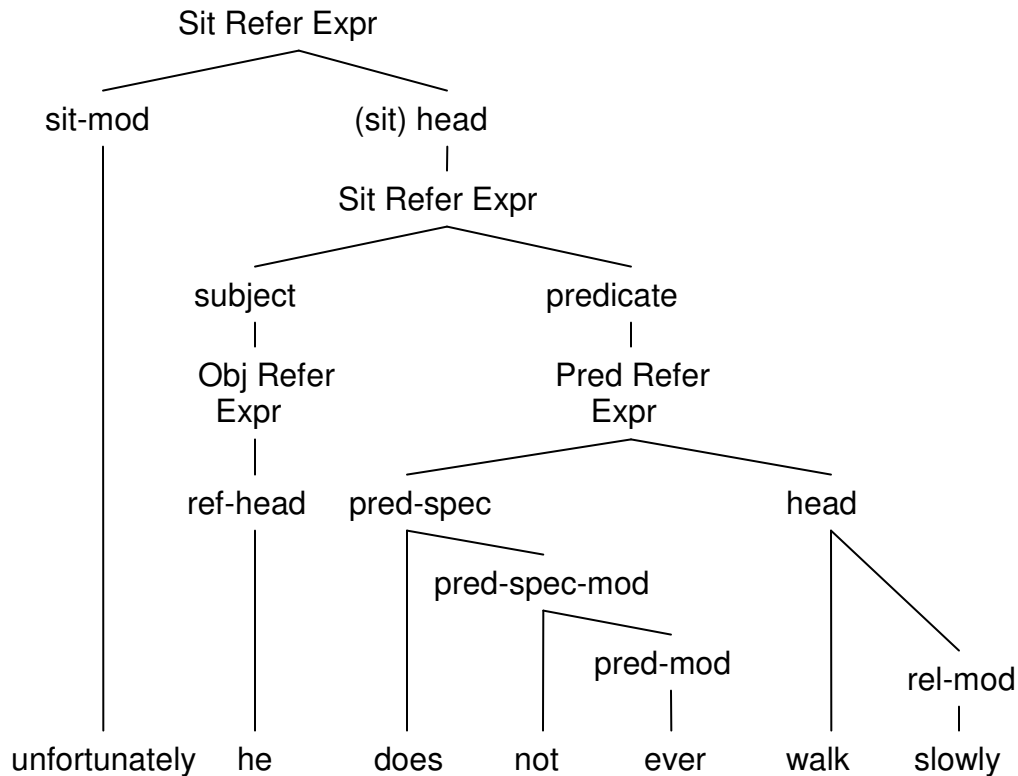
He is, unfortunately, gone.

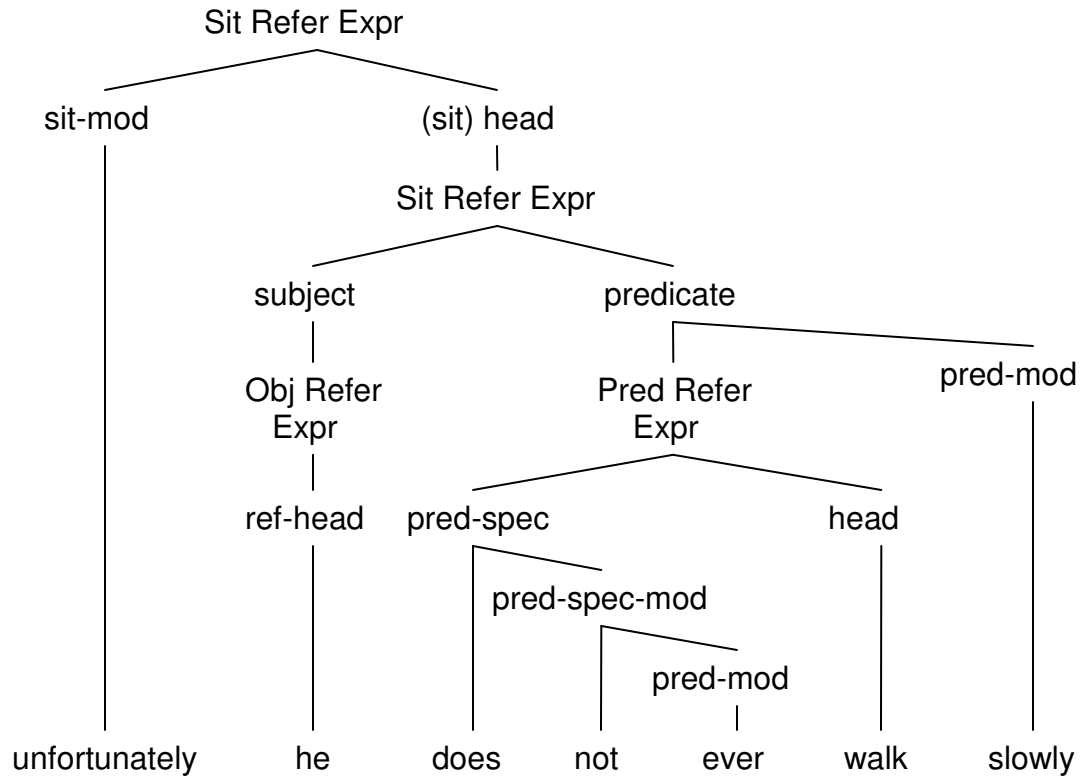


In this sentence “unfortunately” functions as a comment on the sentence “he is gone.” It seems unreasonable to suggest that it occurs within the scope of the auxiliary, despite its position in the sentence. In English, there are numerous occasions when such comments can interrupt otherwise coherent constructions, and they will certainly have to be dealt with. Fortunately, written English frequently makes use of punctuation to mark such constructions. Of course, punctuation will not always be definitive. However, if we do away with the Main Predicate Proximity Principle, the number of possible representations will increase dramatically. For example, consider the sentence

Unfortunately, he does not ever walk slowly.

If the principle does not hold and the four modifiers and specifier can have any scope, then there are 5! or 120 possible representations. If the principle does hold, then the relative ordering of the sentential, predicate and relation modifiers which occur to the left of the main predicate is fixed and there are only 3 possible representations (assuming “ever” functions to modify “not”). Two of these possibilities are shown below:





The possibility of “slowly” functioning as a sentential modifier is not shown. Further, based on the difficulty of constructing a reading for the second representation, there may be additional constraints at work. For example, “slowly” may have a strong preference to function as a relation modifier within the scope of the negative.

Returning to Thomason and Stalnaker’s original discussion of predicate and sentential modifiers, let’s reconsider the following sentence in light of the Main Predicate Proximity Principle:

He is probably walking.

Since “probably” occurs between “is” and “walking” it may either function as a predicate specifier modifier, as is the case for negation, or as a relation modifier as is the case for “slowly”. Treating “probably” as a predicate specifier modifier accords well with its basic modal meaning. Treating it as a relation modifier accords well with its basic adverbial form. In neither case is it functioning as a sentential modifier as Thomason and Stalnaker claim it must. By comparison, in

Probably, he is walking

“probably” is functioning as a sentential modifier. This latter expression can be interpreted as “he may not be walking, in fact, he may not be doing anything” whereas “he is probably walking” is interpreted as “he is doing something, but he may be doing something other than walking”. This is clearly a fairly subtle difference in meaning. For a less subtle difference in meaning, consider

He is probably walking fast  
 He is walking probably fast

Although the second sentence is awkward, in my preferred interpretation “probably” modifies “fast” and not “walking fast.” That is, I take the sentence to mean that “he is walking and he is probably doing so in a fast manner.” As such, it cannot be a sentential modifier, nor does it modify the main predicate. Further, modal auxiliaries like “could” which also express probability fulfill the role of a predicate specifier, not a sentential modifier, as in

He could be walking.

Thomason and Stalnaker’s treatment of “probably” stems from an interest in modal logic. Treating “probably” and “could” as sentential modifiers facilitates their conversion into the modal operators “possible” and “necessary” which have scope over propositions. Unfortunately, the surface structure of English, Jackendoff’s Grammatical Constraint, Givon’s Proximity Principle and Double R Grammar’s Main Predicate Proximity Principle argue against such a treatment.

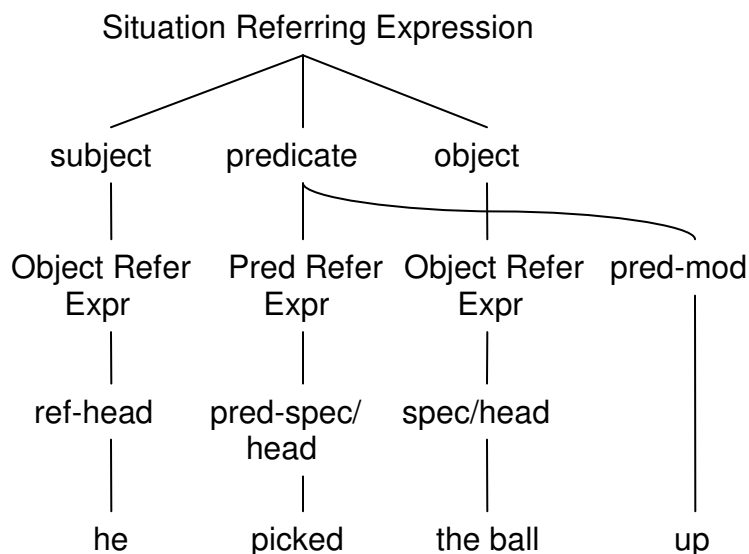
Summing up this section, four important topics have been discussed: (a) the Main Predicate Proximity Principle, (b) the concept of predicate specifier modification, (c) the distinction between relation, predicate and sentential (or situation referring expression) modifiers, and (c) the relationship between the first three topics and the notion of scoping.

### 6.3 Verb Particles and Predicate Modification

Verb particles are “prepositions” which further constrain the nature of the verbs they modify, but which do not take an object argument. The prototypical verb particle provides information about the direction of the action of the verb. For example, the verb particle “up” in the sentence

He picked the ball up

describes the direction of the action of the verb “picked”. Verb particles have a close relationship with the verbs they modify. They are therefore likely to be relation or predicate modifiers rather than sentential modifiers. Assuming this to be the case, the sentence above is represented as



The treatment of “up” as a predicate modifier, rather than a relation modifier, is suggested by the tense marking on the verb and the separation of the particle from the verb by the intervening expression “the ball”. On the other hand, the close relationship between verbs and verb particles is made explicit in languages like German in which the particle actually forms part of the verb in its infinitive form. For example, the German infinitive “einsteigen” contains the particle “ein” and the verb “steigen” combined together in a single word which in English means “to get in or on”. This suggests that the verb particle may also function as a relation modifier within the scope of the predicate specifier as in “he is picking up the ball” where “picking” may combine with “up” before combining with “is”. However, while the particle and verb are combined in the infinitive in German, they occur separately in sentences like

Ich steige der Strassenbahn ein (I am getting on the streetcar).

It is of interest to note that the particle is typically prefixed and not postfixed to the verb in the infinitive form in German. English has a collection of words which appear to behave similarly: “input,” “output,” “outbreak,” “outcast,” “outcome,” etc. There are also words where the particle occurs after the verb: “breakout,” “breakdown,” “breakaway,” “handout,” “makeup,” etc. In English, the combination of a verb and particle into a single word typically results in the formation of a compound nominal rather than a verb. Verbs and particles can be combined to form compound verbs, but the compounds retain the spacing between the verb and particle in the written form: “break down,” “break out,” “break off,” “make out,” “make up,” etc. This difference in spacing may say little about the lexical status of verb-particle combinations. Since the meaning of most such combinations is not a simple composition of the meaning of the individual verb and particle, learning their meanings typically means learning the meanings of the combinations. Indeed, a good dictionary is replete with verb-particle entries. Consider these selected meanings of (a) break down: to become inoperative through breakage or wear; (b) break out: to become affected with a skin eruption; (c) break off: to stop abruptly; (d) make out: to neck; and (e) make up: to reconcile. These examples are not unusual. Essentially then, verb-particle combinations are compound lexical items whose meaning is likely to be directly associated with the combination itself. The meaning of the compound is typically not a compositional function of the meaning of the parts, although the meaning is likely to be semantically motivated in the sense of Lakoff (1987).

To capture the nature of verb-particle combinations, schemas containing both the verb and particle are suggested as in

**|Subj picked Obj up|**  
**|Subj picked up Obj|**  
**|Subj picked Obj<sub>pron</sub> up|**

The third schema captures the fact that pronominal objects prefer to occur before the particle, although this is not a hard and fast rule (as is sometimes assumed).

He picked up them

sounds awkward, but interpretable. More generally, the following schemas are suggested:

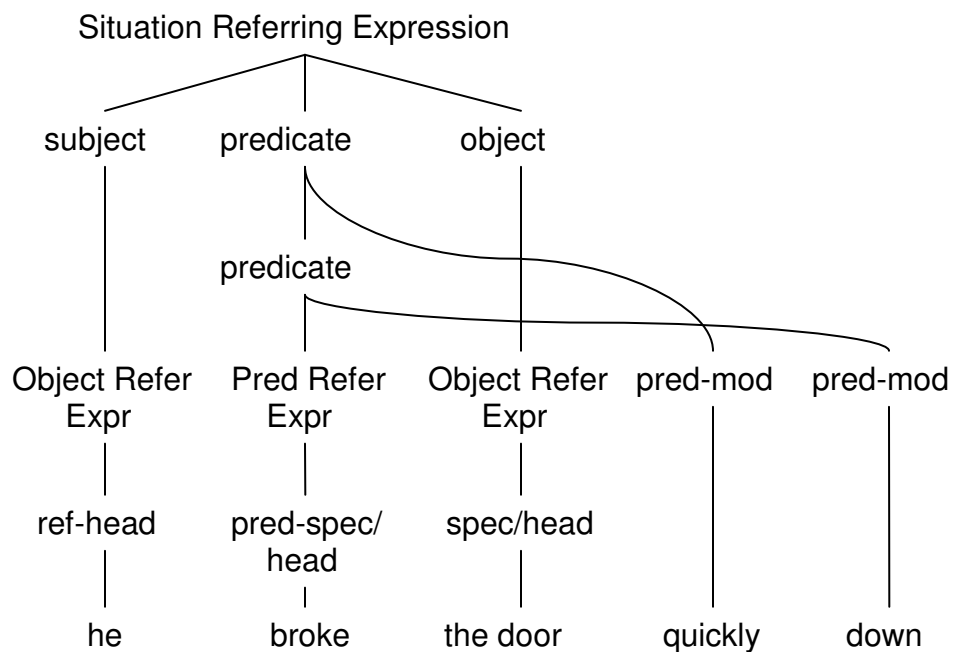
**|Subj Pred Part|**  
**|Subj Pred Obj Part|**

**|Subj Pred Part Obj|**  
**|Subj Pred Obj<sub>pron</sub> Part|**

Given the close affinity of verb-particle combinations, it is assumed that the particle does not have scope over any situation referring expression or predicate modifiers occurring to the left of the main predicate. Further, it should be difficult for another situation referring expression, predicate or relation modifier to occur between the verb and particle. Consider the sentence

He broke the door quickly down

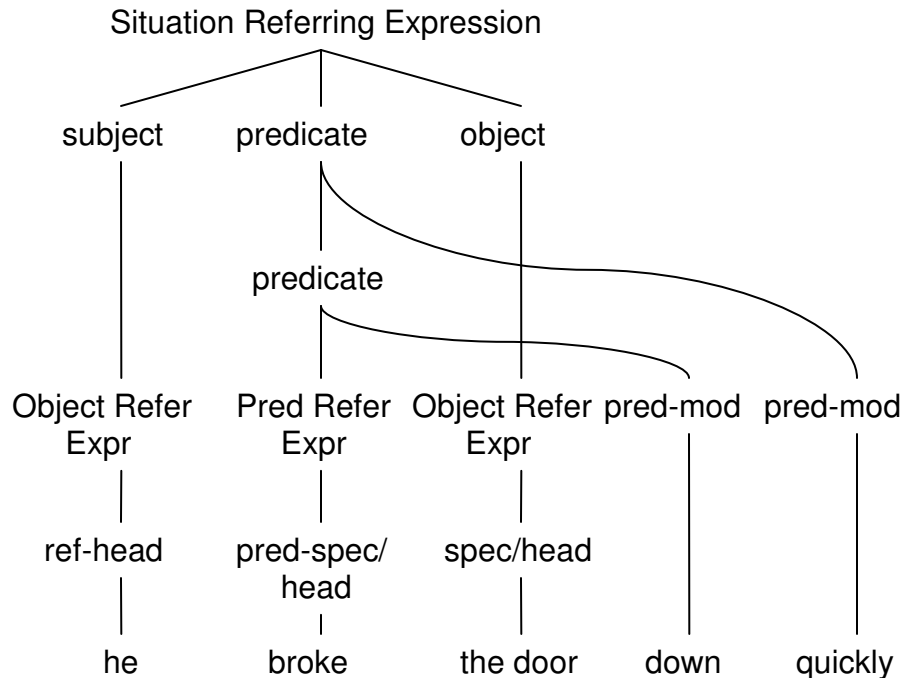
Since the adverb “quickly” occurs between the verb and particle, it should cause problems for interpretation and this sentence is assumed to have a marked surface order.



From a processing perspective, the occurrence of “quickly” between “broke” and “down” impedes the integration of “down” with “broke” under the assumption that “quickly” has wider scope than “down” and is not first integrated with “broke.” This is reflected in the crossing of the links between “broke” and “quickly” and “broke” and “down” in the above representation. On the other hand

He broke the door down quickly

is readily interpretable and is represented by



Although, the occurrence of “quickly” between “broke” and “down” causes problems for interpretation, the occurrence of the object referring expression “the door” between the verb and particle does not cause problems. In general, the location and influence of relational arguments is independent of the location and influence of situation referring expression, predicate and relation modifiers. Thus, any number of situation referring expression, predicate and relation modifiers may occur between the subject and the main predicate without disrupting the instantiation of the subject as an argument of the predicate. It has been stated that this is not the case with regard to the object of the main predicate. Specifically, adverbs do not normally occur between the verb and its object. Thus, the sentence

He hit hard the ball

Sounds awkward and

He hit the ball hard

is preferred. Further, it is well attested in GB Theory (Chomsky 1981) that there are constraints on the relative position of verb particles and pronominal and non-pronominal objects such that pronominal objects “must” be coded between verbs and particles, whereas, particles may be coded between verbs and non-pronominal objects as in

He broke it down

He broke down the door

Presumably such constraints stem from the fact that the encoding of argument structure and the encoding of predicate structure are not strictly orthogonal. Double R Grammar does not currently have a mechanism for explaining such constraints—although other examples where referential and relational meaning interact have been described and it may be that schemas containing pronouns interposed

between verbs and particles are overlearned to the extent that there is a strong preference for this form. What is not suggested in Double R Grammar is that in languages like French where adverbs do occur between the verb and the object, this is the result of some verb raising phenomenon that leaves the adverb behind and hence interposed between the verb and the object.

In sum, verb particles are the strongest example of relation and predicate modifiers considered so far. To the extent that the meaning of verb-particle combinations is not a compositional function of the meaning of the individual words, they are likely to behave like compound lexical items rather than separate words.

## 6.4 Wh-words and Grammatical Categories

The wh-words in English function to stand in the place of the basic constituents of situation referring expressions. The wh-words “who” and “what” stand in the place of object referring expressions as in

Who ate the cookie?	Who <sub>subj</sub> ate Obj
What do you want?	What <sub>obj</sub> Do Subj want

In addition, the wh-word “what” may also stand in the place of situation referring expressions and predicate referring expressions as in

What did he say?	What <sub>prop</sub> Do Subj say
He what?	Subj What <sub>pred</sub>

The wh-words “where,” “when,” “why” and “how” stand in the place of situation referring expressions or predicate modifiers as in

Where did he go?	Where <sub>sit-mod</sub> Do Subj go
Why did he do it?	Why <sub>sit-mod</sub> Do Subj go
How did he do it?	How <sub>sit-mod</sub> Do Subj go
When did he do it?	When <sub>sit-mod</sub> Do Subj go

Wh-words are assumed to be the variables in Double R Grammar’s system of representation and for them to be an adequate set of variables, they must be capable of standing in the place of the major grammatical categories. Looked at from a different perspective, the range of use of wh-words serves as an indicator of the grammatical categories which (as a minimum) should exist.

In this regard, perhaps the strongest evidence in support of the existence of something like a **VP** constituent in English stems from the use of the wh-word “what” to elicit what Quirk et al. (1972) call the **predication** (i.e., the verb + objects and complements less the auxiliary verb). According to Quirk et al. (1972, p. 52), the wh-word “what” is typically used to elicit a predication as a response. Consider the sentence (taken from Quirk et al.)

He had given the girl an apple

for which the question

What had he done?

can be used to elicit the predication

Given the girl an apple

as a response. Further, Quirk et al. note that the verb itself cannot typically be elicited in this manner. Consider the sentence (again taken from Quirk et al.)

They make him chairman every year

for which the question

What do they him the chairman every year?

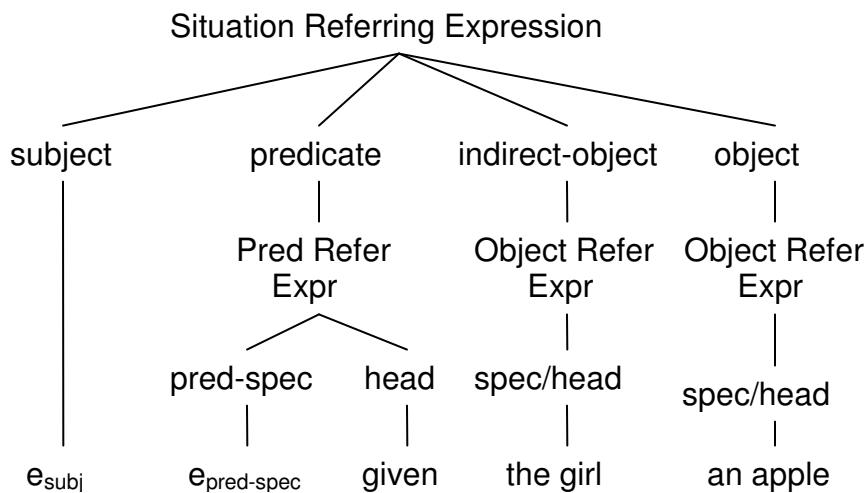
cannot be used to elicit the response

Make.

The use of the wh-word “what” in this manner provides strong evidence for the existence of predications. Nonetheless, predications are assumed to be incomplete units of meaning in Double R Grammar. This does not mean they cannot occur in English text, but that from a relational perspective, predications are elliptical constructions. Thus, given the schema

**!Subj Pred-Spec given Iobj Obj!**

the elliptical “given the girl an apple” can be represented by



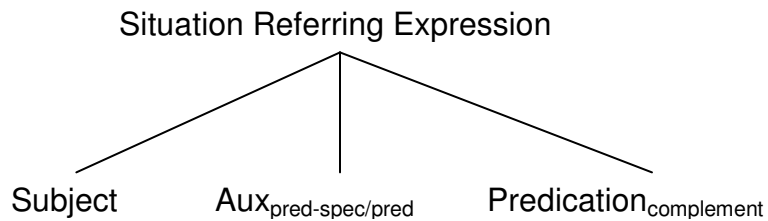
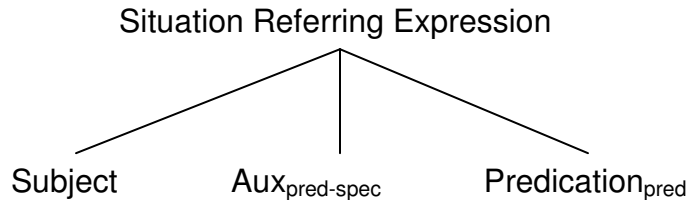
where **e<sub>subj</sub>** represents the empty subject argument and **e<sub>pred-spec</sub>** represents the empty predicate specifier. When Double R Grammar is extended to support the representation of discourse, such empty elements will be linked to their antecedents in the prior discourse and/or linked to elements of the corresponding situation model of the discourse.



The treatment of predication in the sense of Quirk et al. as an elliptical situation referring expression accords well with the encoding of referential and relational meaning in Double R Grammar. As an alternative, a schema of the form

**!Subj Aux Predication!**

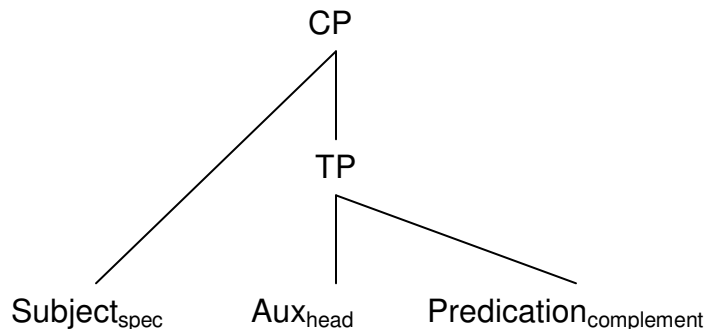
could be posited that explicitly represents the predication as a grammatical category. There are two views of this schema which are represented by



In the first view, the auxiliary functions as a predicate specifier of the predication with the predication functioning as the predicate. This view fails to reflect the relational meaning of the predicate which is embedded in the predication and separated from the subject argument.

In the second view, the auxiliary functions as both the predicate specifier and the predicate with the predication functioning as a complement. This view suggests that the auxiliary establishes a relationship between the subject and the predication, but it is unclear what this relationship means. In addition, this view fails to reflect the predicate specifying relationship between the auxiliary and the main predicate.

Taking the additional step of making the subject external to the auxiliary and predication gives



where the labels TP (Tensed Phrase) and CP (Complement Phrase) are introduced to show the correspondence to X-Bar Theory (Chomsky 1995, p. 172). From the perspective of Double R Grammar, there are several reasons to disprefer such representations. First, the representation fails to reflect relational meaning, with the object and main predicate being embedded in the predication and the

subject being external to the predication and external to the auxiliary as well. Second, it seems clear that predicate specifiers specify predicates and not predications (i.e. predicates with any objects). That is, the relationship between a predicate specifier and a predicate is orthogonal to the relationship between the predicate and its arguments. That orthogonality is sacrificed in this representation. Why should the auxiliary which marks the tense and/or modality of the predicate take the predication, including any objects, for an argument and not just the predicate? Why shouldn't the auxiliary function like the morphological past tense marker “-ed” or the morphological aspect maker “-ing” in applying to just the predicate. Further, treating the subject as the specifier of the CP constituent as is done in Chomsky's recent versions of X-Bar Theory clouds the meaning of what it means to be a specifier. Likewise, treating the auxiliary as the head of the TP constituent—since it projects the tense which defines the TP category—runs counter to the position of Double R Grammar in which it is the specifier and not the head with projects the grammatical (i.e. referential) category to higher level constituents. For a more extended discussion of the relationship between Double R Grammar and X-Bar Theory see Ball (2003c).

## 7. Langacker's Conceptual Schema for Nominals and Clauses

Langacker (1991) provides a detailed Cognitive Linguistic description of the conceptual content of nominals and clauses which is closely aligned with the basic composition of referring expressions as described in Double R Grammar. Langacker puts forward the following schematization of the conceptual content of nominals and clauses:

(G(Q(I(T)))

where G = **grounding predication**, Q = **quantifying predication**, I = **instantiating predication**, and T = **type specification**. A grounding predication grounds an expression in the context of utterance of the expression, where that context includes the speaker and hearer and the immediate environment of the speaker and hearer. The most obvious grounding predication is a deictic word that refers to the speaker, the hearer or some other person in the immediate context (e.g. “I”, “you”, “he” or “she”). The determiner in a nominal expression and the first auxiliary (or modal) verb in a clause also function as grounding predications. In the case of a clause, the first auxiliary grounds the situation expressed by the clause into the context of utterance. A quantifying predication quantifies the number of discrete entities or events that are ground by the grounding predication. In a nominal, the most obvious quantifying predication is a number like the number “two” in “the two books”. In the expression “some books”, “some” functions as both a grounding and a quantifying predication. Note that “two” may combine with a separate grounding predication (e.g. the determiner “the”) whereas, “some” does not. To distinguish these different uses of quantifiers, Langacker categorizes them into absolute quantifiers like “two” and relative quantifiers like “some”. A relative quantifier is relative to some reference set. Thus, “some” represents a quantity relative to a reference set and grounds the quantity with respect to that reference set, whereas “two” is an absolute quantity independent of any reference set. Adverbs like “everyday” and “repeatedly” often function as quantifying predications in clauses. An instantiating predication instantiates an instance that may be further quantified and ground in the context of utterance. According to Langacker (1991, p. 147), the head of a nominal (or clause) functions as the instantiating predication. Instantiation is different from grounding. Instantiation creates or identifies an instance of a type within the domain of instantiation, but does not necessarily ground that instance in the immediate context of the speaker and hearer. Finally, the word (or expression) that functions as the head of a nominal or clause provides a type specification which identifies the type of object or relation that the expression profiles.

Thus, according to Langacker, the head of an expression minimally functions to provide both a basic type specification and to instantiate an instance of that type in the domain of instantiation (i.e. the space domain for nominals and the time domain for clauses). For nominals, this is true, whether the head is singular or plural. If the head is plural, an instance of a collective type—what Langacker calls a **replicate mass**—is instantiated.

Langacker uses the functional categories **head**, **modifier** and **complement** (but not **specifier**) in describing how grounding, quantifying, and instantiating predications, and type specifications compose together. Essentially, the head is a constituent which combines with a modifier such that the head provides the **profile** of the composite expression. A modifier, then, constrains the type specification of the head, but does not provide the profile for the composite expression. That is, the profile of the head **projects** to the composite expression, not the profile of the modifier. Absolute quantifiers function like modifiers in that the head they combine with provides the profile of the quantified expression. Langacker treats grounding predications special in that they not only combine with heads, but, unlike other modifiers, they profile the head they combine with. However, note that it is the head that a grounding predication profiles, not the grounding predication itself. Further, it is the addition of a grounding predication that results in a full-fledged nominal. According to Langacker, “the two components [grounding predication and head] have equal claim to the status of local head, since both their profiles correspond to the composite-structure profile (that of the nominal as a whole).” (1991, p. 147-8). With respect to nominals grounded by the determiner “the”, Langacker states that “to the extent that *the* is regarded as the head, the other component—which elaborates the head—is a complement. To the extent that the elaborating structure is regarded as the head, *the* constitutes a modifier.” (1991, p.147). In the (G(Q(I(T)))) schema, the parentheses reflect the order of composition with the type specification first composing with the instantiating predication which then composes with the quantifying predication and finally the grounding predication. Thus, a grounding predication presupposes a quantifying predication which presupposes an instantiating predication which presupposes a type specification. Each level of composition reflects a modifier-head or head-complement relationship. Note that the order of composition is independent of the surface order of the constituents and the component elements may be morphological as well as syntactic.

In Double R Grammar there is a fourth functional category called the **specifier**. The grounding predication typically corresponds to a specifier with the specifier functioning as the “**referential head**” of a composite expression (the quotes around “referential head” indicate the non-standard use of the term “head” in this expression). The specifier or “referential head” combines with the “**relational head**” (where relational head encompasses objects) to form a composite expression, with the “relational head” providing the type specification for the composite expression and the “referential head” projecting the referential type of the composite expression. The introduction of the specifier function avoids the need to view the “relational head” as a complement as suggested by Langacker. It allows the head (as opposed to a complement) to project the relational type—thereby, retaining a semantic basis for the notion of a head and at the same time maintaining a distinction between heads and complements (i.e. complements do not project relational type to composite expressions). It avoids the “inconvenience” of suggesting that “the” is the head of the expression “the book”—contrary to any semantic notion of what a head is (cf. Cheng and Sybesma’s interview of McCawley, 1998).

There is a close correspondence between Langacker’s grounding predication and the function of a specifier as the determinant of the referential type of an expression, and between Langacker’s type specification and the function of a head as the determinant of the relational type of an expression. Further, Langacker’s conception of modifiers as providing a higher-order type specification is entirely consistent with the function of modifiers in Double R Grammar. Less clear is the correspondence

between Langacker’s quantifying and instantiating predications and the functional categories of Double R Grammar. The fact that a quantifier may function as a specifier (e.g. “two” in “two books”), or as a modifier (e.g. “two” in “the last two books”), or even as the head of an expression (e.g. “two” in “I want two”) argues against its treatment as a separate functional category. In this regard, a quantifier is more like a noun or a verb that can take on multiple functional roles, than it is a separate functional category and the treatment of quantifiers as a part of speech (where a part of speech reflects the inherent meaning of a lexical item) as opposed to a functional category is suggested. The quantifying predication may be encoded in multiple functional roles even within a single expression as in “these two books” where the specifier “these” indicates quantity as does the modifier “two” and the head “books”. Similarly, the grounding predication appears to be encoded in multiple functional roles as in the nominal “two books” where the specifier “two” provides an (indefinite) grounding predication and the plural marker on the head noun “books” provides an additional (indefinite) grounding predication. However, Langacker argues that number marking on a head noun is part of the basic type specification with the head noun instantiating an instance of the basic type (i.e. a replicate mass when the noun is plural), and that number marking does not provide a separate quantifying predication (1991, p. 147). If Langacker’s argument is accepted, then quantifying predications and instantiating predications can be distinguished. Otherwise, assuming all nominal heads are marked for number and that number provides a quantifying predication, then nominal heads are quantified as well as instantiated and this distinction cannot be maintained. Double R Grammar assumes that the number marking on heads supports a quantifying predication and, for plurals, a grounding predication, as well—deviating from Langacker in this respect. The ungrammaticality of the expression “these book” reflects a conflict in the quantifying predication provided by the specifier “these” (plural) and the head “book” (singular) and supports the idea that single count nouns provide a quantifying predication. However, the failure of single count nouns to function as full nominals (e.g. “book” in “I like book”) reflects their lack of a grounding predication. On the other hand, plural count nouns provide both a quantifying and a grounding predication and can function as full-fledged (indefinite) nominals (e.g. “books” in “I like books”).

One way of integrating Langacker’s account of conceptual composition with Double R Grammar is to treat grounding predications, quantifying predications and type specifications as conceptual features that supplement the semantic content of heads, modifiers, specifiers and complements. Note that these conceptual features are not the grammatical diacritics that Langacker argues against in syntactic approaches to linguistic representation. Rather, they represent additional semantic information that is provided by the word or expression functioning as a head, modifier, specifier or complement. For example, in the expression “the book” the word “the” is functioning as a specifier which provides a grounding predication, whereas “book” is functioning as a head which provides a quantifying predication and a type specification. Note that “the” (unlike “a”) does not provide a quantifying predication since it is consistent with both “the book” and “the books”. Schematically, we can represent the functional form of the expression “the book” as

(Spec [G] (Head [Q,T]))

where [G] indicates that the specifier provides a grounding predication and [Q,T] indicates that the head includes a quantifying (i.e. singular) predication and a type specification. Using a tree diagram to represent this schema and the words that instantiate the functional roles gives

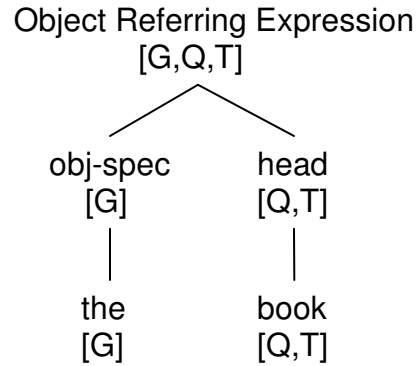


Figure 7.1: adding abstract conceptual features

Note that [G] and [Q,T] identify the conceptual roles of the specifier and head, but do not provide any details about those conceptual roles. For example, Q indicates that the word “book” provides a quantifying predication without saying what that predication is—namely, singular. Likewise, “the” provides a grounding predication—namely, definite grounding. If we substitute these more detailed descriptions into the tree diagram we have

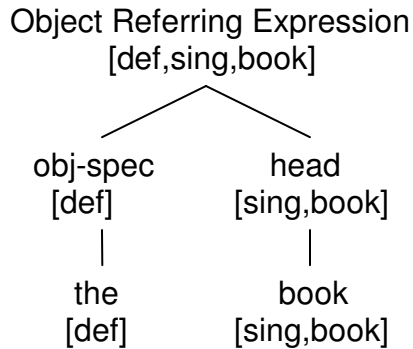


Figure 7.2: more specific conceptual features

where [def] indicates the definite grounding predication of “the”, [sing] indicates the singular quantifying predication of “book” and [book] indicates the type specification.

In Double R Grammar, features are a means of providing additional semantic detail at a particular level of abstraction—in particular, at the level of abstraction represented by the functional categories head, modifier, specifier, and complement (and their subtypes). For example, the functional category specifier may be subcategorized as object specifier or predicate specifier and object specifier may be subcategorized as definite object specifier or indefinite object specifier. Alternatively, a feature notation may be used in which the more abstract specifier category is marked for the relevant semantic features as in

- |                             |   |
|-----------------------------|---|
| specifier [obj, definite]   | vs. definite-object-specifier (e.g. “the”)    |
| specifier [obj, indefinite] | vs. indefinite-object-specifier (e.g. “a”)    |
| specifier [pred, finite]    | vs. finite-predicate-specifier (e.g. “is”)    |
| specifier [pred, nonfinite] | vs. nonfinite-predicate-specifier (e.g. “to”) |

These are really just alternative representations of the same semantic content. That is, regardless of how the semantic content is represented, the word “the” provides information about the definiteness and “objectness” of the head it profiles and the word “to” (i.e. the infinitive marker) provides information about the non-finiteness and “predicateness” of the head it profiles.

The correlation between categories and features goes back at least to Chomsky (1970, p. 208) where he suggests the replacement of categories by sets of features, although he continues to use category labels for convenience. However, categories are more than just a convenience in Double R Grammar. They are the basis for the creation of schemas at multiple levels of abstraction. Further, there is no assumption that the feature set of a category is necessarily fully determinate, nor that the inheritance of features in a hierarchy of categories is absolute and infeasible, nor that all features are of equal importance to a category. Thus, linguistic categories represent an abstraction mechanism that is subject to the limitations of human categorization, more generally, and they are not replaceable by feature sets.

The integration of Langacker’s conceptual schema with Double R Grammar would be facilitated by the addition of the specifier function to his description. The addition of the specifier function makes it possible to provide more constrained and semantically motivated definitions of the traditional head, modifier and complement functions than is otherwise possible. The specifier is the locus for the encoding of referential information. Modifiers and heads are the locus for the encoding of information about the relational type of expressions. Complements are the locus for encoding information about the participants in relations. Complements encode referential and semantic information about the participants in relations, but that information is not profiled in the larger relational expressions in which they participate. In Langacker’s terms, the specifier supports the encoding of grounding and (optionally) quantifying predications. Heads and modifiers support the encoding of type specifications and, via number marking, quantifying and grounding predications. Quantifying predications are primarily referential and are typically expressed by quantifiers functioning as specifiers, but may also be expressed by quantifiers functioning as modifiers that constrain the relational type of the heads they modify.

An alternative representation for the expression “the book” which emphasizes the referential and relational poles and the attraction of various features to each pole is shown below:

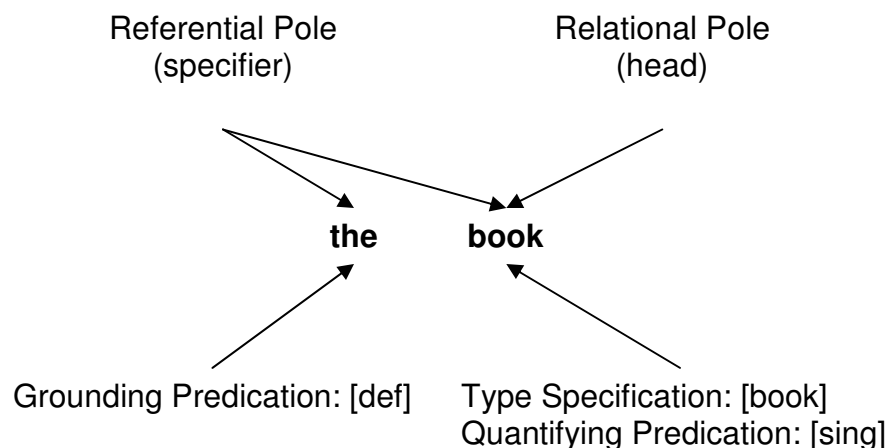


Figure 7.3: referential and relational poles

In this representation, the referential pole is the locus for the grounding predication, and the relational pole is the locus for the type specification. The link from both poles to “book” reflects the combined

referential and relational function of the quantifying predication which is reflected in the number marking on “book”.

For a more complex example, consider the expression “the two old bulls” which is represented by

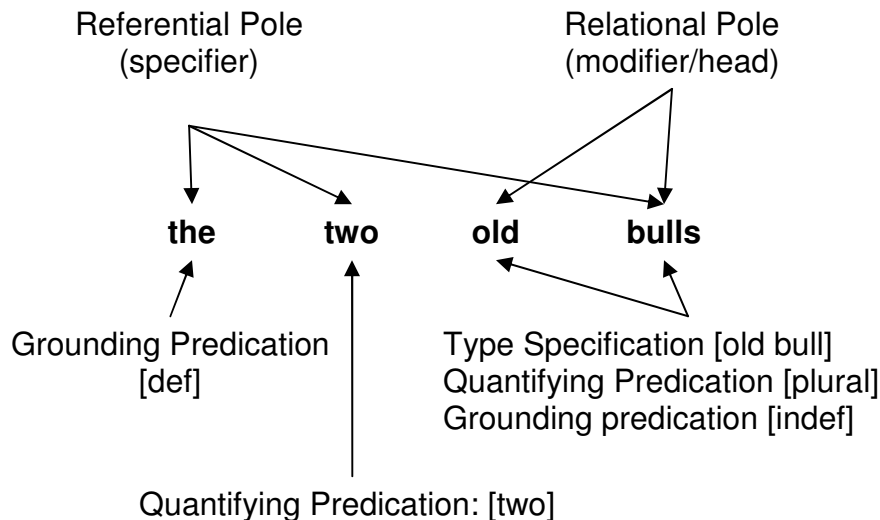


Figure 7.4: a more complex example

In this example, referential and relational information is spread throughout the expression, although the specifier is still the locus of the grounding predication and the head is still the locus of the type specification. Note that the definiteness of the specifier “the” contrasts with the indefiniteness of the plural number marking on “bulls”. Typically, when such a contrast occurs, the specifier further constrains the grounding predication of the head, and the more constraining grounding predication of the specifier projects to the expression as a whole. However, the grounding predication of the specifier may also be less constraining than that of the head, and when it is, it still overrides the grounding predication of the head. For example, the expression “a Bob you don’t know” is indefinite because of the specifier “a” even though the proper noun “Bob” is normally definite. What is not typically allowed is for the quantifying predication of the specifier and head to be inconsistent (e.g. “a books”).

The bipolar representation of the basic structure of expressions adopted in Double R Grammar contrasts with the more typical nuclear representation characteristic of X-Bar Theory, Dependency Grammar, and other theories which focus on the contrast between heads and modifiers (and heads and complements) and adopt a strong notion of endocentricity. It is hoped that the arguments in this manuscript make the validity of the bipolar metaphor apparent, and support a weakening of the more common nuclear metaphor, reintroducing the notion of exocentricity which has been out of favor for some time. It should also be noted that the distinction between the referential and relational pole differs from Langacker’s distinction between the phonological and semantic pole. The referential and relational poles of Double R Grammar are both subsumed under Langacker’s semantic pole.

In discussing the grounding predication of clauses, Langacker argues that only the first auxiliary or modal verb provides the grounding predication and that all other auxiliaries form part of the head. Further, the composition of these components proceeds from the main verb outwards. For example, in the expression “he could not have been kissed”, “kissed” first combines with “been” which combines with “have” which combines with “not” which combines with “could”. A similar position was adopted in an earlier version of Double R Grammar in which the first auxiliary or modal (also called the

**operator** by Quirk et al., 1972) filled the specifier role, with other auxiliaries functioning as modifiers of the main verb (note that Langacker treats the outer auxiliary as a head which combines with a verbal complement). However, there are reasons for modifying this position. Auxiliaries are members of a closed class verb subtype that look and behave very much like other specifiers (i.e. they are short, frequently occurring, and provide a referential function). Further, from a processing perspective, delaying the composition of complex auxiliaries until the main verb is processed, would strain the capacity of short-term working memory. In the processing of “he could not have been kissed”, if auxiliaries do not compose together until the main verb is encountered, five separate linguistic chunks (e.g. “he”, “could”, “not”, “have”, and “been”) would need to be retained in short-term working memory until the main verb “kissed” is processed. Allowing auxiliaries to compose together in forming a complex specifier “could not have been”, avoids the need to retain separate chunks in short-term working memory. The previous section on the scope of relation, predicate and sentential modifiers provided additional support for treating subsequent auxiliaries as modifiers of the predicate specifier and not the main predicate.

## 8. Situation Models

Reference is a frequent topic of study in both philosophy and linguistic semantics. Martinich (1985, p. 8) refers to reference as “the single most discussed issue in the philosophy of language”. Unfortunately, many philosophers implicitly or explicitly reject the grammatical constraint and assume that the underlying meaning of linguistic expressions is not transparently reflected in the grammatical form of the expression. For instance, Russell (1919; reprinted in Martinich, 1985, p. 214) remarks that philosopher’s are all too often “misled by grammar” in their analyses of linguistic expressions. And Frege’s (1892) broaching of the sanctity of the subject (and object) in extending the scope of quantifiers to sentences—despite their clear grammatical status as constituents of the subject (and object) and not the sentence as a whole—is another example of the short shrift giving to grammatical form within philosophical considerations of language. Of course, there is much that is right about the philosophical analysis of language, but where philosophical theorizing diverges from grammatical form, grammatical form, and not philosophical theory, often receives the brunt of the criticism.

Within linguistic semantics, grammar is more likely to be accorded credence in discussions of reference. Lyons (1977) provides an enlightened discussion of the referential aspects of definite and indefinite expressions. Allan (1986) presents a treatment similar to that of Lyons. Jackendoff (1983) takes a strong stand on the relevance of grammatical evidence to questions of meaning and reference in positing his grammatical constraint and in arguing against numerous violations of this constraint in logical treatments.

Within philosophical and linguistic approaches to reference, the focus is on the ability of linguistic expressions filling the roles of subject and object to refer, and the referential ability of linguistic expression describing situations is accorded far less attention. Thus, we see extensive treatment of the referential qualities of definite and indefinite descriptions in both philosophy and linguistics, but little consideration of the referential qualities of finite and infinite situation descriptions.

This section is in the spirit of Lyons (1977) and Jackendoff (1983), but introduces a distinction between type of referring expression and referential type. That is, a referring expression of a given type may refer to a range of different referential types. Thus, a definite description may refer to a specific individual or to a collection of individuals, but it may also refer to some additional referential types to be introduced below. Given the distinction between type of referring expression and referential type, it is argued that linguists typically focus on the ontology of referring expressions, assuming an ontology of



referential types limited to individuals, whereas philosophers typically focus on the ontology of referential types, assuming an ontology of referential types limited to individuals (and sometimes including situations as individuals). That is, in both cases the ontology of referential types is typically limited to individuals.

An ultimate objective of Double R Grammar is to demonstrate that it is possible to provide adequate representations of meaning which adhere to the grammatical constraint. While this objective will not be achieved in this section, it is hoped that it represents a step in that direction.

## 8.1 An Ontology of Referential Types

First order predicate calculus is typically grounded in a model theoretic semantics with an ontology limited to atomic individuals. That is, the model consists of a domain and a collection of individuals in that domain and nothing else. Typically these individuals are assumed to correspond to objects (or individuals) in the real world being modeled. In FOPC, a relation is modeled in terms of the set of individuals (for 1-ary relations) or set of ordered sets of individuals (for n-ary relations,  $n > 1$ ) for which the relation is true. This notion of relation is borrowed from mathematics where a relation is defined as a set of ordered sets of elements (for n-ary relations,  $n > 1$ ) from one domain to another. In FOPC, a relation with its arguments bound to individuals in the domain is either true or false of those individuals and it is said that the reference of the proposition is one of the values true or false. Situation semantics (Barwise and Perry, 1983) extends FOPC by allowing situations to be individuals. That is, not only are situations true or false of sets of individuals in the domain being modeled, but they are themselves individuals in the domain. A situation consists of a relation and the participants in that relation. We may say that the relation has “first-class” status in situation semantics, whereas it is a second-order (or derived) notion in FOPC.

Situation semantics is a step in the right direction. However, from a perspective which takes the grammatical constraint seriously, what is needed is a referential ontology which covers the range of types of referring expressions and types of referents that actually occur. Unfortunately, it is more typical in linguistic semantic theories to presume an ontology of referential types limited to individuals and to force linguistic expressions to map to members of that ontology (perhaps allowing situations to be individuals). This results in arcane formalisms which are at their most perverse where the presumed ontology corresponds least well to the realities of linguistic expressions. For example, a common logical representation for the expression “a car is a vehicle” is

$$\text{Forall}(x): \text{car}(x) \text{ implies } \text{vehicle}(x)$$

However, even a logician when asked to generate a logical representation for the expression “a car” alone would balk at representing it as

$$\text{Forall } (x): \text{car}(x)$$

How then does the universal quantifier “forall” wind up in the representation of an expression containing the (in)definite descriptions “a car” and “a vehicle”? Apparently, this is the preferred way to represent type/subtype relationships given the extremely limited referential (and representational) ontology available in FOPC. From a grammatical perspective, “a car” is clearly singular, whatever its referential import. What then does “a car” refer to? Johnson-Laird (1983) suggests that the expression “a car” in the sentence “every man owns a car” maps to some representative subset of cars, in particular, to

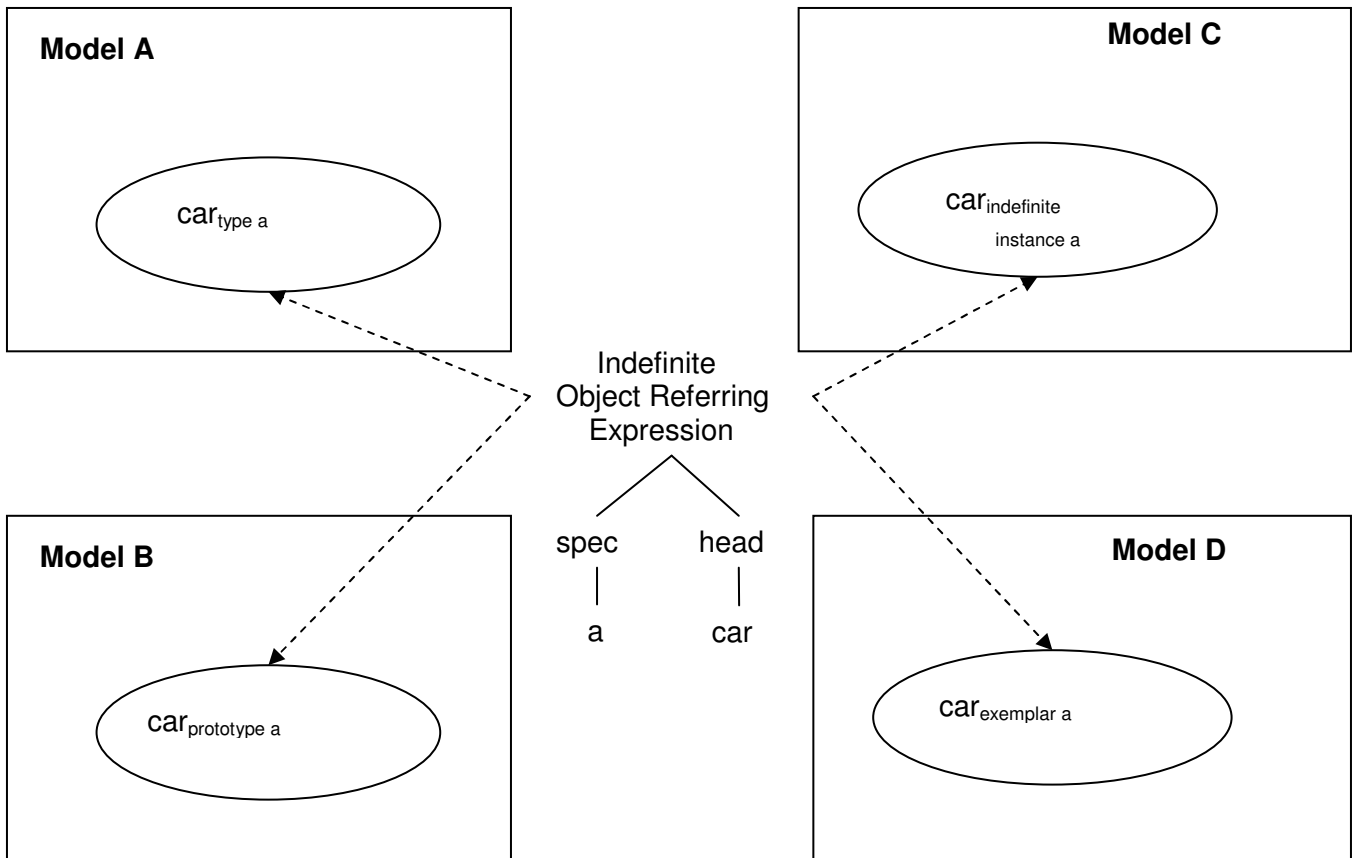
the subset of cars that corresponds to the representative subset of individuals referred to by “every man,” plus a subset of cars that are not owned. He (1983, p. 421) represents this as

man => car  
man => car  
    (car)

But if “a car” is essentially singular and not plural, then it does not refer to multiple cars, even limited to just a few. From a psychological perspective, there are at least six potential referents for expressions like “a car” that do not violate the singular status of the linguistic expression:

- Type
- Prototype
- Exemplar
- Indefinite Instance
- Definite Instance
- Collections of the above viewed as a whole

“A car” may refer to a type of object, namely the type of object that is a car. “A car” may also refer to a prototype that represents what is common to most cars, or it may refer to an exemplar which is an instance that is a representative car. Further, “a car” may refer to an indefinite instance with the determiner “a” marking the indefinite status of the referent of “a car”. Note that “indefinite instance” is used here as a referential type and not a type of referring expression. In all cases, the type of the referring expression is an indefinite object referring expression when marked by the determiner “a”. Given the occurrence of the indefinite determiner “a” in this expression, “a car” cannot typically be used to refer to a definite instance of a car. Nor is there anything in the grammatical form of “a car” to suggest reference to a collection of cars. What then does “a car” in “every man owns a car” refer to? Every man owns some indefinite thing whose type is car (i.e. which has the essential features of a car), or of which an exemplar which comes to mind is representative, or which has the features of a prototypical car which comes to mind. Note that the suggestion that “every man owns a car” may mean that there is a specific car that every man owns is not an expected reading given the indefinite status of “a car”. How might we represent such an indefinite thing in a situation model? If types, prototypes, exemplars and indefinite instances have first class status, then they can be referred to directly. This is depicted in the graphic below:



In this graphic, boxes bound the possible situation models that correspond to the linguistic expression “a car”. Within the situation model boxes, ovals bound objects that can be referred to. Referential links are marked by broken lines with arrows pointing to the referent. The existence of types, prototypes and exemplars is well attested in cognitive psychological studies (e.g. Collins & Quillian 1969, Rosch 1975, 1978). Prototypes are an important element of cognitive linguistics (e.g. Lakoff 1987, Taylor 1989). Indefinite instances are essentially unbound variables which may be of a particular type. Definite instances are constants (or perhaps bound variables) which may be of a particular type. Note that “a car” does not typically refer to a definite instance, although it may refer to a specific, but indefinite instance (Lyons, 1977). In a model theoretic semantics limited to definite instances (the typical case), the use of indefinite object referring expressions is problematic. This sometimes leads to the suggestion that indefinite object referring expressions (or indefinite descriptions) refer to all individuals of which the description is true in the model—a clear violation of the grammatical constraint and a psychologically implausible treatment as well. Expanding the range of referential types provides a means for overcoming these problems.

In the graphic above, which situation model is appropriate for a given use of the expression “a car” is dependent on the context of use. In a given use of “every man owns a car” and lacking any additional context, reference to an indefinite instance may be the preferred reading.

In the graphic, the linguistic expression “a car” is categorized as an indefinite object referring expression. Its internal structure is categorized in terms of the functional categories specifier and head. A specifier combines with a head to form an object referring expression. Note that the word “car” by itself lacks the specification needed to function as an object referring expression and the meaning of “car” is taken to be a type that can be used to refer as part of an object referring expression (i.e. when

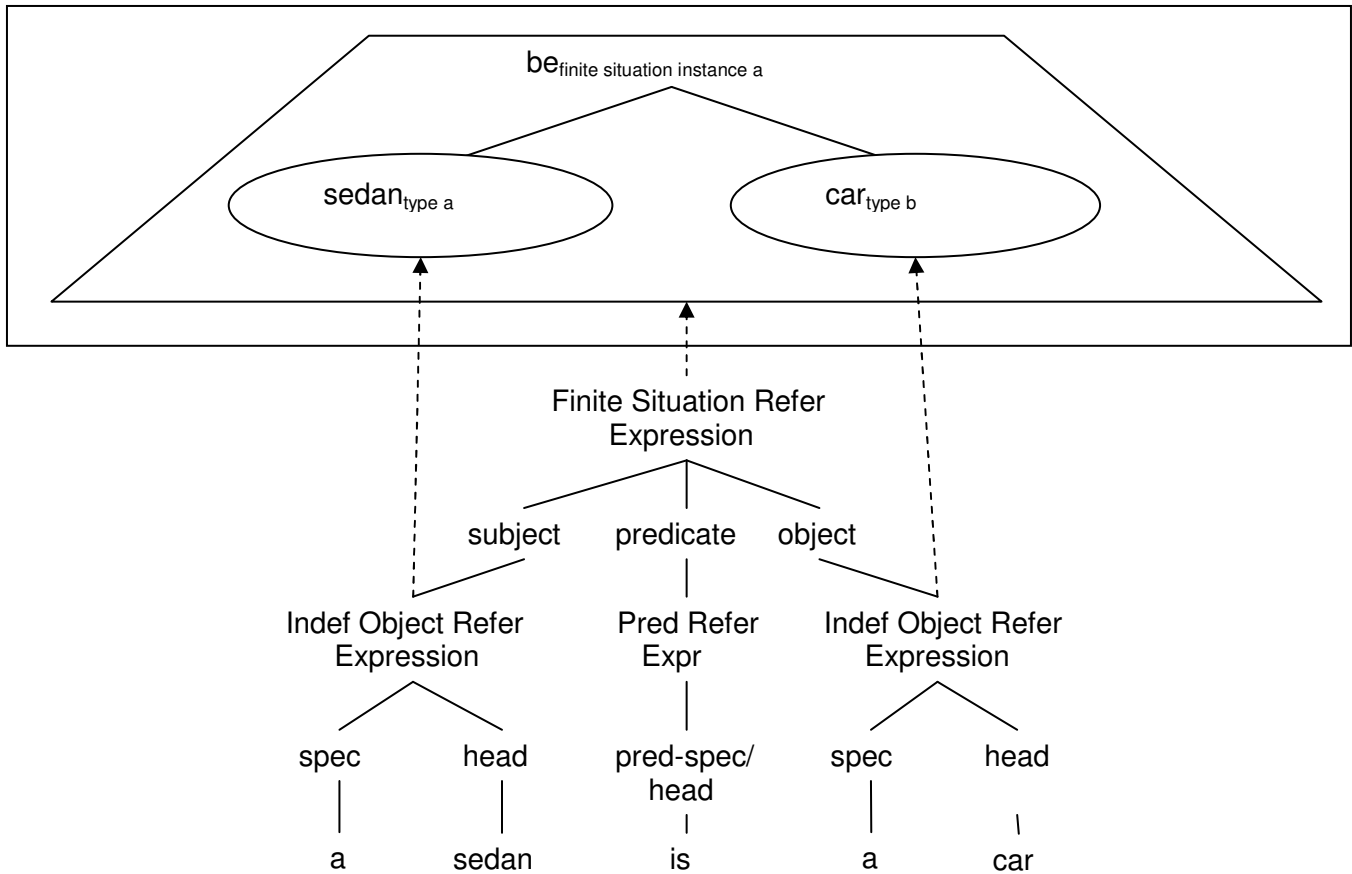
specified), but is not in and of itself typically used to refer. Thus, treating “car” as referring to the set of individuals which are cars is problematic once again, since “car” is not by itself a referring expression. To avoid this problem, Lyons (1977) uses the term **denotation** to capture the meaning of a word like “car” independent of its use in any referring expression. According to Lyons, the denotation of “car” is the set of all things that are cars. But if types are first class entities, then the denotation of “car” may just be the type car. That is, there is no requirement to define a type in terms of the things which are of that type. Of course, there must be some inferential mechanism for determining if some thing is a particular type of thing, but this need not be part of the inherent meaning of a type, rather it may reflect a general cognitive capability to categorize (Lakoff, 1987). And that mechanism is not guaranteed to work in all cases. For example, there may well be types for which it is difficult or impossible to determine the instances. Putnam’s (1975) suggestion that identifying instances of many types (e.g. diamond, gold) requires expert knowledge not available to the typical individual, argues against the necessity of being able to do so. Nonetheless, it is still possible to refer to the type independently of the ability to determine what instances are of that type.

### 8.1.1 Reference to Types

Type hierarchies are common in systems of knowledge representation and making types first class objects allows an expression like

A sedan is a car

to be represented as



In this graphic, the situation model contains a finite instance of a “being” situation in which two types are equated. Whereas objects are surrounded by ovals, situations are surrounded by trapezoids and include the objects which are the participants in the situation. In the graphic, the linguistic expression “a sedan is a car” is categorized as a **finite situation referring expression**. The term **predicate** identifies the head of the situation referring expression. The predicate is assumed to be specified by the tense marking on the verb unless a separate predicate specifier (i.e. modal or auxiliary verb, or infinitive marker “to”) occurs in the expression. The object referring expressions associated with the predicate are the **arguments** of the predicate, further categorized as the functional types **subject**, **object**, **indirect object** and **complement**. Note that the situation referring expression refers to the entire situation including the participants in that situation. This is reflected in the referential link pointing to the trapezoid which circumscribes the situation in the model. The object referring expressions separately refer to the objects in the model. A link from the predicate referring expression to the relation of “being” to which it corresponds in the situation model is not shown.

That the equation of these two types is asymmetric has to do with the meaning of “sedan” and “car”. This asymmetry is not explicitly reflected in the representation.

Jackendoff (1983) argues against the possibility of referring to types. His main argument is that types have no experiential basis that would allow them to be referred to:

The claim is simply that [TYPES] do not correspond directly to experience. We can't point to a #type# but only to #instances of a type#...

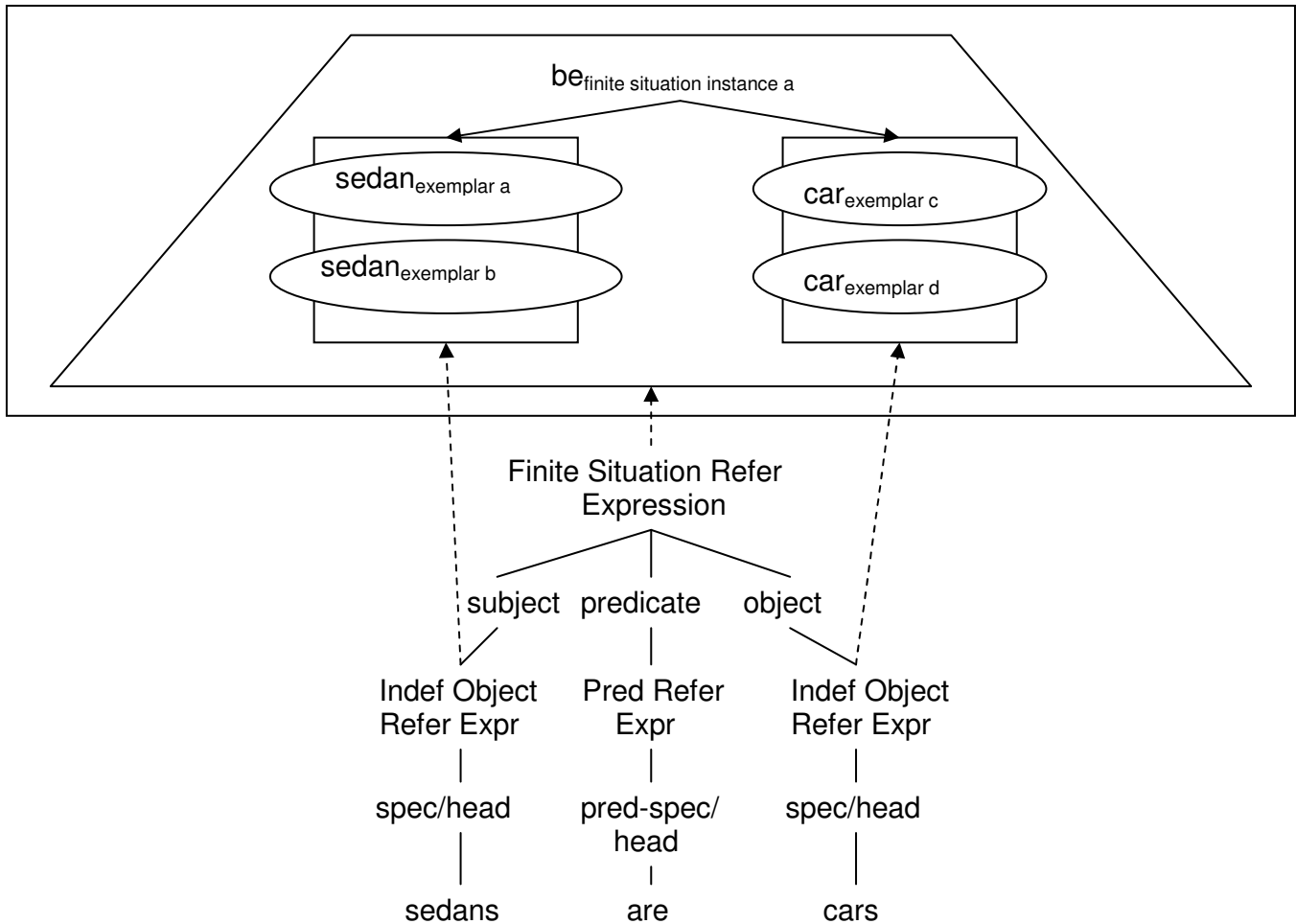
While it is true that there is no direct analog representation for a type corresponding to representations for tokens with arms, feet and what not, Jackendoff does not consider the possibility of a more abstract, but still experientially based, representation of types that can in fact be referred to. In particular, there are a whole host of types expressed via linguistic expressions like “dog”, “cat”, “woman”, etc. that are arbitrarily associated with the types they represent, but perceptually based and experiential, nonetheless. One could certainly use the linguistic expressions themselves as a basis for supporting the reference to types. However, types may also have a more direct perceptual basis, albeit not one based on the raw perception of the type, but one based on the experience of instances of a type, with the type being abstracted from that experience and corresponding to a more general experience. For example, experience of a particular cat, may evoke a specific representation of that cat, but may just as well evoke a more abstract representation of the experience of “cat hood”, capturing what is similar across different experiences of cats. Since there is no abstract concept of [CAT] in Double R Grammar that is not based on experience, unlike Jackendoff’s conceptual structures, abstractions from experience are as close as one can get to pure concepts. In the absence of any perceptual stimulation, I can envisage a cat, but what I envisage is clearly an abstraction of my perceptual experience of cats and is already drifting towards being a type, rather than an instance. I might better call my perceptual recall of a cat an exemplar, rather than an instance, since it is not tied to current experience. I can also cobble together features of different exemplars in constructing what might be called a prototypical house cat. And I might use this prototypical house cat as a stand-in for a type. Or I can cobble together atypical features in constructing an atypical, perhaps three legged, cat. The mind is capable of representing amorphous concepts like “furniture” and abstract concepts like “justice” and these concepts can be referred to by expressions like “your furniture is nice” and “justice will prevail”. Representation of these concepts is based on experience of instances of furniture and justice as well as verbal descriptions of them. While there may be no concrete thing that they correspond to and for which an analog, perceptual representation exists in memory, there may well be some gestalt, resonating pattern of activation over representations, abstracted from experience, that is activated when these concepts are entertained and which might come to represent them. To the extent that this pattern of activation is replicable, it can constitute the mental representation of a type. And the pattern of activation may be invoked by the mere linguistic expression of a type. In sum, I find the notion of types as being abstractions of experience that can be referred to as less problematic than the notion of abstract concepts which have no experiential basis.

### **8.1.2 Reference to Exemplars and Prototypes**

The plural variant of the expression “a sedan is a car”

Sedans are cars

suggests a representation based on exemplars rather than types leading to



This example introduces the possibility of referring to a **collection** of individuals as is marked by the enclosing rectangle around the exemplars of sedan and car. The five referential types introduced above are all potential candidates to participate in collections. From a grammatical perspective, collections are plural as is reflected in the use of the plural verb form “are”. The referential links from the object referring expressions suggest that reference is to the collection and not to the individual exemplars, although the fact that the object referring expressions are plural suggests that the members of the collection are salient. This is reflected in the graphic by having the ovals for the exemplars overlap the bounds of the rectangle. For psychological reasons having to do with the limited capacity of humans to attend to multiple chunks of information (e.g. Miller, 1956), it is assumed that any linguistic expression may only introduce a small number of possible referents into a model (cf. Johnson-Laird, 1983). In the graphic, two exemplars each of “sedans” and “cars” are introduced into the model—the minimal number consistent with the plurality of the object referring expressions.

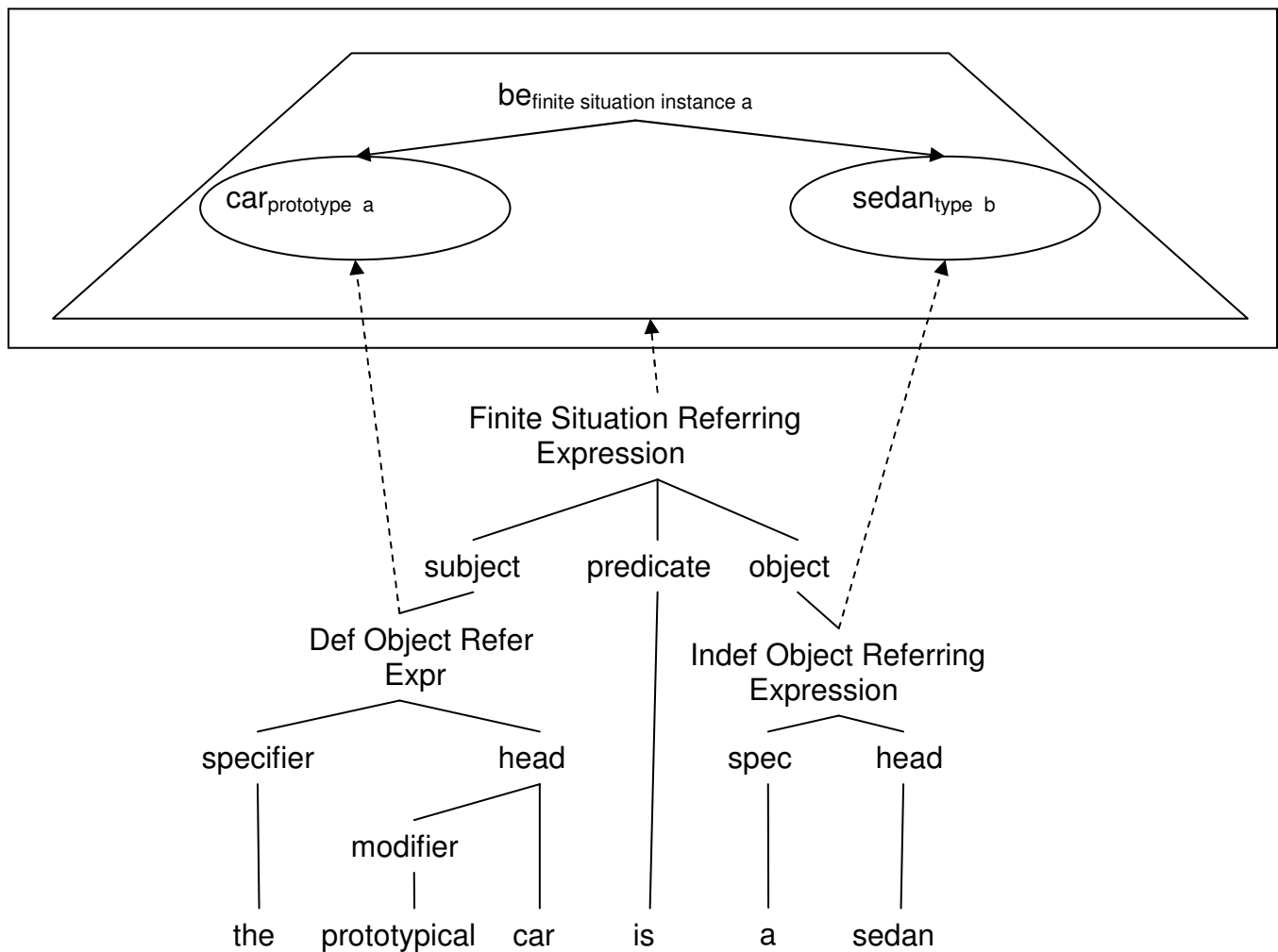
If references to collections are allowed in the ontology of referential types, then it is not necessary to pair each member of one collection with a member of the other collection. Such pairings are possible, but are assumed to involve inferential processes operating over the model and are not part of the grammatically encoded meaning. In any case, only a limited number of such pairings are possible given the capacity limitations mentioned above. A model theoretic semantics which involves an unbounded number of such pairings is psychologically implausible.

It is difficult to distinguish reference to prototypes from reference to types and exemplars since they have much in common. A prototype may be viewed as a partial type or a washed out exemplar. It is a partial type in that it may not include all the features that are characteristic of the type (hence the prefix “proto”). It is a washed out exemplar in that it is a generalization over the experience of particular instances of the type. Prototypes make it clear that the distinction between types and instances (or tokens) is less clear cut than is typically assumed.

The use of specific lexical items may help to make the distinction, although there is some risk that the lexical item “prototypical” may not have the intended effect. Consider

The prototypical car is a sedan

If the expression “the prototypical car” refers to a prototypical car, this can be represented by



If the expression “the prototypical car” actually picks out a prototype for a referent, and the expression “a sedan” picks out a type, then equating a prototype with a type has the effect of defining the prototype to be of a particular type. Of course, it is also possible that “the prototypical car” actually picks out a type or exemplar rather than a prototype, and in this case equating that referent with the referent of “a sedan” will have somewhat different effect.



The use of the definite determiner “the” in the expression “the prototypical car” suggests the ability to pick out a definite referent. This may favor the picking out of an exemplar or prototype, rather than a type. Prototypes and exemplars may both be viewed as generic instances of a given type, with prototypes being abstractions over previous experience of exemplars. Allan (1986, volume two, p.134ff.) discusses the semantics of generic NPs noting that “there is no marking for the generic within NP morphology” and that generics have “to be inferred from context.” Grammatically a singular object referring expression is either definite or indefinite. If the referent of the expression is a type, prototype or exemplar, then the reference is generic. Definite object referring expressions typically refer to exemplars or prototypes which are more instance-like than types. Indefinite object referring expressions typically refer to types which are less instance-like than exemplars and prototypes. Thus, in the expression

The sedan is a car

where there is no existing referent for “the sedan” to refer to, “the sedan” presumably picks out a prototype or exemplar and not a type.

If we collapse the distinction between prototypes and exemplars, we are left with a category of **generic instance**. This category is well suited to the traditional grammatical treatment of genericity. The motivation for distinguishing prototypes and exemplars is a psychological one. However, if this distinction fails to be supported by grammatical evidence, it may need to be withdrawn.

Allan (1986, p. 142) notes that in addition to generic NPs, there are generic propositions. He provides the sentence

Daniela smokes

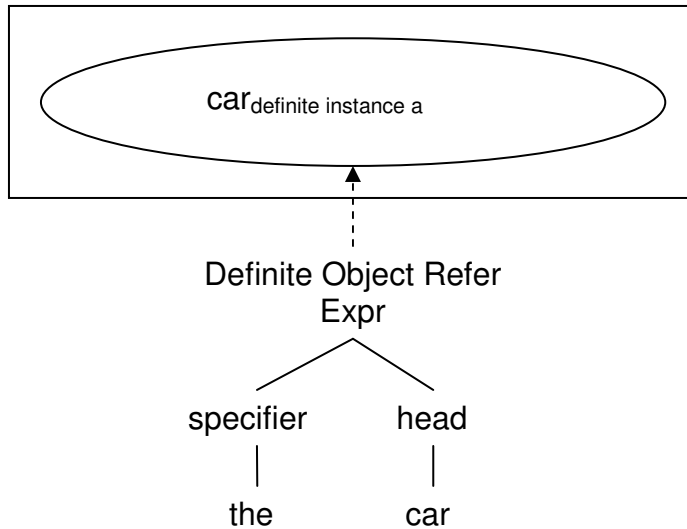
as an example of a sentence expressing a generic proposition. That is, this sentence does not refer to a finite instance of smoking by Daniela at a particular time and place, but to a generic instance which is unspecified for time and place. If exemplars of situations are fixed in time and place, then generic instances of situations pattern after situation prototypes which are presumably not fixed for time and place and the distinction between exemplars and prototypes may actually have more validity for dynamic situations than static objects. Nonetheless, the suggestion that the above sentence refers to a prototype situation of smoking is not immediately satisfying as an explanation, and it may be that the suggestion that it invokes a collection of exemplars as in a repetitive behavior is preferable. Further, the suggestion that exemplars of situations are fixed in time and place can be questioned.

### 8.1.3 Reference to Definite Instances

The determiner “the” marks reference to definite instances. Consider the expression

The car

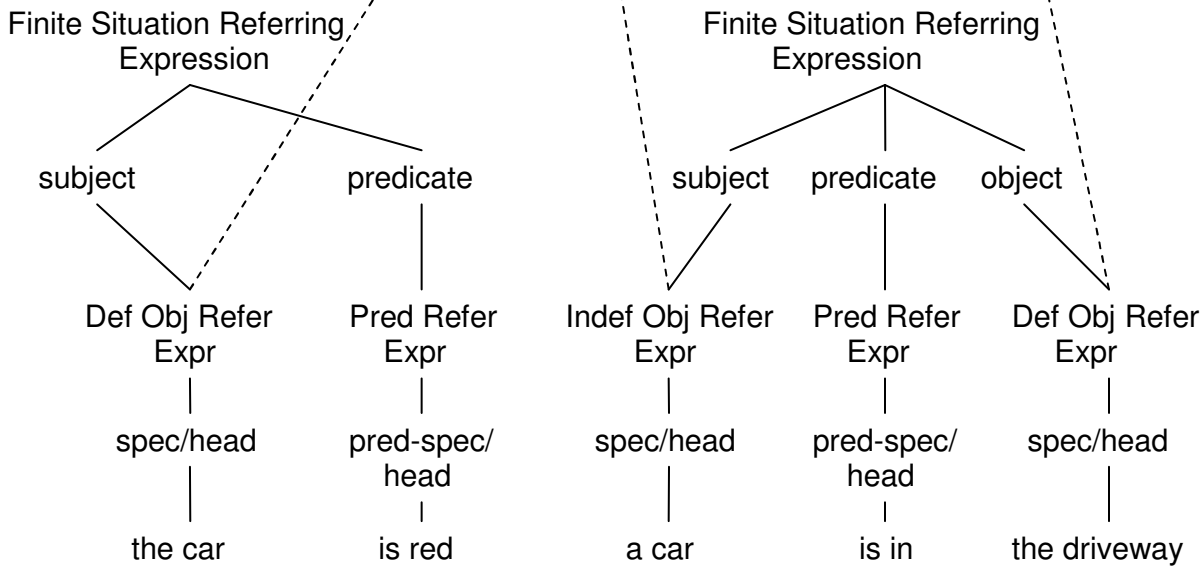
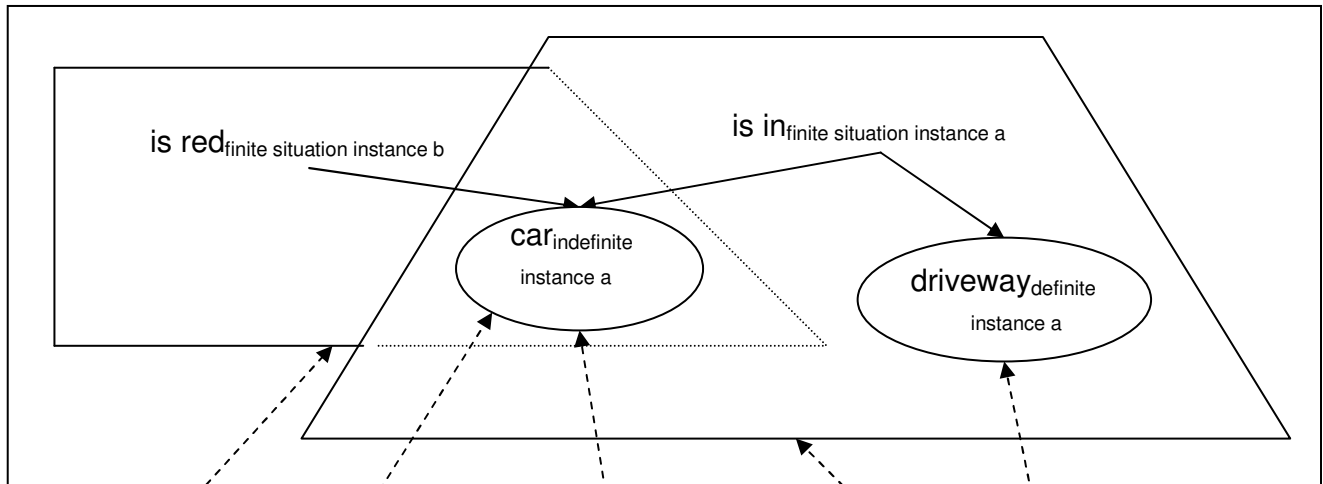
which is represented by



What are the differences between a definite instance and an indefinite instance? One difference is in terms of how the referent of the expression is established. In the use of an indefinite referring expression, there is no presupposition that a referent already exists in the model, and a new referent is introduced into the model. In the case of a definite referring expression, there is a presupposition that some referent is already available in the model (or in the universe of the model), and that the expression refers to the existing referent.

Consider

A car is in the driveway. The car is red.



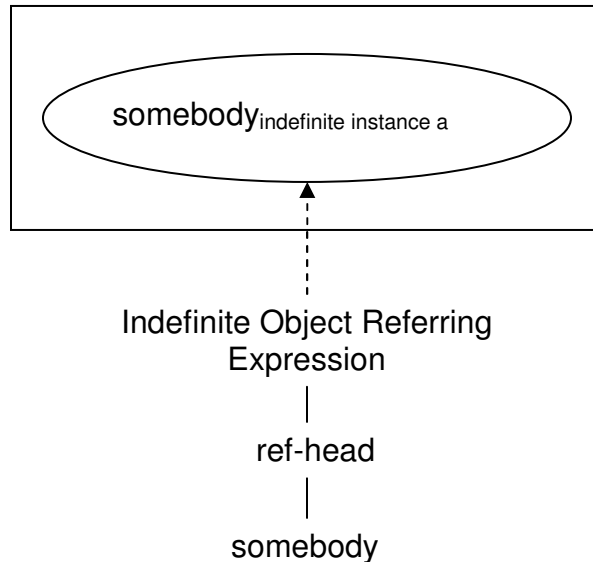
The situations in this graphic have been reordered to facilitate the depiction of the shared referent between “a car” and “the car”. Although “the car” refers to the referent introduced by “a car” this referent is still indefinite in the sense that it has not been identified which any object in the universe which provides the context of the model. That is, it is the universe of the situation model which ultimately grounds referents and makes them definite (as would occur by actually perceiving the car in the driveway or by remembering a past experience of the car that is being referred to). Thus, the definite referring expression “the car” refers to an indefinite instance, albeit one that has already been introduced into the model. Note that in addition to “the car,” “the driveway” is a definite object referring expression. In the case of “the driveway” the universe of the model provides the basis for use of a definite referring expression. That is, in the use of the expression “a car is in the driveway” it is presumed that the referent of “the driveway” is available and grounded in the context of use. Thus, there are at least two types of definite reference: 1) reference to an existing indefinite referent in the model, and 2) reference to an existing definite referent in the universe of the model. The grounding of referents in the model to elements of the universe of the model is discussed further below.

Besides expressions containing the definite determiner “the,” proper nouns, pronouns and deictic words like “this” and “that” can be used as definite object referring expressions. There are many

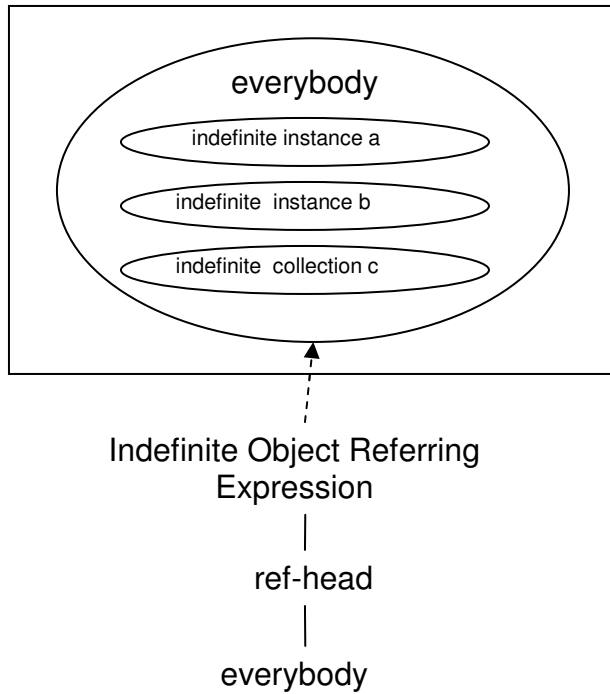
important issues having to do with the determination of the referents of such expressions (e.g. Garnham, 2000) which will not be considered in this paper.

### 8.1.4 Reference to Indefinite Instances

Besides object referring expressions containing the determiner “a” functioning as a specifier in expressions like “a car,” there are single words like “somebody” that may be used to refer to indefinite individuals. From a logical perspective they behave like unbound variables—although it is atypical in logical approaches to allow for unbound variables in a model.



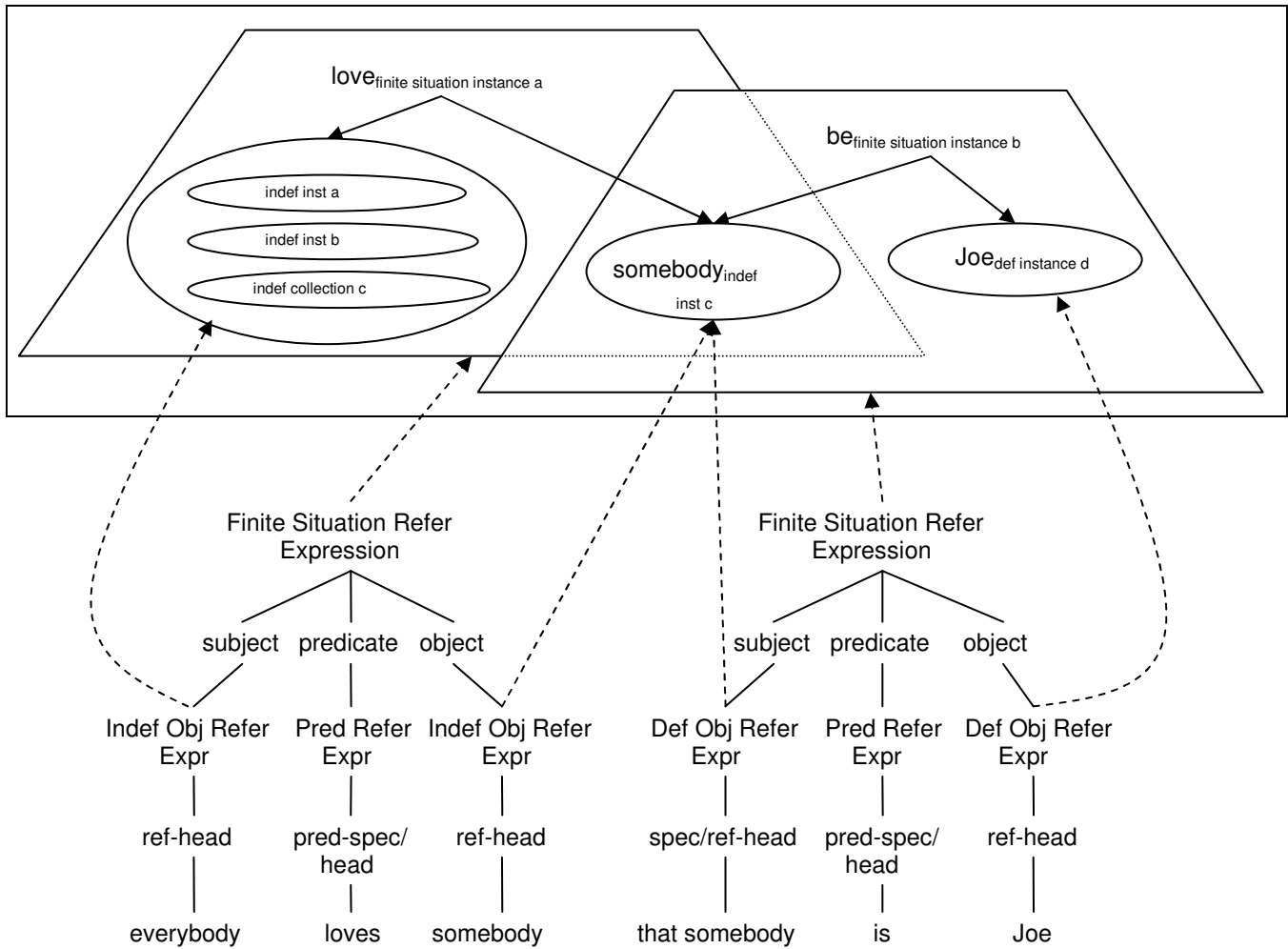
Words like “somebody” fill both the specifier and head role in functioning as indefinite object referring expressions. Whereas “somebody” introduces a single indefinite individual into the model, “everybody” may introduce a collection of indefinite individuals. That collection of referents may be indefinite in the sense of not being ground to referents in the universe of the model; however, “everybody” may also be used as a definite referring expression in the sense of mapping to existing referents of the model where those referents may be either definite or indefinite. In either case, the collection introduced by “everybody” is special in that it is grammatically singular. To account for this graphically, an oval rather than a rectangle is used:



Thus, although “everybody” introduces a collection, that collection is viewed as a single object. Note further that within the object referred to, two indefinite individual instances and an indefinite individual collection are included. As noted earlier any expression may only introduce a small number of referents into a model, although one of those referents may correspond to a collection that could be further elaborated via inferential processes operating over the model.

Although words like “somebody” and “everybody” introduce indefinite individuals into a model, the actual referents may be made definite by the subsequent discourse. Consider

Everybody loves somebody. That somebody is Joe.



In the second sentence, the indefinite individual introduced by “somebody” is resolved to be “Joe”. In the graphic, both “somebody” and “that somebody” refer to the same indefinite referent in the model. That indefinite referent is equated with the definite referent corresponding to “Joe”. Thus, equating an indefinite referent with a definite referent has the effect of making the indefinite referent definite.

Note that if we force “somebody” to be bound to an individual (or individuals) when introduced, that binding may well turn out to be inappropriate in the wider discourse. Thus, if we assume that the interpretation of “everybody loves somebody” involves a pairing of individuals (as is typical of logical approaches), then those pairings may be shown to be inappropriate in the wider discourse.

### 8.1.5 Reference to Mass Nouns

Mass nouns are interesting in that they may occur without separate specification and they are grammatically singular.

Rice is good for you

Like pronouns and deictic words they are inherently specified, but that inherent specification is indefinite, not definite. Mass nouns typically apply to 1) objects which are small in size and grouped

together like rice, 2) liquids like milk and 3) solids like butter. Collections of small or indiscernible objects are treated collectively as singular objects when referred to indefinitely. Of course, reference to a specific collection requires a definite determiner as in

The rice is ready

Interestingly, the word “data” is used to refer to collections of information and it has properties typical of mass nouns, but since the word is derived from a Latin plural form, the “proper” grammatical treatment assumes it to be plural. The reality is that most people must force themselves to use plural agreement when using “data” with the result that they frequently miscorrect sentences inappropriately. Thus, you might see

The analysis of the data are ready.

where the agreement with “are” is forced and incorrect (probably based on a conscious rule like – whenever you make the mistake of using “is” after “data”, which you often do, change “is” to “are”). The reality is that “data” is well on its way to becoming a mass noun and singular agreement is likely to become the norm at some point. Consider

More data is needed

More data are needed

Which do you prefer? Be honest!

### **8.1.6 Reference to Collections**

Lyons (1977) distinguishes between the distributive and collective use of referring expressions which refer to multiple individuals. In the distributive use, agreement is plural; in the collective use, agreement is singular. This corresponds to the use of a rectangle above to mark collections whose agreement is plural (e.g. “sedans”) and an oval to mark collections whose agreement is singular (e.g. “everybody”).

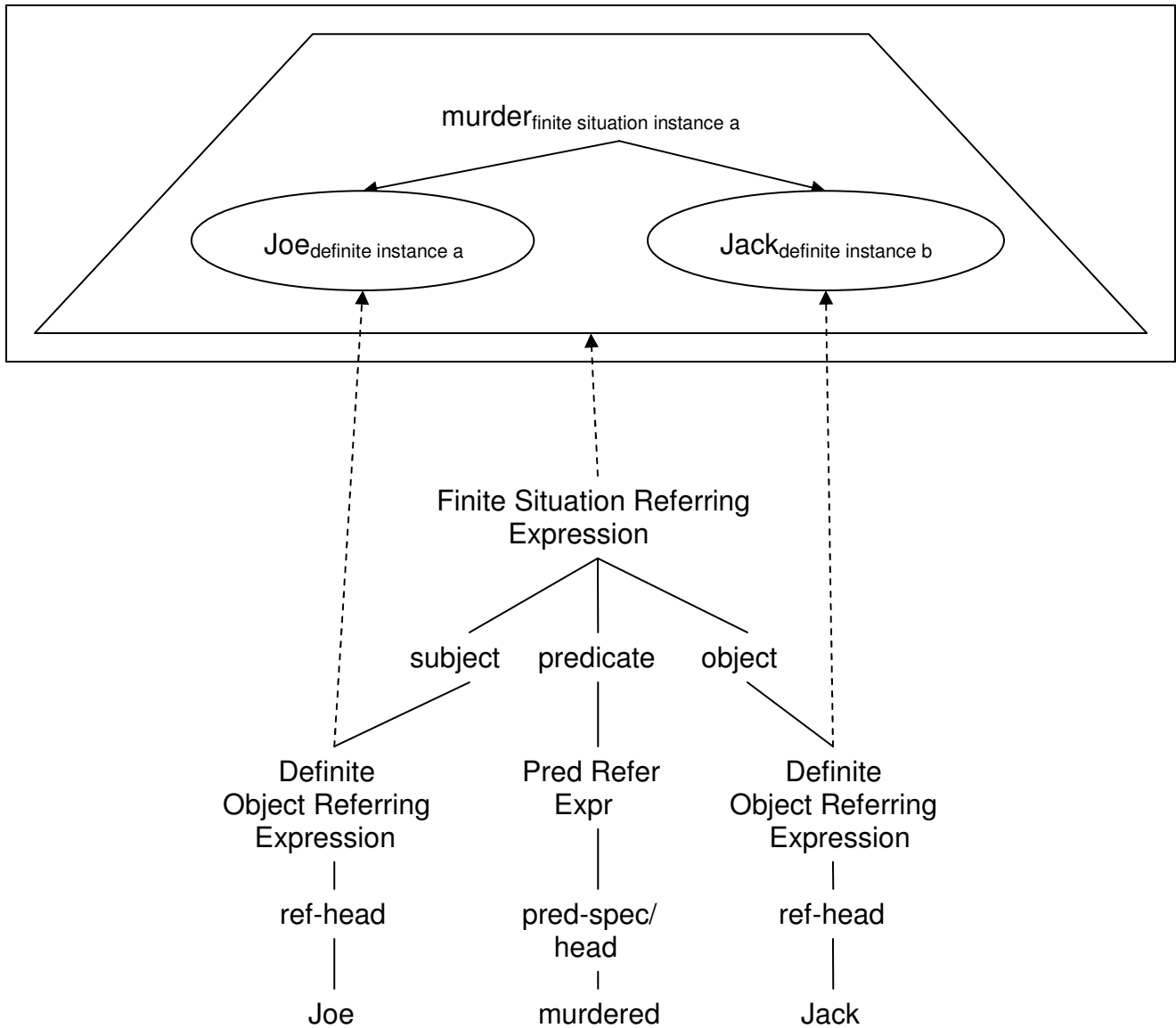
The grouping of referential types into collections is orthogonal to the distinction between types, prototypes, exemplars and instances (situations and individuals). Any of these referential types may be grouped together into a collection.

### **8.1.7 Reference to Objectified Situation Instances**

Situations may be referred to by object referring expressions. Consider

Joe murdered Jack. The murder was gruesome.

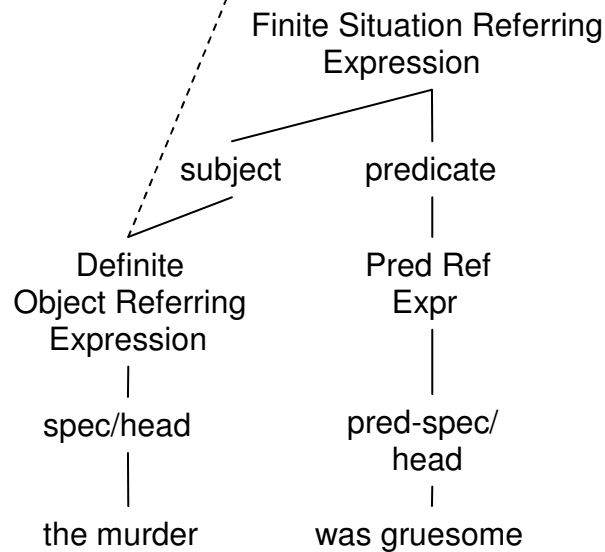
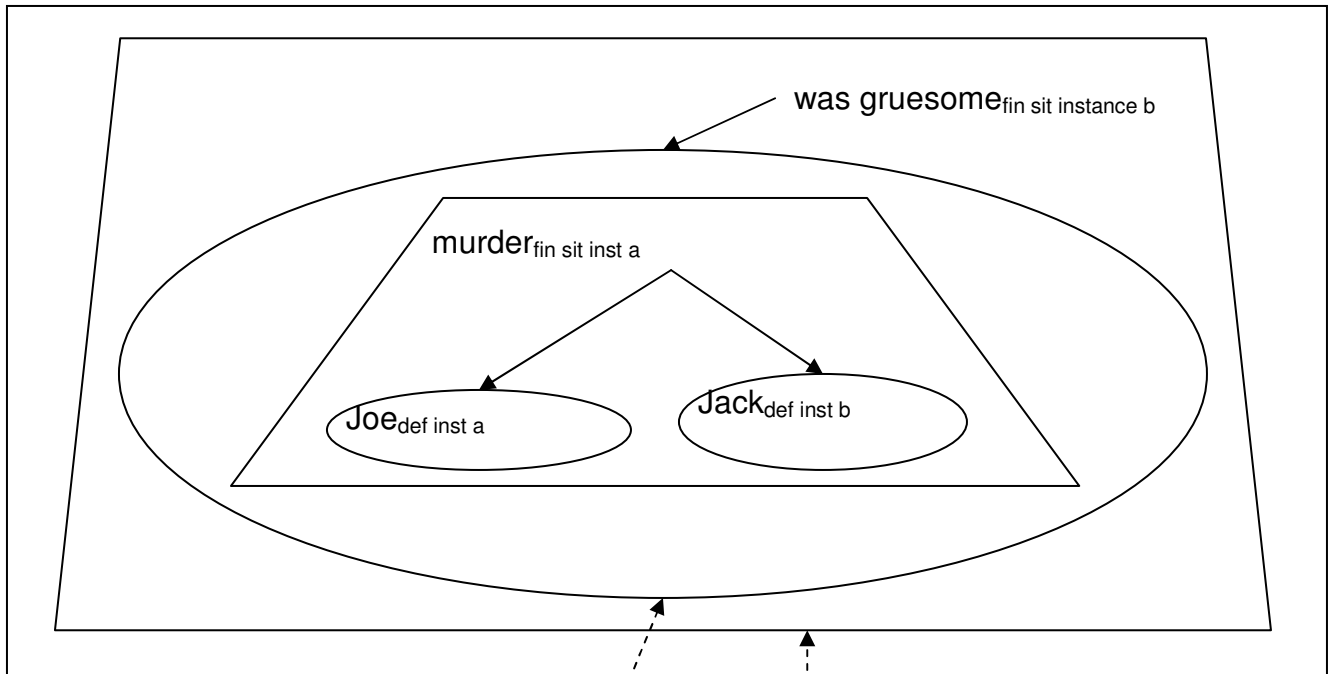
The first sentence is represented as follows:



The expressions “Joe” and “Jack” refer to individual instances. They are examples of definite object referring expressions where the proper nouns encode both the head and specifier functions.

In the second sentence the object referring expression “the murder” refers to the situation introduced in the first sentence. A mechanism for objectifying situations is needed to handle such expressions.





In this graphic, the situation “Joe murdered Jack” is objectified as is reflected by the oval surrounding the trapezoid containing the situation. The object referring expression “the murder” then refers to this objectified situation. The expression “the murder was gruesome” also introduces a new situation.

### 8.1.8 Reference to Nothing

The empty set is a useful notion in set theory. The null symbol (or empty list) is a useful symbol in the Lisp programming language. In both set theory and Lisp, these are actual objects that can be referenced and manipulated. The grammatical and lexical structure of English strongly suggests the possibility of referring to a corresponding empty or vacuous object whose existence is taken for granted. Yet

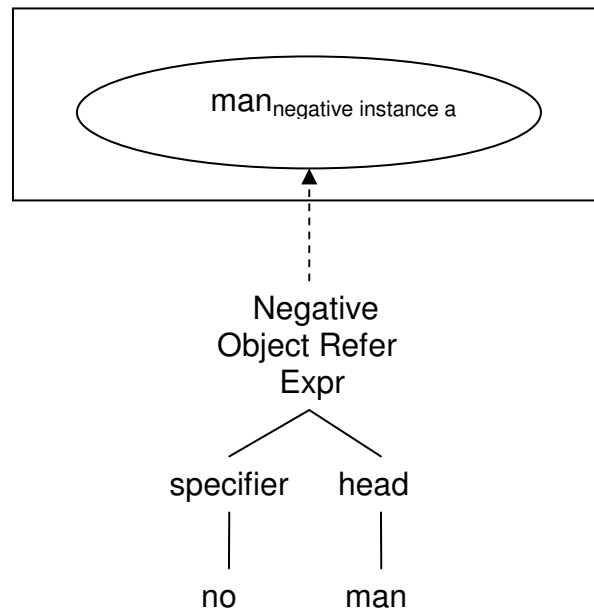
Martinich (1985, p. 3) argues that the existence of nothing is an “absurd view” which rests on “a misunderstanding of how language works”. However, not only does grammar suggest the existence of objects corresponding to nothing, but it suggests that nothingness comes in lots of different types. Consider

- Nothing
- No one, nobody
- Nowhere, Never
- No man, No woman, No dog...

It is true that a quantified logical representation for expressions like “no man” makes little sense

Forall x: ~man(x).

but this is taken to be a problem for the logical representation of the meaning of negative expressions, rather than as a criticism of language. If we allow for referential types that refer to nothing in our model, then we can straightforwardly represent “no man” as



Negative instances are referents in the model which are not at the time of introduction, nor subsequent to introduction, ground to any referent in the universe which is the context of the model. That is, they are intended not to be ground. As such, they are necessarily indefinite and non-specific. The same holds for negative situations as in

Joe did not murder Jack

where the situation has no grounding in the universe of the model, although a negative situation instance is introduced into the situation model (or an existing situation instance in the situation model is negated).

More generally, situation models are the locus for the creation of all kinds of counterfactual situations and individuals, of which negated individuals and situations are an interesting instance.

### **8.1.9 Predicate Nominals**

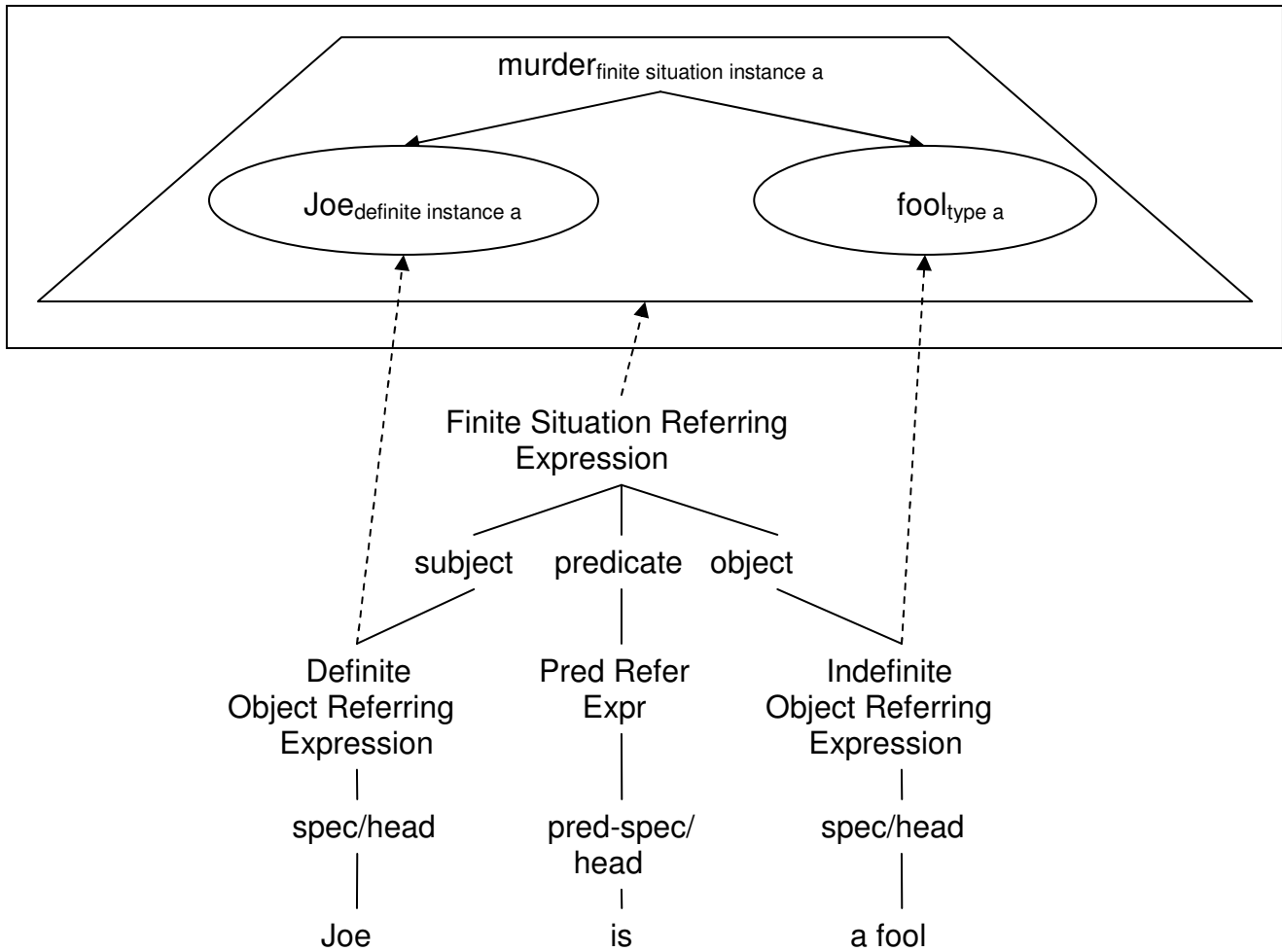
The typical logical treatment of predicate nominals suggests that they are non-referential. That is, in a sentence like

Joe is a fool

“a fool” is treated as a predicate that says something about the individual that “Joe” refers to and this sentence is often considered synonymous with “Joe is foolish”, often being rendered logically as

fool(Joe) or foolish(Joe)

From a grammatical perspective, there are at least two problems with the treatment. Grammatically, “a fool” has the form of an indefinite object referring expression. Grammatically “Joe is a fool” has the form of a finite situation referring expression. If “a fool” refers to a type rather than an individual and “Joe is a fool” refers to a situation, this sentence can be represented by



Equating an instance with a type has the effect of ascribing the characteristics of the type to the instance.

## 8.2 The Universe of the Model

Up to this point, the concepts “situation model” and “universe of the situation model” have been used abstractly and without grounding in psychology. A situation model is essentially a mental scratchpad for maintaining information about the individuals and situations under consideration in the flow of consciousness. The cognitive ability to create and manipulate situation models rests on an attentional mechanism for focusing on particular elements of a situation model, a collection of buffers for introducing new elements into the situation model via perception or retrieval from memory and in support of the attentional mechanism, a long-term memory to store the products of prior experience, and the ability to activate portions of long-term memory, thereby making that memory accessible to the situation model.

The representational component of the situation model consists roughly of the content of the buffers and the content of the activated portions of long-term memory. The activated portions of long-term memory correspond to working memory. To the extent that short-term memory and working memory are distinct, short-term memory is more closely aligned with the contents of buffers and working memory with the activated portions of long-term memory.

The universe of the situation model includes the full contents of long-term memory in addition to the mechanisms and memory structures that support attention and working memory. Long-term memory is used generally to include semantic and episodic memory. The universe of the situation model is the full cognitive and perceptual capability of an individual. The universe of the situation model is not the real world, but the mental world of an individual living in the real world. The universe of the situation model is the real world filtered through the perceptual and cognitive apparatus of an individual over the course of a lifetime. The universe of the situation model is the mind of the individual who created the situation model.

Like situation models, the universe of the situation model is full of counterfactual individuals and situations. An individual may have a long history of experience of unicorns, both perceptual and cognitive, despite the fact that unicorns only exist as figments of imagination in objective reality. The universe of the situation model may also have well established and distinct referents for the morning star and the evening star, despite the fact that those referents map to the same planet in objective reality. The existence of God is attested in the minds of most individuals, despite the failure of philosophy to prove her existence. Referential conundrums only arise under the assumption that reference is to objective reality which is necessarily external to minds. Presumably, individuals whose mental worlds correspond most closely to objective reality will be more successful in the long run, but this is not a given. It may be that individuals whose mental worlds correspond most closely to the accepted view of objective reality are equally or more successful.

Communication is largely concerned with conveying a situation model from one individual to another. However, the universe of the situation model differs from one individual to another. When I use the expression “a car” when talking to my wife, it means some other car, but not our car. When I use the expression “the car” it means our car, but not our truck. In my model universe, “the driveway” is my driveway. Had I not wanted to refer to my driveway in the example above, I should have used

A car is in a driveway

This expression sounds odd since there is no tie to my model universe and the entire expression represents new information. However, it is appropriate in the communication of a situation model which has no direct tie to my model universe as, for example, at the beginning of a story which I am reading.

In my using the definite referring expression “the driveway”, I left the reader of the expression without a basis for grounding the description in their own model universe. I did not take into consideration their model universe in the context of the example and point I was trying to make. Such lapses in communication are no doubt common. When my wife says “I went to the mall” my response is “what mall?” Had she said “I went to a mall” I would be less prone to so respond, since the use of “a mall” suggests that I am not intended to be able to identify the referent in my situation model of her mall trip.

## 9. A Few Final Thoughts

Double R Grammar is a **Generative Semantic** theory in the sense that a finite, albeit large, set of schemas are capable of generating an infinite set of semantic structures. However, Double R Grammar does not endorse the reduction into semantic primitives that was a cornerstone of Generative Semantics (Lakoff, 1971), and Preference Semantics (Wilks, 1975), as well. Jackendoff (2002) takes a different tack in admitting a Generative Semantics into his theory of conceptual structures, but retains a Generative Syntax and adds other generative levels as well (e.g. Generative Phonology). Double R

Grammar argues against the existence of a separate Generative Syntax (since there is no separate syntactic level of representation), but is agnostic with respect to a Generative Phonology. To the extent that such a generative level exists, it corresponds to Langacker's Phonological Pole. Jackendoff notes that semantic theories as divergent as Cognitive Linguistics and Montague Grammar, if they agree on nothing else, agree on the existence of a Generative Semantics. One view of the Minimalist Program (Chomsky, 1995), which has no syntactic levels of representation, only PF and LF (which I take to be semantic), is as the ultimate victory of Generative Semantics over Generative Syntax. Oddly, the Minimalist Program, with its extreme lexicalism and focus on the merging of lexical items in the construction of logical form, is in some ways quite consistent with Double R Grammar.

## 10. Future Directions

Double R Grammar is as yet an incomplete theory of grammar. Its current focus is on the encoding of referential and relational meaning, and other dimensions of meaning—especially dimensions of meaning more usually associated with discourse (e.g. topic/comment, given/new, co-reference, ellipses, implicature)—are not accounted for. With respect to referential meaning, the discussion of situation models and the grounding of referring expressions in a situation model, is preliminary, at best. A consideration of the relationship between situation models and mental spaces (Fauconnier, 1985) or mental models (Johnson-Laird, 1983) will not be attempted. Double R Grammar does not yet provide a theory of inference over representations, founded in either logic or mental models, or both. Neither will an explanation of how Double R Grammar representations map to Langacker's (1987, 1991) semantic and phonological poles be given. A discussion of the representation of many nonlinguistic aspects of meaning (e.g. spatial representation) is wholly missing. Much work remains to be done.

Double R Grammar is part of a larger theory and research program, (Ball, 2003a) concerned with the implementation of large-scale, functional language comprehension systems founded on the principles of Cognitive Linguistics and constrained by well-established psycholinguistic principles. The larger theory is called Double R Theory, and encompasses a psycholinguistic theory of language processing called Double R Process. Double R Process is a highly interactive theory of language processing which eschews a separate syntactic analysis feeding a semantic interpretation component in favor of a direct interpretation of the referential and relational meaning of input texts. Double R Model is a computational psycholinguistic implementation of Double R Theory using the Atomic Components of Thought – Rational (ACT-R) cognitive architecture and modeling environment (Anderson & Lebiere, 1998). Double R Model is intended to validate the representation and processing commitments of Double R Theory, and to form the basis for the development of large-scale, functional natural language understanding systems. It is hoped that Double R Grammar has evolved to the point where it is feasible to begin the development of functional language comprehension systems, and it is expected that the theory of Double R Grammar will continue to evolve and expand in tandem with such development.

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