UNIVERSIDADE DE LISBOA
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SYNTAX AND SEMANTICS OF ADJECTIVES IN PORTUGUESE

ANALYSIS AND MODELLING

Sara Mendes

DOUTORAMENTO EM LINGUÍSTICA
LINGUÍSTICA COMPUTACIONAL

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Tese orientada por
Professora Doutora Palmira Marrafa

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À brisa revigorante do Atlântico
e à luz aquática de Lisboa

“The question is,” said Alice, “whether you CAN make words mean so many different things.” (...)

After a minute Humpty Dumpty began again. “They’ve a temper, some of them (…). Adjectives you can do anything with, but not verbs – however, I can manage the whole of them!”

Lewis Carroll, *Through the Looking Glass and what Alice found there*,
chap. VI: Humpty Dumpty

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ABSTRACT

In this dissertation we approach the syntax and semantics of adjectives in languages like Portuguese.

More than any other POS, adjectives can take different meanings depending on their linguistic context. Our approach involves an integrated perspective of syntax and semantics, and, even if its main motivation is linguistic, the research is developed under a computational perspective, aiming at the modelling of the linguistic properties of adjectives, in view of their computation in large scale lexica and grammars. Thus, the research presented here is a deep study of linguistic phenomena, modelled in an operatively efficient way, and aiming to meet the following goals: (i) determining adjectives prototypical features, while establishing the relations holding between this and other POS; (ii) characterising the syntactic and semantic behaviour of representative Portuguese adjective classes; (iii) defining the set of appropriate relations and role features for the representation of adjectives in linguistic knowledge databases; (iv) identifying the appropriate modelling structures in a framework of maximal generalisation and minimal complexity, able to account for complex linguistic phenomena.

With regard to (i), in this dissertation we provide strong additional evidence supporting and strengthening the controversial thesis that adjectives constitute an independent category. The idea that adjectives are an "independent" lexical category is thus strengthened by the data, particularly through the contrastive description of the linguistic behaviour of adjectives, nouns and verbs. We determine an operative definition of what is an adjective, showing that there is a set of common features which generally hold for all adjectives: (a) a particular and precise function (adjectives are words that apply to words that denote entities to ascribe a property or a set of properties to them); (b) specific semantic properties (adjectives denote states and only exceptionally are transitive); and (c) a set of 'typical' features (independence from the object, ability to ascribe properties to objects and gradability).

However, ascribing the status of lexical category to adjectives does not entail arguing that all adjectives display exactly the same characteristics. We deal with this fact very naturally, arguing that it is precisely the presence or absence of some of these

features, in combination with other properties, that is on the basis of the definition of adjective classes.

The research depicted in this dissertation is developed under the scope of Computational Lexical Semantics, within a feature structure framework: the Generative Lexicon (Pustejovsky, 1995). We also adopt the EuroWordNet framework (Vossen, 1998), for a representation of adjectives in linguistic knowledge databases, specifically relational models of the lexicon – WordNet.PT (Marrafa, 2001; 2002).

Having established and characterised relevant adjective classes in languages like Portuguese, we delineate a linguistically motivated approach for modelling their syntactic and semantic properties. Combining syntactic and semantic criteria, we argue that the semantics of adjectives can be appropriately captured in wordnet-like lexica by means of the implementation of a small set of relations – particularly cross-POS relations. We test the adequacy of this set of relations by implementing it in WordNet.PT, a task which makes apparent that these relations preserve the coherence of the wordnet model, and have an important impact in increasing its adequacy.

The strategies used for WordNet.PT adjective representation constitute a linguistically motivated approach for encoding adjectives in computational relational lexica in a principled and integrated way. Hence, the modelling strategies delineated are mostly concerned with adjective definitional properties. Realising that some of the syntactic contrasts involving adjectives remain unaccounted for, as well as the different ways the meaning of compound expressions is built, we argue that wordnets should include information on event and argument structures. Discussing relevant data in detail, we conclude for the need for fine-grained, rich and structured lexical representations, in order to enable a principled account of the different ways the meaning of compound expressions is built.

In this context, we put forth a homogeneous and economic approach for representing all adjective classes in the lexicon, in the Generative Lexicon framework. We make apparent that putting a small set of economic generative mechanisms to work – unification, underspecification and information sharing between structures – allows us to account for complex linguistic phenomena such as relativity to a comparison class, selection restrictions, construction of meaning in context, and sense change. This way,

we account for the most characteristic and general syntactic and semantic aspects of adjective behaviour.

Given the important role played by adjective relative position in the NP with regard to the construction of NP meaning, we put forth an explicative principle for the distribution restrictions evinced by adjective classes. Along with many authors in the literature, we argue for the markedness of prenominal position, underlining its emphatic role and the contrast between prenominal and postnominal adjectives in terms of the relation they establish with the modified noun. We assume a dependence between nominal items with a set reference and prenominal adjectives, and we provide a unified analysis for all adjectives occurring in prenominal position, as well as a unified treatment of verbal and adjective alternations

Moreover, we make our crucial assumptions apparent, by modelling full NPs in GL. Representing NPs with prenominal and postnominal adjectives enables us to straightforwardly make adjective semantic contribution self-evident, as well as the meaning contribution coming from the structure in which they occur – prenominal or postnominal position in the NP –, in a linguistically motivated way and without introducing any important changes to the adjective lexical entries proposed.

Finally, we address specific phenomena related to event modification by adjectives. We analyse event modifying adjectives which show adverbial readings whose scope seems to go beyond the NP in which they occur, being extended over the whole sentence. Our approach underlines the role played by events associated to the lexical items involved in these structures, providing a unified treatment of adjectives and adverbs. In fact, modelling this semantic similarity makes apparent the number of semantic features shared by these POS. This is particularly relevant if we consider that these are the two POS that play the role of modifiers in language.

Although event modifying adjectives make up a very specific group of contexts displaying apparently exceptional semantic behaviours, our analysis shows that understanding them better allows for more accurately delineating the fine line distinguishing different POS in language, and, particularly, various types of modifiers. Moreover, our approach makes the expressiveness of GL apparent: having thoroughly provided modelling strategies for members of all adjective classes, we are able to

straightforwardly deal with apparently exceptional data, in a linguistically motivated way and without the need to introduce any changes in adjective lexical entries.

Being so, this dissertation contributes to a better understanding of adjectives as a word class and to an accurate and economic modelling of this POS in the lexicon, in constant dialogue with other related POS and in an integrated approach to syntax and semantics. Also, we make apparent that the economic and underspecified modelling strategies we put forth are suitable for the computation of this POS in large scale lexica and grammars. In fact, as shown in this dissertation, the development of increasingly robust linguistic resources benefits from the incorporation in linguistic models of mechanisms such as unification, inheritance and recursivity, which allow for the representation and computation of the relation holding between form and meaning with economy of means and efficiency of results, also being more adapted to the caption of linguistic properties such as discreteness, compositionality, incrementality and productivity, among others.

KEYWORDS

adjective classes, noun modification, syntax and semantics interface, computational lexical semantics, wordnets

RESUMO

Esta dissertação tem por objecto de estudo a sintaxe e semântica do adjectivo em línguas como o Português.

Mais do que qualquer outra categoria, os adjectivos podem revestir-se de significados diferentes consoante o contexto linguístico em que ocorrem. O presente trabalho desenvolve-se no âmbito de uma perspectiva integrada da sintaxe e da semântica e, embora as suas motivações de base sejam de natureza linguística, a investigação foi desenvolvida numa perspectiva computacional que visa a modelização das propriedades linguísticas dos adjectivos com vista à sua implementação em léxicos e gramáticas de larga escala. Assim, a investigação aqui apresentada consiste num estudo aprofundado de fenómenos linguísticos, modelizados de forma computacionalmente eficiente, orientando-se em torno de quatro objectivos específicos: (i) determinar os traços prototípicos dos adjectivos, estabelecendo também as relações existentes entre esta e outras categorias; (ii) caracterizar o comportamento sintáctico e semântico de classes representativas de adjectivos em línguas como o Português; (iii) estabelecer as relações e traços de função relevantes para representar os adjectivos em bases de dados de conhecimento linguístico; (iv) identificar as estruturas de modelização adequadas para representar esta categoria, num quadro de máxima generalização e mínima complexidade, dando conta simultaneamente de fenómenos linguísticos complexos.

Relativamente ao objectivo em (i), nesta dissertação são apresentadas fortes evidências em favor da controversa tese de que os adjectivos constituem uma categoria independente. A tese da "independência" dos adjectivos enquanto classe lexical sai assim fortalecida pelos dados, particularmente graças à descrição contrastiva do comportamento linguístico de adjectivos, nomes e verbos. Apresenta-se uma definição operativa do adjectivo, caracterizado por um conjunto de traços regra geral comuns a todos os elementos desta categoria: (a) uma função específica e precisa (os adjectivos são palavras que se aplicam a palavras que denotam entidades para lhes atribuir uma propriedade ou um conjunto de propriedades); (b) propriedades semânticas particulares (os adjectivos denotam estados, sendo transitivos apenas excepcionalmente); e (c) um

conjunto de traços característicos (independência do objecto, capacidade para atribuir propriedades a entidades e gradabilidade).

Defender o estatuto de categoria lexical para o adjectivo não implica, no entanto, assumir que todos os seus elementos partilhem exactamente as mesmas características. Neste trabalho, lida-se com este facto de modo intuitivo e natural, argumentando-se que é precisamente a presença ou ausência de alguns destes traços, em combinação com outras propriedades, que está na base da definição das classes de adjectivos.

A investigação apresentada nesta dissertação enquadra-se no domínio da Semântica Lexical Computacional, mais precisamente num quadro teórico baseado em estruturas de traços: o Léxico Generativo (Pustejovsky, 1995). Para além disso, adoptou-se também o modelo da EuroWordNet (Vossen, 1998) na representação dos adjectivos em bases de dados de conhecimento linguístico, e em particular em modelos relacionais de léxico – WordNet.PT (Marrafa, 2001; 2002).

Uma vez estabelecidas e caracterizadas as classes de adjectivos relevantes em línguas como o Português, apresenta-se uma abordagem linguisticamente motivada para modelizar as propriedades sintácticas e semânticas dos seus membros. Combinando critérios sintácticos e semânticos, demonstra-se que o conteúdo semântico dos adjectivos pode ser adequadamente representado em wordnets através da implementação de um conjunto restrito de relações com forte motivação linguística, com destaque para as relações inter-categoriais. Testando a adequação das relações propostas neste trabalho pela sua implementação na WordNet.PT, põe-se em evidência que estas preservam a coerência do modelo Wordnet, contribuindo para o incremento da sua adequação.

Sendo uma abordagem linguisticamente motivada à implementação integrada e rigorosa dos adjectivos em léxicos relacionais computacionais, as estratégias de codificação desta categoria em wordnets que foram definidas espelham essencialmente propriedades definitórias dos adjectivos. Assim, perante a necessidade de dar conta de alguns contrastes sintácticos evidenciados pelos adjectivos, bem como das diferentes formas de determinar o significado de expressões complexas em que estes participam, propõe-se a integração nas wordnets de informação relativa às estruturas argumental e eventiva dos adjectivos, já que a descrição dos dados aponta para a pertinência de representações lexicais finas, ricas e estruturadas.

Neste contexto, apresenta-se uma abordagem homogénea e económica para representar as diferentes classes de adjectivos no léxico, no quadro do Léxico Generativo (LG). Demonstra-se que um pequeno conjunto de mecanismos generativos económicos – unificação, subespecificação e partilha de informação entre estruturas – permite dar conta de fenómenos linguísticos complexos, tais como a relatividade a uma classe de comparação, as restrições de selecção, a construção de significado em contexto e a mudança de significado. Assim, a proposta aqui apresentada lida adequadamente com os aspectos sintácticos e semânticos mais característicos do comportamento linguístico dos adjectivos.

Dado o importante papel desempenhado pela posição relativa do adjectivo no SN no que toca a construção do seu significado, estabelece-se um princípio explicativo para as restrições distribucionais observadas nas diferentes classes de adjectivos. Com numerosos autores, assume-se a marcação da posição pré-nominal, salientado-se o seu papel enfático e o contraste entre os adjectivos pré e pós-nominais no que respeita a relação estabelecida com o nome modificado. Assume-se uma dependência entre itens nominais com referência definida e adjectivos pré-nominais, e apresenta-se uma análise homogénea de todos os adjectivos que ocorrem em posição pré-nominal, tratando-se também de modo unificado alternâncias adjectivais e verbais.

A modelização de estruturas nominais completas (SNs) no LG põe em evidência as propostas cruciais apresentadas nesta dissertação relativamente a estes fenómenos, dado que a contribuição semântica do adjectivo fica claramente patente, bem como a da estrutura em que este ocorre – a posição pré ou pós-nominal. Para além da motivação linguística da proposta, o facto de esta não implicar alterações relevantes nas entradas lexicais adoptadas para os adjectivos é seguramente uma das suas mais-valias.

Por fim, analisaram-se fenómenos específicos relacionados com a modificação adjectival de eventos. Consideraram-se adjectivos modificadores de eventos com leituras adverbiais cujo escopo aparentemente se estende para além das fronteiras do SN em que ocorrem, abrangendo toda a frase. A proposta apresentada realça o papel desempenhado pelos eventos associados aos itens lexicais envolvidos nestas estruturas, preconizando um tratamento unificado de adjectivos e advérbios. A modelização da semelhança semântica entre elementos destas duas categorias pôs em evidência o número de traços semânticos por elas partilhados, aspecto particularmente relevante se

considerarmos que estas são as categorias que desempenham na língua o papel de modificador. Embora os contextos de modificação de eventos sejam contextos muito específicos e com comportamentos semânticos aparentemente excepcionais, a análise apresentada demonstra a relevância destes dados, evidenciando que uma melhor compreensão dos princípios que regulam o seu funcionamento permite uma definição mais precisa da fronteira entre diferentes categorias e, em particular, entre tipos de modificadores. Além disso, esta análise põe em evidência o poder expressivo do LG, dado que uma vez estabelecidas estratégias de modelização para todas as classes de adjectivos se torna possível dar conta de dados aparentemente excepcionais de forma linguisticamente motivada e sem se introduzir alterações nas entradas lexicais dos elementos envolvidos.

Esta dissertação contribui, assim, para uma melhor compreensão da categoria Adjectivo e para uma modelização económica e rigorosa desta categoria no léxico, num diálogo constante com outras categorias que com ela se relacionam e numa abordagem integrada da sintaxe e da semântica. Adicionalmente, demonstra-se também a adequação das estratégias de modelização propostas neste trabalho à computação desta categoria em léxicos e gramáticas de larga escala. De facto, como fica demonstrado, o desenvolvimento de recursos linguísticos cada vez mais robustos beneficia da incorporação de mecanismos como a unificação, a herança e a recursividade nos modelos linguísticos, que permitem codificar a relação entre forma e signicado com economia de meios e eficiência de resultados. Esta evolução dos modelos linguísticos contribui também para que estes estejam mais adaptados para captar propriedades linguísticas cruciais como discretude, composicionalidade, incrementalidade e produtividade.

PALAVRAS-CHAVE

classes de adjectivos, modificação de estruturas nominais, interface sintaxe-semântica, semântica lexical computacional, wordnets

CONTENTS

CHAPTER 1
MAIN ISSUES AND METHODOLOGY

1.0. INTRODUCTION

The factors behind the choice of a particular subject are to a great extent random. In order to justify choices and motivations I should probably mention previous work, mostly developed in the scope of several projects in Computational Lexical Semantics, during which the issue of adjective modelling started to impose itself to me. However, the decisive reasons – and therefore the only ones worth discussing here – leading to the determination of the object of this work are bound to the conviction that the results of the research developed within the scope of this dissertation will be, to some extent, interesting, either from a scientific, technical or any other point of view.

In this opening chapter we will begin by presenting the goals that led to the development of the research work presented here (section 1.1). We will then focus on the subject of this dissertation (section 1.2), briefly presenting the main issues discussed under its scope. Naturally, the object of our research and the framework used in our analysis are mutually dependent. For operative reasons they are briefly characterised in different sections: section 1.2 Object and section 1.3 Framework. This chapter comes to its conclusion with the presentation of the outline of this dissertation (section 1.4).

1.1. GOALS

Language study has considerably advanced in the last decades, due to a great extent to the interchange between several disciplines, namely Linguistics, Logic and Computer Science.

Nonetheless, these advances are not independent of the growing need to develop robust linguistic resources, linguistic resources that can be used in large scale, in several subdomains of Language Engineering.

In fact, the work developed in the domain of Computational Linguistics is wide and diverse. On one extreme one can find work aiming at the development of practical efficient systems for specific applications, in which the need for a system that works often sacrifices a formal and deep treatment of linguistic phenomena. On the other extreme, there is research towards the modelling of grammatical formalisms, in which the operativity of the system is often relegated to a second plan in face of the objective of arriving at total linguistic coverage.

We also have to mention the incorporation of mechanisms such as unification, inheritance and recursivity, which allow for the representation and computation of the relation holding between form and meaning with economy of means and efficiency of results. In this context, linguistic models have evolved towards the incorporation of formal resources, more and more adapted to the caption of linguistic properties such as discreteness, compositionality, incrementality and productivity, among others. Simultaneously, there is an increasingly stronger articulation between the expressive power and the deductive capacity of the representation languages used.

Also, integrated approaches of syntax and semantics, along with the transversal definition of their interface, have been decisive in the development of linguistic studies, as many of the recurring questions involve the articulation of these domains. Questions such as *syntactic structuring and semantic compositionality*, *event structure and argument distribution*, *structure and semantics of constituents and predication*, for instance, are currently among the most important topics of research.

Our approach involves an integrated perspective of syntax and semantics. Even if the main motivation of the work presented here is linguistic in nature, the research is essentially developed under a computational perspective, as it aims at the determination and modelling of the syntactic and semantic properties of different Portuguese adjective classes, in view of its computation in large scale lexica and grammars. Thus, the research presented here is a deep study of linguistic phenomena, modelled in an operatively efficient way.

1.2. OBJECT

Adjective semantic analysis and representation is far from being a trivial issue, as adjectives show a very particular linguistic behaviour, namely in what concerns sense change depending on linguistic context. Appearing in different positions in the sentence, as a modifier of the noun or as a complement of a copular verb, adjectives, more than any other part-of-speech, can take different meanings depending on their linguistic context.

In the literature we find several works on adjectives, most of which regard rather specific aspects. Casteleiro (1981), for instance, presents a thorough descriptive work on transitive adjectives taking sentential objects. Despite the detailed description of the syntactic contexts of occurrence for this group of adjectives, this work fails to provide the general features characterising adjective behaviour, as it is concerned with very specific contrasts regarding the adjective subclass under analysis. Berwisch & Lang (1987), for instance, aim at giving an account of the various aspects of structure and processing related to a restricted domain of linguistic knowledge, the domain of dimensional adjectives in German. Although this study provides an account of various aspects of structure involving dimensional adjectives, it is restricted to this very specific group of German adjectives. Bouillon (1998) analyses adjective sense change depending on the context within the Generative Lexicon framework, using *qualia* structures to derive several different uses. Nonetheless, her work focuses on particular cases, namely the behaviour of *vieux* (old) in French. Adjective sense change is also analysed by Amaro (2002), who describes the connection between sense change and the relative position of adjectives and nouns in Portuguese. This analysis focuses on a particular group of Portuguese adjectives that show important sense changes when they occur in prenominal position. Thus, in comparison to the large amount of work devoted to verbs and nouns, adjectives have been somewhat neglected in traditional lexical syntax and semantics, and large scale research on adjective behaviour still rests to be done.

One of the first issues we will address in this dissertation regards the identification of the prototypical features of adjectives and, at the same time, the characterisation of the syntactic and semantic behaviour of representative adjective classes in Portuguese.

According to Demonte (1999, forth.), generality, i.e. independence with regard to the object, is one of adjectives main distinctive features. According to this author, adjectives are general terms which can be applied to several different objects, being in that aspect different from nouns, a POS which defines a set of necessary conditions for the identification of a certain individual. As pointed out by this author, data like (1) corroborate this idea. In fact, adjectives, differently from nouns, cannot be combined with an identity expression like *o mesmo* (the same)[1].

(1) a. o rapaz contente
'the happy boy'

b. o mesmo rapaz
'the same boy'

c. *o mesmo contente
'the same happy'

Another distinctive adjective feature pointed out by Demonte (1999, forth.) is gradability, although, as we will show further down, this is not valid for all adjectives. Nonetheless, it is precisely via adjectives that the characteristics of entities referred by

[1] These contexts do, in fact, allow for testing adjective status with regard to its ability to identify entities, hence overcoming the noise introduced by noun ellipsis contexts such as (i).

(i) Acabaram de chegar os dois rapazes: o (*mesmo) contente à frente, a assobiar, e o (*mesmo) triste logo depois, de cabeça baixa.
*'Two boys have just arrived: the (*same) happy in front, whistling, and the (*same) sad just after, with his head down'*

Colour adjectives are apparently an exception to this. However, the acceptability of (ii)c is due to the ambiguity between a colour adjective and a colour noun. *Vermelho* (red) in (ii)c can only be interpreted as the name of the colour.

(ii) a. o carro vermelho
'the red car'

b. o mesmo carro
'the same car'

c. o mesmo vermelho
'the same red'

The unacceptability of (iii)b confirms the idea stated above, since when the context blocks the nominal interpretation, the combination of *vermelho* (red) and *o mesmo* (the same) becomes impossible.

(iii) a. O carro vermelho avariou. O mesmo carro tinha estado na oficina o mês passado.
'the red car broke down. The same car had been to the repair-shop last month'

b. O carro vermelho avariou. *O mesmo vermelho tinha estado na oficina o mês passado.
'the red car broke down. The same red had been to the repair-shop last month'

nouns are measured in the language. Finally, adjectives role in language cannot be dissociated from their ability to attribute properties to objects – both physical and mental – denoted by nouns. Given their semantic content, adjectives relate to the elements they co-occur with in different ways, namely via modification and predication relations. Naturally these different types of relation are expressed in the language by different syntactic structures. Further below we will present some of the co-occurrence restrictions shown by adjectives and briefly discuss how we can use them as criteria to characterise and organise adjectives in homogeneous classes.

This leads us to another important issue we will address in this dissertation: the characterisation of representative adjective classes. The literature provides us with several different adjective typologies and classifications: semantic based classifications, syntactic based classifications, classifications regarding the relation holding between the adjective and the modified noun, and so on.

As our work on this issue progressed, it has become clear that only a combination of syntactic and semantic criteria can offer interesting insights concerning adjective linguistic behaviour and the identification of relevant common features, which may set the basis for an accurate modelling of this POS. The data presented below introduce some of the issues discussed in the following chapters.

(2) o livro azul
'the blue book'

(3) o diamante falso
'the false diamond'

Noun phrases such as (2) and (3) have exactly the same structure. However, the relation holding between the adjective and the noun is considerably different. In (2) we have a property ascribing adjective, as *azul* (blue) adds a new restriction to the properties introduced by the noun *livro* (book). On the other hand, *falso* (false) in (3) is a non-restricting adjective, which behaves like a semantic operator, taking the reference of the noun *diamante* (diamond) as its argument[2].

[2] This distinction between *property ascribing adjectives* and *non-restricting adjectives* is basically equivalent to the one used in the SIMPLE project (Lenci et al., 2000) (*extensional* vs. *intensional adjectives*, following Chierchia & McConnel-Ginet (1990)) to address the semantics of adjectives. This distinction is also included in the EAGLES recommendations for a semantic typology of adjectives.

Adjectives like *falso* (false), for instance, deal with concepts instead of real or referential objects, showing how it applies to a particular object. These adjectives constitute a closed class with very particular properties, which makes them somewhat close to semantic operators.

Adjectives like *azul* (blue) on the other hand, belong to a much wider group, within which further subdivisions can be operated. Demonte (1999), for instance, proposes a classification of this group of adjectives based on their intrinsic meaning, a classification combining syntactic and semantic criteria to determine adjective classes.

In languages like Portuguese, occurrence in attributive and predicative contexts will allow us to generally distinguish between two groups of adjectives – descriptive adjectives and relational adjectives – as shown in the examples below, adapted from Casteleiro (1981:52). In fact, Casteleiro (1981) establishes these two classes of adjectives strictly using syntactic criteria. However, even if the groups defined using these criteria often display common syntactic and semantic features, that is not always true.

(4) a. Adoro as casas rurais.
'I love the houses rural'

b. *Adoro as rurais casas.
'I love the rural houses'

c. *Adoro as casas muito rurais[3].
'I love the houses very rural'

d. ?*Adoro as casas que são rurais. (*As casas são rurais.)
'I love the houses that are rural' ('the houses are rural')

[3] As pointed out by González (1995), there is a margin of acceptability for certain constructions where relational adjectives are modified by degree adverbs. This acceptability is somehow linked to the possibility of reinterpreting certain relational adjectives as descriptive. Hence, in typical contexts, the semantic content of relational adjectives is somewhere along the following lines: 'relating or pertaining to X', X being the domain associated to each relational adjective, the **countryside** in our example in (4). Nonetheless, in the contexts where modification by degree adverbs is licensed, the adjective is interpreted quite differently, ascribing certain qualities to the modified noun, in a way that is closer to the incidence relation typical of noun modification by descriptive adjectives. These qualities generally correspond to some prototypical features of the domain associated to the adjective at stake. Demonte (forth.) also associates 'gradable' relational adjectives to prototypicality readings. We come back to this question in more detail in chapter 3, footnote 17.

(5) a. Adoro as paisagens calmas.
'I love the landscapes calm'

b. Adoro as calmas paisagens.
'I love the calm landscapes'

c. Adoro as paisagens muito calmas.
'I love the landscapes very calm'

d. Adoro as paisagens que são calmas. (As paisagens são calmas.)
'I love the landscapes that are calm' ('the landscapes are calm')

Adjectives like *calmas* (calm) in (5), generally classified as a descriptive adjective in the literature, can occur both in attributive and predicative contexts, while adjectives like *rurais* (rural) in (4), a relational adjective, occur almost exclusively in attributive contexts[4]. Both prenominal and postnominal positions are possible for descriptive adjectives in attributive contexts. Relational adjectives, contrarily, can only occur in postnominal position. Finally, descriptive adjectives are gradable, i.e. they can co-occur with degree adverbs, which is not the case for relational adjectives. However, these criteria are not always sufficient to make a clear-cut distinction between these two groups of adjectives.

(6) a. Adoro os livros baratos.
'I love the books cheap'

b. *Adoro os baratos livros.
'I love the cheap books'

c. Adoro os livros muito baratos.
'I love the books very cheap'

d. Adoro os livros que são baratos. (Os livros são baratos)
'I love the books that are cheap' ('the books are cheap')

[4] Predicative contexts with relational adjectives are generally ruled out in Portuguese. Nonetheless, some specific contexts, like contrastive ones, for instance, seem to license predicative uses of relational adjectives:

(iv) As próximas eleições são autárquicas, não são presidenciais.
'next election will be autarchic, not presidential'

(7) a. Adoro os livros únicos.
'I love the books single'

b. *Adoro os únicos livros.
'I love the single books'

c. *Adoro os livros muito únicos.
'I love the books very single'

d. Adoro os livros que são únicos. (Os livros são únicos)
'I love the books that are single' ('the books are single')

As shown in (6) and (7), not all the members of the classes identified by Casteleiro (*op. cit.*) show exactly the same syntactic behaviour with regard to the criteria established by this author. As shown in (6)b, *barato* (cheap) cannot occur in prenominal position, although it is a gradable adjective ((6)c) and it can occur in predicative contexts ((6)d). *Único* (single) in (7), can only occur in postnominal attributive position and in predicative contexts, prenominal attributive position and gradation contexts being ruled out, as shown in (7)b and c. Demonte (1999) proposes some additional criteria in order to make a more accurate characterisation of these adjectives: their occurrence in comparative structures ((8)a and (9)a), and the formation of polarity systems ((8)b and (9)b). In fact, this author considers that, due to the almost nominal status of relational adjectives, only these two contexts allow for a satisfying distinction between descriptive and relational adjectives.

(8) a. O sabor desta laranja é mais doce do que o daquela.
'this orange taste is sweeter than that one's'

b. a laranja doce / a laranja amarga
'the sweet orange / the bitter orange'

(9) a. *Este sabor é mais mineral do que aquele.
'this taste is more mineral than that one'

b. o sabor mineral / *o sabor amineral / *o sabor não-mineral
'the mineral taste / the amineral taste / the non-mineral taste'

In the examples above, we have already observed some occurrence restrictions regarding the relative position of the adjective in adnominal contexts. Besides these occurrence restrictions, data also seem to indicate that the relative position of adjectives in adnominal contexts plays a role in determining possible readings.

Generally occurring in postnominal position (cf. Mateus et al. (1989:186)), adjectives can appear, in adnominal contexts in Portuguese, both in prenominal and postnominal positions. Although, as shown in the examples above, prenominal position is not always possible, in some specific cases, it can be associated to adjective sense change (Amaro, 2002), besides introducing some nuances in meaning computation. Thus, it is important to discuss what is behind these syntactic and semantic contrasts.

Traditionally identified with either an objective (postnominal position) or subjective (prenominal position) value (cf. Cunha & Cintra (1984:270)), the relative position of the noun and the adjective has been differently analysed by several authors.

According to Casteleiro (1981), in Portuguese, adjectives in prenominal position have an explicative value, while adjectives in postnominal position have a restrictive reading. Arnold & Sadler's (1994) analysis states that these two adjective positions correspond to two different structures: the prenominal adjective would be in a head to head relation with the modified noun, while the postnominal adjective would be in a phrase to phrase relation. Assuming that prenominal adjectives are in a head to head relation with the modified noun can, for instance, account for the blocking of the occurrence of adjective complements in these contexts, as shown in (10) and (11).

(10) a. um rapaz digno
'a boy worthy'

b. um digno rapaz
'a worthy boy'

(11) a. um rapaz digno de confiança
'a boy worthy of trust'

b. *um digno de confiança rapaz
'a worhty of trust boy'

Besides involving syntactic restrictions such as the one shown above, these different syntactic contexts also affect the semantic interpretation of the adjective. Demonte (1999, 2008, forth.) deepens the ideas stated above proposing that postnominal adjectives, on the one hand, be associated to common nouns (which, according to this author, denote extensions) to create new extensions. Prenominal adjectives, on the other hand, do not affect the extension of the modified noun, affecting its reference in a

different way. This dichotomy corresponds generally to Larson's (1999) distinction between intersective and non-intersective readings.

(12)-(13) below strengthen this idea of adjective prenominal position being in a privileged association with a subjective evaluation of the speaker. Hence, the occurrence of objective adjectives such as *quadrada* (square) in prenominal position is blocked, has shown in (12)b, the same not being true for adjectives like *interessante* (interesting), that somehow involve the speaker's subjectivity.

(12) a. O João comprou uma caixa quadrada.
'John bought a box square'

b. *O João comprou uma quadrada caixa.
'John bought a square box'

(13) a. O João comprou uma caixa interessante.
'John bought a box interesting'

b. O João comprou uma interessante caixa.
'John bought an interesting box'

Moreover, prenominal adjectives are also blocked in generic constructions.

(14) a. As caixas triangulares vendem-se sempre.
'the boxes triangular always sell'

b. * As triangulares caixas vendem-se sempre.
'the triangular boxes always sell'

(15) a. As caixas bonitas vendem-se sempre.
'the boxes pretty always sell'

b. ?? As bonitas caixas vendem-se sempre.
'the pretty boxes always sell'

These examples lead us to considering the hypothesis that there is in fact a set of properties associated to prenominal position of adjectives. One possible analysis is to consider, along the same lines of Carlson (1977), who postulated that predicates could either have a temporary or intrinsic value, the existence of different values associated to the different adnominal positions in which the adjective occurs. Thus, one can consider that prenominal position is associated to temporary properties, hence accounting for the marginality of (15)b, since generic contexts and temporary properties are incompatible.

(16) a. Umas caixas triangulares vendem-se sempre.
'some boxes triangular always sell'

b. * Umas triangulares caixas vendem-se sempre.
'some triangular boxes always sell'

(17) a. Umas caixas bonitas vendem-se sempre.
'some boxes pretty always sell'

b. Umas bonitas caixas vendem-se sempre.
'some pretty boxes always sell'

(16) and (17) provide additional evidence supporting this hypothesis, as replacing the definite article with an indefinite, thus changing the generic construction into an indefinite one, has a clear impact on the acceptability of prenominal adjectives (see, for instance, (15)b and (17)b).

This analysis is also able to justify the ungrammaticality of (12)b, (14)b and (16)b: the shape of an object, specified by adjectives like *quadrada* (square) or *triangular* (triangular) in the examples considered here, is usually an intrinsic property of objects. Hence, these adjectives cannot occur in a position associated to temporary properties.

But most of all, and besides all the syntactical contrasts we have mentioned above, there is a clear contrast in the way descriptive and relational adjectives relate to the noun they modify. Descriptive adjectives ascribe a single property, setting a value for an attribute, whereas relational adjectives are associated to a set of properties.

(18) o prédio alto
'the high building'

(19) a indústria alimentar
'the alimentary industry'

Looking at (18) and (19), we see that, while *alto* (high) sets the value of the **height** attribute of *prédio* (building) to *high*, *alimentar* (alimentary) does not ascribe a single property to *indústria* (industry), putting it in relation with a set of properties instead. Moreover, this set of properties corresponds to the main features describing another noun – *alimento* (food) in the example above. In fact, the way properties are ascribed to the modified nouns in (18) and (19) are considerably different. Ascribing a single property usually corresponds to an incidence relation of this property in the nominal referent, while introducing sets of properties usually entails more complex and

diversified semantic relations. Relational adjectives establish a link between the modified noun and other domains which are exterior to them. (20) and (21) illustrate this.

(20) o vestido vermelho (there is an X that is a dress and that is a red object)
'the red dress'
dress(X) ∧ red(X)

(21) o cais marítimo (there is an X that is a quay and that has a relation R1 with the sea)
'the sea quay'
quay(X) ∧ R1(X,sea)

Nonetheless, despite the relevance of the descriptive/relational dichotomy, it cannot account for the following contrasts:

(22) A Maria é/está alta.
'Mary is (verb *ser*)*/is* (verb *estar*) *tall'*

(23) O carro *é/está cheio.
'the car is (verb *ser*)*/is* (verb *estar*) *full'*

(24) a. *Ele viu a Maria alta.
'he saw Mary tall'

b. Ele viu a Maria triste.
'he saw Mary sad'

c. Ele viu o carro cheio.
'he saw the car full'

Adjectives like *alta* (high), *cheio* (full) and *triste* (sad) show the same linguistic behaviour with regard to the criteria we have been discussing above. They are descriptive adjectives, but they do not behave in the same way in the contexts presented in (22), (23) and (24). Although our work focuses on adjectives occurring in the nominal phrase, contexts such as the ones presented above also have to be looked into, as they seem to indicate the need for a finer-grained classification of adjectives, considering, for instance, the opposition between accidental properties and permanent or inherent properties (this distinction goes back to Milsark (1974; 1977) and Carlson (1977)).

Among the crucial aspects regarding the internal structure of the property ascribed by the adjective is its time-stability. Properties ascribed by adjectives can either be

circumstantial properties – passing stages of entities – or stable features – permanent properties which characterise a given entity and determine its belonging to a class. Related to the internal structure of the quality ascribed by the adjective, this issue has found particular attention within the scope of formal semantics. Bolinger (1967) was the first to discuss adjective time-stability in detail, identifying a contrast between two kinds of adjectives: temporary and non-temporary adjectives. In order to test these time-stability contrasts, Bolinger postulated the existence of two verbs *to be*: a temporary one (be_{temp}), which combined with adjectives introducing a passing quality, a transitory state, situation or quality, hence entailing change and spatio-temporal restrictions; and a non-temporary *to be* ($be_{non\text{-}temp}$), that co-occurred with adjectives determining stable situations, permanent properties that characterise an entity, and are therefore outside the scope of any spatio-temporal restrictions. In Portuguese, as in other Romance languages, there is no need to postulate two verbs *to be,* they exist: verb *ser* ($be_{non\text{-}temp}$) and verb *estar* (be_{temp}). Therefore, the co-occurrence of an adjective with either of these copula verbs will set its value with regard to this aspect of properties. However, as pointed out by Marrafa (2004) and previous work, the characterisation of adjectives on the basis of this dichotomy is not straightforward, since certain adjectives are ambiguous with regard to this, as it is the case of *triste* (sad). In (24)b *triste* (sad) denotes a temporary property, but in an expression like *um livro triste* (a sad book) it denotes a non-temporary property. The ambiguity between these two values can be a problem when it comes to modelling these adjectives in the lexicon, as a decision between two possibilities has to be made. Should we consider that these adjectives have a basic meaning that is changed in context or should we introduce two different adjectives in the lexicon, one associated to an accidental property, the other to a permanent one?

Going back to the issue of relations holding between adjectives and the elements they co-occur with, when the example (20), above, was presented, we stated that ascribing a single property usually corresponds to an incidence relation of this property in the nominal referent. However, contexts like (25) show that there are sometimes more complex relations involved. Larson (1999) introduces the example below to address the problem of ambiguity evidenced by certain adjectival constructions between an intersective and a non-intersective reading.

(25) Olga is a beautiful dancer.
'Olga is beautiful & Olga is a dancer' (intersective reading)
'Olga dances beautifully' (non-intersective reading)

In the literature, we can find two major families of analysis regarding this question: those attributing the ambiguity of these structures to the semantic complexity of the noun and those considering that their two possible readings are due to certain properties of the adjective.

The analyses of Wheeler (1972) and Platts (1979) ascribe the source of this kind of ambiguity to the relational structure of certain descriptive adjectives such as *beautiful*. According to these analyses, adjectives like *beautiful* denote binary predicates instead of unary predicates, as they are considered to have a specific feature: being relative to a comparison class (see (26)).

(26) Felix is a big flea.
'Felix is big for a flea & Felix is a flea'
big(f, ^x(x is a flea)) & f Є ^x(x is a flea)

Larson (*op. cit.*) considers that this analysis does not solve the question of ambiguity between intersective and non-intersective readings, as it mixes two different phenomena: relativity to a comparison class and non-intersectivity. However, independently of the analysis adopted, the following data by themselves seem to question the general hypothesis of adjectives being the only responsible for the type of ambiguity shown in (25).

(27) O Carlos é um bom guitarrista. (non-intersective reading)
'Carlos is a good guitar player'
'Carlos is good as a guitar player, i.e. Carlos plays the guitar well'

(28) O Carlos é um guitarrista bom. (ambiguous)
'Carlos is a guitar player good'
'Carlos is a guitar player & Carlos is good' (intersective reading)
'Carlos is good as a guitar player, i.e. Carlos plays the guitar well'
(non-intersective reading)

(29) O Carlos é um bom rapaz. (intersective reading)
'Carlos is a good boy'
'Carlos is a boy & Carlos is good'

(30) O Carlos é um rapaz bom. (intersective reading)
'Carlos is a boy good'
'Carlos is a boy & Carlos is good'

Given the minimal pairs in (27)-(30) it becomes very hard to state that adjectives be the sole responsible for the ambiguity of sentences like (28). In fact, the contrast between the available readings for (28) and (30) can only be ascribed to the nouns *guitarrista* (guitar player) and *rapaz* (boy) occurring in these constructions, since both the syntactic structures and all the remaining lexical material are common to the two sentences.

Larson (*op. cit.*) analysis defends that the responsible for the ambiguity in (25) is the noun, and not the adjective. Following work on adverbs by Davidson (1967), this author adopts Event Semantics to account for ambiguous constructions like (25), associating events to nouns like *guitarrista* (guitar player) or *dancer*. Ambiguity between intersective and non-intersective readings is thus attributed to the existence of two different features available for modification to the adjective. The ambiguity observed in (25) is therefore due to the fact that *beautiful* can either modify the entity denoted by *dancer* or the event that is associated to it. This analysis accounts for the contrasts between (28) and (30). *Rapaz* (boy), in contrast with *guitarrista* (guitar player), is not associated to any event. Thus, in (30) there is only one feature made available to *bom* (good), so there is only one possible reading and no ambiguity.

However, some data raise problems to this analysis. If only the semantic complexity of the noun would be on the basis of the ambiguity we have been addressing, then it would be expected that exactly the same ambiguity would exist with synonyms (or near synonyms) of adjectives like *beautiful*. Nonetheless, as shown in (31)-(33) that does not seem to be the case.

(31) a. Olga é uma bailarina bela. (intersective reading)
'Olga is a dancer beautiful'

b. Olga é uma bela bailarina. (ambiguous)
'Olga is a beautiful dancer'

(32) a. Olga é uma bailarina linda. (intersective reading)
'Olga is a dancer beautiful'

b. Olga é uma linda bailarina. (intersective reading)
'Olga is a beautiful dancer'

(33) a. Olga é uma bailarina bonita. (intersective reading)
'Olga is a dancer beautiful'

b. Olga é uma bonita bailarina. (intersective reading)
'Olga is a beautiful dancer'

In (31)-(33) the noun *bailarina* (dancer) is modified in succession by several synonym (or near synonym) adjectives of *bela* (beautiful). However, the kind of ambiguity expected only appears with *bela* (beautiful). Larson's proposal does not account for all the contrasts observed. Hence, this issue will have to be further analysed.

Still under the scope of the goal of investigating the relations holding between adjectives and the elements they co-occur with, we will also discuss some data, first noted by Bolinger (1967), and later discussed by Larson (1999). These data regard adjectives occurring inside a nominal phrase which seem to be understood as if they were a matrix adverbial. Let us look at the alternations presented by Larson (*op. cit.*) and at some Portuguese data as well.

(34) Barbara saw an occasional sailor.
'Barbara saw a person who occasionally sailed' (internal adverbial reading)
'Occasionally, Barbara saw a sailor' (external adverbial reading)

Larson (*op. cit.*) states that the existence of an external adverbial reading constitutes a puzzle for compositional semantics and refers a movement analysis in which the adjective requires an article as an 'escape-hatch' out of DP and cannot move over an intervening adjective. Although it accounts for certain constraints on the availability of the external adverbial reading, this analysis appears nonetheless dubious: it offers no account for the reason why an element interpreted outside DP is projected within it initially, nor does it explain the non participation of the adjective in the semantic composition of the DP. In fact, if the adjective does not participate in the semantic composition of the DP, what does it do there in the first place? Besides some empirical difficulties regarding an alternation in definiteness which is left unexplained by this analysis, Larson (*op. cit.*) comments that the behaviour we have been referring to is confined to adjectives of infrequency. If adjectives were simply rising out of DP, then a difference in frequency *versus* infrequency would not be expected. We will not discuss

English examples for now, but Portuguese adjectives behave quite differently in this kind of contexts.

(35) a. Passou um cliente ocasional do bar.
'an occasional customer of the pub strolled by'

b. = Passou uma pessoa que ocasionalmente é cliente do bar.
'a person who is occasionally a customer of the pub strolled by'

c. ≠ Ocasionalmente passou um cliente do bar.
'occasionally a customer of the pub strolled by'

(36) a. Ele é um cliente ocasional do bar.
'he is an occasional customer of the pub'

b. = Ocasionalmente ele é cliente do bar.
'occasionally he is a customer of the pub'

Differently from what is observed by Larson (*op. cit.*), even if (35)a, b and c are possible Portuguese sentences, they do not have the same semantic content. Nonetheless, (36)a and b show the alternation discussed by this author and presented in (34). However, the examples above seem to indicate further restrictions regarding these phenomena than those observed by this author. Furthermore, in Portuguese, this kind of alternation is not restricted to infrequency adjectives, as shown in (37).

(37) a.Ele é um cliente habitual do bar.
'he is a usual customer of the pub'

b. = Habitualmente ele é cliente do bar.
'usually he is a customer of the pub'

In fact, what seems to be at stake in the examples above, and corroborated by (38)-(41), is adjective modification of events. Being so, it is only natural that an alternation between adjectives and adverbs is possible. Since we are dealing with event modifying adjectives, what is crucial for the sake of our discussion is the possibility of associating events to the semantics of nouns. But not all nouns seem to be associated to events, as shown by the following examples.

(38) *Este objecto é uma garrafa habitual da Maria.
'this object is a usual bottle of Maria'

(39) a. Este rapaz é um colaborador habitual da Maria.
'this boy is a usual collaborator of Maria'

b. = Este rapaz colabora habitualmente com a Maria.
'this boy usually collaborates with Maria'

(40) a. Este objecto é a garrafa habitual da Maria.
'this object is the usual bottle of Maria'

b. = Este objecto é a garrafa que a Maria usa habitualmente.
'this object is the bottle Maria usually uses'

(41) a. Este rapaz é o colaborador habitual da Maria.
'this boy is the usual collaborator of Maria'

b. = Este é o rapaz que colabora habitualmente com a Maria.
'this is the boy that usually collaborates with Maria'

Starting with (38) and (39), we notice a clear grammaticality contrast between these two sentences. However, they have exactly the same syntactic structure, the only difference being the head noun modified by the adjective *habitual* (usual). Let us now look at (40) and (41). These sentences are identical to (38) and (39) except for the determiner introducing the noun phrase modified by *habitual* (usual). Nonetheless, (38) is ungrammatical while (40) is grammatically sound. The explanation for the acceptability of (40)[5] seems to be the availability of an event to be modified by *habitual* (usual). In fact, (38), differently from (39), (40) and (41), is the only sentence which does not have an adverbial reading (cf. (39)b, (40)b and (41)b). This fact seems to indicate the absence of an event associated to the noun *garrafa* (bottle), which might be modifiable by an adverb, the same not being true for *colaborador* (collaborator). This idea gains more strength as we look at the examples below, which show that the event making (40) acceptable is context-dependant, i.e. it is not associated to the noun *garrafa* (bottle) but can be retrieved from context. As for *colaborador* (collaborator), it is always associated with the same event: *colaborar* (collaborate).

[5] The fact that both the noun phrases in (40) and (41) are definite descriptions, and not in (38) and (39), seems to somehow make an event available to be modified by *habitual* (usual), licensing (40), by contrast with (38). We will not develop the issue of definiteness now, nor why it has an impact on making an event available to the adjective. What is indeed crucial for the sake of this discussion is the fact that the acceptability of (39), (40) and (41) seems to depend on an event being made available to the adjective.

(42) a. A Maria trouxe a garrafa habitual.
'Maria brought the usual bottle'

b. = A Maria trouxe a garrafa que traz habitualmente.
'Maria brought the bottle she usually brings'

(43) a. A Maria cumprimentou o colaborador habitual.
'Maria greated the usual collaborator'

b. = A Maria cumprimentou a pessoa que colabora habitualmente com ela.
'Maria greated the person that usually collaborates with her'

As stated above, there is a contrast between the nouns *colaborador* (collaborator) and *garrafa* (bottle) in what concerns their association to events. Based on (38)-(41), we can formulate the hypothesis of *colaborador* (collaborator) always being associated to an event, the same not being true for *garrafa* (bottle), a noun which can only be modified by adjectives such as *habitual* (usual) when an event can be retrieved from the context. The context-dependency of the event modified by *habitual* (usual) in (40) becomes clearer as we look at (42) and (43). In fact, all the sentences in which *colaborador* (collaborator) occurs have an adverbial reading in which the adverb invariably modifies the exact same verb: *colaborar* (to collaborate). When *garrafa* (bottle) is the noun at stake, the verb modified by the adverb in the paraphrase - when an adverbial reading is possible - depends on the context, varying from sentence to sentence (*usar* (to use) in (40) and *trazer* (to bring) in (42)).

In this section it has become clear that adjectives have a considerably dynamic behaviour, namely with regard to sense change according to the linguistic context they appear in. Thus, modelling this POS in large-scale lexica and grammars is far from being a trivial issue. Finding the more suitable approach and strategies in order to accomplish this task is one of the goals we pursue in this dissertation.

1.3. FRAMEWORK

Under the scope of Computational Lexical Semantics, the work presented here is generally developed within a feature structure framework. More precisely, the linguistic data are discussed and described within the Generative Lexicon framework (Pustejovsky, 1995). Although a detailed presentation of this framework would be out of place here, it is pertinent to justify and motivate this choice.

This work having both theoretical and computational concerns, and since adjectives show a non trivial semantic behaviour, namely with regard to sense change depending on the linguistic context, we needed a model of lexical semantics which would provide us with the necessary lexical resources to explain the interpretation of words in context and deriving a potentially infinite number of senses for words from finite resources. In short, we need a model enabling us to account for the multiplicity of senses observed, generatively.

Given the data introduced in the previous section, the importance of finding a framework that would straightforwardly account for semantic underspecification and meaning permeability has become apparent. The Generative Lexicon (henceforth GL) consists of a system of feature structures and a small set of rules that allow for a structured semantic representation of lexical items, simultaneously accounting for the creative use of words in novel contexts and for the interaction between syntax and semantics.

Also, as it has become clear from the preliminary presentation of the data above, the role of events in lexical semantics allows us to account for some alternations. The role of events in verbal semantics is generally acknowledged in linguistic research. Pustejovsky (1991b) evaluates the role of events within a general theory of lexical semantics, proposing a configurational model of event structure. Incorporated in GL, the event structure provides a useful level of representation for linguistic analysis.

As argued in Pustejovsky (*op. cit.*), finer-grained distinctions than sorts of events are necessary in order to capture different phenomena such as aspect and Aktionsarten. Thus, events are described in terms of their subevent structures, an option which has significant theoretical consequences, making available, within GL, an event semantics defined, not only by sorts, but also by the internal configurational properties of the event. Nonetheless, what is crucial for the sake of our work is the possibility of associating events to the semantics of nouns and adjectives.

The representation of adjectives in linguistic knowledge databases also being one of the main goals of our work, we chose to encode adjectives in a relational lexicon – WordNet.PT.

As well known, the experiment conducted by George Miller on the properties of the mental lexicon in the early 80s pointed out that lexical meaning is derived from a set of

lexical and conceptual relations among concepts. Subsequently, a computational lexicon conceived as a semantic network has been built – the Princeton WordNet (Miller, 1990; Fellbaum, 1998). Given its psychological plausibility and its crucial role for applications like machine translation, information retrieval and language learning systems, among many others, this relational model of the lexicon has been extensively adopted for machine lexical knowledge representations, playing a leading role in this field.

One of the most salient undertakings in this domain is EuroWordNet (Vossen, 1998), a multilingual database which stores wordnets for several European languages that follow the same main lines as the Princeton WordNet and are inter-related amongst themselves. Although EuroWordNet wordnets follow the Princeton WordNet model, they are richer concerning both the number and the nature of conceptual relations.

In our work we have adopted the EuroWordNet framework, discussing the specifications for an accurate modelling of lexical knowledge in WordNet.PT, a EuroWordNet-like wordnet for Portuguese. Although WordNet.PT (Marrafa, 2001, 2002) is being developed in the general EuroWordNet framework, basic research has been carried out on Portuguese data, in order to guarantee its accuracy.

Hyponymy is the main structuring relation both in WordNet and EuroWordNet. However, the semantic organisation of adjectives is quite different from that of other POS such as verbs and nouns: nothing like the hierarchies of hyponymy (in the semantic organisation of nouns) and troponymy relations (in the semantic organisation of verbs) is available for adjectives. Even if some small local hierarchies can be found, hyperonymy/hyponymy is far from being the crucial semantic relation in the organisation of adjectives in relational lexical databases such as wordnets.

In the Princeton WordNet adjectives are not hierarchically organised in the network, antonymy and semantic similarity being the main relations for adjective encoding. These relations between adjective synsets depict an organisation like the one proposed by Gross, Fischer & Miller (1989): adjectives are organised in clusters, determined by the semantic similarity of each adjective to a certain focal adjective around which a cluster is formed. These focal adjectives generally oppose to other focal adjectives, thus determining opposing clusters. However, according to Miller (1998:59), adjective

encoding in the Princeton WordNet database does not make up a theoretical contribution, since the chosen organisation strictly depends on registered uses.

Some authors working within the EuroWordNet framework have nonetheless considered the possibility of encoding hyponymy for adjectives. Hamp and Feldweg (1997), in the development of GermaNet, abandon the cluster organisation of WordNet in favour of a hierarchical structuring of adjectives, arguing for a uniform treatment of all POS. In ItalWordNet, Alonge et al. (2000) also organise adjectives into classes sharing a superordinate, and corresponding to adjectives sharing some semantic features. However, as noted by Peters & Peters (2000), even though similarities exist, "adjectives belonging to the same semantic class may differ from each other in numerous ways", i.e. the classes established in this way are not homogeneous.

The issue of the lexical organisation of adjectives is thus far from having a consensual treatment. This dissertation discusses this matter in order to appropriately capture the semantics of adjectives in wordnets by means of a small set of relations. We will use cross-POS relations with strong linguistic motivation in order to preserve the coherence of the model, hence aiming at providing a simple and integrated solution for several complex and heterogeneous problems. Since we will be implementing cross-POS relations, we argue that increasing the expressive power of the system has an important impact in precision concerning the specifications of all POS.

Besides the issue of the lexical organisation of adjectives, which is investigated here from a theoretical point of view, the question of meaning delimitation of lexical items has also been the focus of studies in Computational Lexical Semantics. The methodological options concerning this question are numerous and diverse, from the extreme of certain proposals in Artificial Intelligence, which opt for the assumption of a single sense to each lexical item, deriving particular uses via complex derivation procedures, to the opposing extreme of certain approaches in lexicography, which identify almost as many senses of a lexical item as its uses.

The non-existence of deep large-scale studies within the perspective mentioned above, on the one hand, and the importance of the codification of the intrinsic selective binding and co-compositional properties of adjectives in natural language processing systems, on the other hand, are the decisive motivations behind the work presented in this dissertation.

1.4. ORGANISATION

The goals presented in the previous sections have led us to the definition of a set of questions around which the work presented in this dissertation is organised:

- Determining the prototypical features of the POS adjective;
- Stating the relations holding between adjectives and other POS;
- Characterising the syntactic and semantic behaviour of representative Portuguese adjective classes;
- Defining the set of appropriate relations and role features for the representation of adjectives in linguistic knowledge databases;
- Identifying the appropriate modelling structures in a framework of maximal generalisation and minimal complexity.

The first two questions are addressed in **chapter 2**. We discuss the status of adjectives as a lexical category, providing relevant data to identify adjectives main features, namely through the contrastive description of the linguistic behaviour of adjectives, nouns and verbs. Arriving at the end of chapter 2 with an operative definition of what is an adjective, in **chapter 3** we address the third question listed above. We use the presence or absence of some adjective characteristic features, in combination with other properties, to establish adjective classes, focusing on contrasts that allow for grouping adjectives together. First, we define and characterise adjective classes based on adjective intrinsic meaning. We also discuss and characterise groups of adjectives with regard to the basic semantic relations they establish with the modified noun, underlining that not all of the latter subclasses are lexically marked, and thus, it is more accurate to consider them to be adjective readings, rather than adjective classes.

Having established and characterised adjectives classes, in **chapter 4** we delineate a linguistically motivated approach for modelling their syntactic and semantic properties in computational relational lexica such as wordnets. We argue that the semantics of adjectives can be appropriately captured in wordnet-like lexica by means of the implementation of a small set of relations – particularly cross-POS relations –, which have a strong linguistic motivation and preserve the coherence of the model. By implementing a selection of Portuguese adjectives in WordNet.PT we test the adequacy of the set of relations encoded, thus making apparent that increasing the expressive

power of the system, with no significant loss in parsimony, has an important impact in precision concerning the specifications of all POS.

Our modelling strategies for representing adjectives in computational relational lexica allow for mirroring adjective main definitional features. However some syntactic contrasts remain unaccounted for. This leads us to the fifth question in our list, which is addressed in chapters 5, 6 and 7 of this dissertation.

In **chapter 5** we pursue our proposal for modelling adjectives in the lexicon, discussing the need for fine-grained, rich and structured representations, in order to enable a principled account of the different ways the meaning of compound expressions is built. We argue that, in order to do so, wordnets should include information on event and argument structures. To achieve this goal, we adopt the Generative Lexicon framework. We put forth a homogeneous and economic approach for representing all adjective classes in the lexicon, while simultaneously accounting for crucial empirical data, particularly regarding the construction of meaning in context. Moreover, we make apparent that putting a small set of economic generative mechanisms to work – unification, underspecification and information sharing between structures – allows us to account for complex linguistic phenomena such as relativity to a comparison class, selection restrictions, construction of meaning in context, and sense change.

But, besides the linguistic information encoded in adjective lexical entries, there is also an important role played by adjective relative position in the NP with regard to the definition of the meaning of adjective-noun groups, namely in what concerns adjective sense change. We focus on this issue in **chapter 6**, where we provide a thorough description of adjective distribution in adnominal contexts, putting forth an explicative principle for the distribution restrictions evinced by each adjective class. We assume the markedness of prenominal position, underlining its emphatic role and the contrast between prenominal and postnominal adjectives in terms of the relation they establish with the modified noun. This observation leads us to research on the role played by adjective position in the construction of NP denotation. We arrive at an economical proposal, which provides a unified analysis of verbal and adjective alternations and of all adjectives occurring in prenominal position, accounting for the role played by adjective relative position in the NP in the definition of the meaning of adjective-noun groups.

In **chapter 7** we address specific phenomena related to event modification by adjectives. We analyse event modifying adjectives which show adverbial readings whose scope seems to go beyond the NP where they occur, extending over the whole sentence. Our approach underlines the role played by events associated to the lexical items involved in these structures, providing a unified treatment of adjectives and adverbs. This is particularly relevant if we consider that these are the two POS that play the role of modifiers in language. Moreover, our approach to these specific linguistic phenomena makes the expressiveness of GL apparent: having thoroughly provided modelling strategies for members of all adjective classes, we are able to straightforwardly deal with apparently exceptional data, in a linguistically motivated way and without needing to introduce any changes in adjective lexical entries.

Chapter 8 sums up our contributions to a better understanding of adjectives as a word class and to an accurate and economic modelling of this POS in the lexicon, in an integrated approach to syntax and semantics. Also, we make apparent that, even if the main motivation of our work is linguistic in nature, the research depicted in this dissertation was essentially developed under a computational perspective, resulting in a modelling of adjective classes suitable for its computation in large scale lexica and grammars.

CHAPTER 2
DEFINING ADJECTIVES

2.0. INTRODUCTION

Word classes are primarily established on the basis of morphological and syntactic criteria. On the other hand, they have been labelled in accordance with more general considerations, usually semantic in nature (cf. Lyons, 1977; Schachter, 1985). The central issue in the establishment of word classes regards selecting suitable criteria and ranking them. In fact, the major word classes are distinguished on the basis of clusters of properties which are usually non-discrete, showing a certain degree of overlap, along with some differentiation. Hence, as noted by Wetzer (1996), establishing the borders of a word class involves defining what is 'essentially identical' among the items under analysis and what constitutes 'enough difference' between them. But what is crucial in any linguistic description is to accurately describe the grammatical properties of the items under analysis, explicitly stating the criteria used for any classification.

A thorough analysis of the grammatical properties of adjectives reveals that these do not represent a clearly distinct and homogeneous cross-linguistic category – as most word classes do not. Furthermore, adjective status as an independent POS is not universally accepted. Some authors, as Wetzer (*op. cit.*), for example, go as far as stating that there seems "to be no clear definitional criteria for *adjective-hood*". Here we argue against this idea. Thus, one of the first issues we address in this dissertation regards the identification of prototypical features of adjectives. Moreover, the argument for the necessity to represent adjectives "in formal semantics is strong since in languages with a productive open class of adjectives there are very clear general syntactic, morphological and semantic criteria distinguishing adjectives from verbs and nouns" (Demonte, forth.:2).

The main purpose of this chapter is to arrive at an operative definition of what is an adjective. In order to do so, we will begin by looking at previous work, namely at some definitions and empirical descriptions elaborated by different authors with regard to this POS.

2.1. ADJECTIVES MAIN FEATURES

In general terms, adjectives are a syntactically distinct class of words[1], whose most characteristic function is to modify nouns. In a common sense ontology, adjectives have been defined as the class of words that express properties (Croft, 1991) or that denote qualities (Vendler, 1967), as, in languages that have adjectives[2], this POS is used to express the necessary finer gradations of meaning that alter, clarify or adjust the meaning contributions of nouns and verbs. The core semantic function of adjectives is therefore to provide terms for individual properties. However, this general definition does not enable us to determine whether some particular lexeme is an adjective or not. For this, we need to consider the distinctive grammatical properties of adjectives.

According to Dixon (1977:62-63), the adjective class "is a set of lexical items distinguished on morphological and syntactic grounds from the universal classes Noun and Verb". However, as mentioned above, adjectives are not universally considered an independent word class, often because the status of their distinctive properties – and, hence, the status of classes defined according to such properties – is far from finding consensus among grammarians, who sometimes consider them differences of kind, other times, differences of degree. In Portuguese grammatical tradition, for instance, adjectives have not always been considered a separate POS. Barbosa (1881:75) points out that many Portuguese 'grammarians do not regard adjectives as a different class in

[1] As mentioned above this is not a universally accepted idea. Some authors consider that the status of this lexical category is questionable, as the members of the adjective class tend to share some properties with nouns and with verbs, namely morphological and syntactical properties. Furthermore, even if most authors see adjectives as a fully independent word class, others consider that, even if there are empirical arguments for identifying a separate word class for adjectives, it will never be as independent as the classes of nouns and verbs. Here we show that, despite these shared grammatical properties, adjectives do have distinctive features that allow us to draw a defining border for this word class.

[2] As presented in detail in Wetzer (1996), comparative studies show that adjectives are not a universal POS in language. In fact, many languages do not have a distinct open class of adjectives. Unlike Indo-European languages, which have this major word class, some languages, such as Mandarin Chinese, lack this class completely, while others, like Bantu languages, for instance, only have a small set of adjectives. Naturally, these differences are compensated in such languages, namely by the use of nominal and verbal expressions to convey properties or qualities, i.e. the kind of semantic content typically associated to adjectives in languages having this distinct word class.

nature, with regard to nouns'[3] and distances himself from this approach to the grammar of Portuguese. He presents three criteria for considering words as basic POS in a natural language[4] and shows how adjectives fulfil these criteria and hence must be regarded as an independent POS.

> *"O adjectivo exercita uma funcção necessaria e indispensavel na enunciação do pensamento. Porque, se não póde haver proposição sem um sujeito e sem um attributo, e se o nome substantivo é preciso para exprimir aquelle, o adjectivo não o é menos para significar este. Estas duas funcções são inteiramente distintas. (…) Além d'isto nenhum dos nomes, substantivo e adjectivo, póde trocar um com o outro estas duas funcções que são próprias a cada um; tanto assim que para o adjectivo poder ser sujeito de uma proposição, é necessario substantival-o por meio do artigo; e para o substantivo poder fazer as vezes de attributo na mesma proposição, é preciso adjectival-o, empregando-o sem artigo nem determinativo algum que o individue."*[5]
>
> Soares Barbosa (1881:75)

Even though grammarians do not agree on the status of adjectives in the grammar, what is certain is that the semantic content conveyed by adjectives and their function in language is present in all natural languages, and it can be observed that, independently from the existence of a fully independent adjective class, in terms of grammatical behaviour these items tend to associate with the major word classes Noun and Verb, sharing some of their grammatical properties. Further below, we present a detailed description of these shared grammatical properties, as well as of the distinguishing grammatical behaviour allowing for a characterisation of this POS. Here we only address the case of languages that, like Portuguese, have an independent open class of adjectives.

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[3] "muitos grammaticos, e os nossos especialmente, não contam os *adjectivos* como especie separada do nome" (Barbosa, 1881:75)

[4] According to Barbosa (1881:74) for sets of words to be considered a basic POS, they should show the following characteristics: (1) be simple and indivisible; (2) be necessary and essential to the expression of thoughts; and (3) have an essentially different function in language.

[5] Adjectives have a necessary and essential function in the enunciation of thought. Because, if there is no proposition without a subject and an attribute, and if the noun is needed to express the former, the adjective is just as needed to express the latter. These two functions are entirely distinct. (…) Besides, nouns and adjectives cannot switch these characteristic functions between them; thus for an adjective to be able to be the subject of a proposition it has to be nominalised via a determiner; and for a noun to be able to play the role of attribute in a proposition it has to be adjectivalised, used without any determiner that individualises it.

As noted by Demonte (1999, forth.), adjectives can be considered both a grammatical and a semantic category. Like all grammatical categories, adjectives are a class of words whose members show precise formal characteristics, namely their function and their morphological and syntactical behaviour. With regard to function, adjectives are expressions which apply to expressions that denote objects[6] – nouns – to attribute a property or a set of properties to them. In order to do so, adjectives establish two kinds of syntactic and semantic relations with nouns: modification and predication relations. We will characterise these relations in more detail further below. Gender and number agreement with the head noun is the main distinctive morphological and syntactical feature of adjectives. In fact, in Romance languages, adjectives and nouns are considerably close in terms of form. These similarities, as well as the distinctive properties of nouns and adjectives, will be discussed in section 2.2.1.

Adjectives should also be considered a semantic category, as there is a kind of meaning that is preferably expressed by adjectives. Adjectives typically denote states, providing terms for individual properties, and only exceptionally are transitive, taking syntactic objects. Naturally, the semantic nature of adjectives cannot be dissociated from their function in language and the kind of syntactical configurations they occur in. In Chierchia & McConnel-Ginet (1990) the semantic contribution of adjectives is discussed in detail. Most adjectives are typed as one-place predicates that combine with a noun by generalised predicate conjunction[7]. Although most adjectives accept a semantic analysis such as this one, not all adjectives conform to it. We will leave the discussion of these and other contrasts to the next chapter, since the main goal of the present chapter consists in identifying the distinctive features of adjectives so that determining which lexical items belong to the lexical class of adjectives can be achieved (this way clearly determining the object of the study presented here).

Even though some distinctive features can indeed be identified, sometimes it is difficult to draw a strict, definite line between sets of lexical items, clearly stating to which POS they belong to. This difficulty in making clear-cut classifications of lexical items has led some authors to argue for less closed sets.

[6] These object denoting expressions can either be complex or atomic.
[7] According to Chierchia & McConnel-Ginet (1990), this analysis of the semantic nature of adjectives results on a semantic equivalence between noun modification by an adjective and by a relative clause.

On the basis of this kind of reasoning, Ross (1972) defines lexical classes as a continuum of elements, organised in a sequence. This analysis is based on the study of a set of syntactic phenomena, arguing that adjectives have an intermediate position between verbs and nouns, since, according to this author, there are some syntactic processes that affect most verbs, only a few adjectives and hardly any nouns. However, if we extend the number of syntactic phenomena considered by Ross (*op. cit.*), we will find several counter arguments with regard to the homogeneity of the sequences of lexical classes he proposes. In fact, there is no clear reason why this author values some syntactic restrictions over others. Nonetheless, and besides these insufficiencies, this analysis mirrors the idea that the relations holding between verbs, adjectives and nouns is far from being satisfyingly analysed. The existence of features approaching lexical items, as well as others driving them apart is undeniable. Identifying these features and finding those that may allow us to define and characterise adjectives as a lexical class is the general goal of the following sections.

2.2. NOUNS, VERBS AND ADJECTIVES

It is commonly accepted that we conceive the world as being ontologically divided in three different classes of entities. Following Lyons (1977) we may consider the existence of three different entity orders: physical objects or first order entities; events, processes or states of affaires placed in time and space or second order entities; propositions not placed in time and space or third order entities. As well noted by Lyons (*op. cit.*), if we organise our reality in terms of these three classes of entities, we can also consider that nouns, verbs, and adjectives and adverbs, respectively, represent these three kinds of entities in language.

However, as pointed out by Lyons (*op. cit.*), the correspondence between this triple distinction and different POS is not exact. First order entities are only typically represented in language by nouns, second order entities by verbs and third order entities by adjectives and adverbs. The correspondence is not absolute, as there are nouns, such as *altura* (height) or *inteligência* (intelligence), that represent properties, others that denote events or states, like *revolução* (revolution) and *felicidade* (happiness), or even adjectives that introduce sets of properties, *marítimo* (maritime) and *rural* (rural) for

instance. Being so, lexical classes cannot be conceived as completely homogeneous sets of lexical items.

Traditionally, the concept of class as a set of necessary and sufficient conditions results in discrete and very rigid categories. However, there are always some lexical items that constitute a problem in terms of classification, sharing characteristics of more than one word class and being, therefore, problematic to some extent in terms of classification. On the other hand, this kind of lexical items can help us make finer grained characterisations of lexical classes, as they can make apparent the sometimes thin borderline between POS. The notion of prototype or of 'core members' of a class may be a helpful tool for dealing with the data. According to Rosch (1975) – one of the first to introduce the concept of prototype –, this concept introduces some changes in the definition of categories. In her words, natural categories are not "logical, bounded entities, membership in which is defined by features, in which all instances (…) have a full and equal degree of membership." (Rosch, 1975:544). Thus, if we understand lexical classes as natural categories, some of the apparently problematic data just become natural. Following Geeraerts (1997), the concept of prototypicality can be defined in terms of the concepts of non-discreetness and non-equality. "Non-discreteness involves the existence of demarcation problems and the flexible applicability of categories. Non-equality involves the fact that categories have internal structure: not all members or readings that fall within the boundaries of the category need have equal status, but some may be more central than others; categories often consist of a dominant core area surrounded by a less salient periphery." (Geeraerts, *op. cit.*:21).

The well known Dixon's (1977) adjective classification, for instance, divides the "basic members" of English adjective class into seven "universal semantic types". This author points out, however, that these types are not homogeneous, some being more peripheral than others.

This lack of homogeneity does not entail the impossibility of identifying typical features shared by most adjectives, features that can thus be regarded as characteristic of this POS. Aiming at arriving at an operative definition of what is an adjective, we will now look at previous work.

Let us start with some of the definitions present in traditional grammar. In his *Grammatica Philosophica da Lingua Portuguesa*, Soares Barbosa defines adjectives as follows:

> *"O adjectivo é um nome que exprime uma coisa como accessoria de outra, para ser sempre o attributo de um sujeito claro, ou occulto, sem o qual não pode subsistir.*[8]*"*
>
> Soares Barbosa (1881:95)

According to Cunha & Cintra (1996:251), "adjectivo é a espécie de palavra que serve para caracterizar os seres ou os objectos nomeados pelo substantivo[9] (...)".

These two definitions present the idea that adjectives are expressions that apply to other expressions that introduce physical or mental objects. The strong and necessary relation holding between adjectives and nouns in sentences is the strongest idea stated in them. Considering this dependence between adjectives and nouns a distinguishing feature, characteristic of adjectives, is also present in João de Barros's grammar[10]. This author proposes a test in order to evaluate this dependence and hence identify adjectives: combining them with the noun *cousa* (thing) – adjectives accept this combination, nouns do not. Let us consider João de Barros's examples with the following lexical items: *formoso* (beautiful), *bravo* (brave), *cavalo* (horse) and *toiro* (bull). As can be observed in (1) and (2), only adjectives *formosa* (beautiful) and *brava* (brave) can combine with *coisa* (thing) (cf. (1)). The same combination with nouns *cavalo* (horse) and *toiro* (bull) results in ill-formed phrases, presented in (2).

(1) coisa formosa / coisa brava
'beautiful thing' / 'brave thing'

(2) *coisa cavalo / *coisa toiro
'thing horse' / 'thing bull'

According to Demonte (1999, forth) members of the adjective class have very precise formal characteristics and express a specific kind of meaning. Hence, according

[8] An adjective is a noun that expresses a thing as accessory to another one, always being an attribute of a clear object or of a hidden one, without which it cannot subsist.
[9] Adjective is the kind of word used to characterise the beings or the objects mentioned by the noun (…).
[10] "Nome ajetivo [chamamos] ao que nam tem ser per si, mas está encostádo ao sustantivo (...)" (Barros, 1540:301) (we call adjective to the word that does not exist on its own, but that is supported by the noun).

to this author, adjectives typically show the following features: independence from the object; ability to ascribe properties to objects; and gradability.

Independence from the object is a fundamental adjective feature, which distinguishes this POS from nouns: adjectives are general terms, they can be applied to multiple objects, while nouns define a set of conditions necessary and sufficient to identify an entity, or more precisely, a set of entities. Interestingly, we already find this intuition in Barbosa (1881)[11], an intuition which is rigorously stated in Demonte (1999, forth.) as we will see in more detail in the following section.

On the subject of the nature of lexical items and POS, Barbosa (*op. cit.*:72) also declares that "in nature there is not anything else besides individuals and the relations holding between them, either within themselves, looked at from different perspectives, or with other individuals, arising from their own properties, either natural or accidental"[12]. Adjectives do in fact place a certain property (or properties) in a comparison scale. When applied to a noun, adjectives ascribe this property to it. At the same time, adjectives indicate how and to what extent this property is present in the entity it is attributed to, often combining with adverbs or certain morphemes in order to refine the information they carry and to ascribe these properties with more accuracy. This is why we say they are gradable.

Hence, these are 'typical' adjective features, which do not hold for all members of this POS. Besides, as noted by Demonte (1999) it is often the presence or absence of one of these features, in combination with other properties, that will allow for establishing adjective classes and explaining adjective contrasting syntactic behaviour.

2.2.1. NOUNS AND ADJECTIVES

Portuguese grammatical tradition usually identifies a very close relation between nouns and adjectives, often arguing that these two classes are in fact subclasses of a common wider class. Authors such as Barbosa (1881), Câmara (1970) or even Cunha &

[11] "(…) a idéa que faz o attributo da proposição, necessariamente ha de ser uma idéa de qualidade ou coisa que o valha, e que per si não póde subsistir, mas necessita de um sujeito em quem exista." (Barbosa, 1881:75) (the idea associated to an attribute of a proposition will necessarily be an idea of a quality or of something like that, which cannot hold on its own, but which needs a subject on which to hold on).

[12] "Na natureza não existe outra coisa mais do que individuos e as relações que elles teem, ou comsigo mesmos, olhadas por diferentes lados, ou com outros diversos, nascidas das suas mesmas propriedades, ou naturaes ou accidentaes." (Barbosa, 1881:72)

Cintra (1996) consider adjectives and nouns (*nomes adjectivos* and *nomes substantivos* respectively, in their nomenclature) as subclasses of the wider class of *nomes*.

The main criterion behind this kind of analysis is form: adjectives and nouns share features such as inflection paragons and class markers. Distinction between *nomes adjectivos* and *nomes substantivos* is made on the basis of different criteria, according to the authors considered. Amongst traditional grammarians semantic criteria are usually on the basis of this distinction. Cunha & Cintra (1996), for instance, use this criterion – among others – to elaborate their definition of adjectives: "adjectives are used to characterise beings, objects or notions named by the noun" [13]. On the other hand, when we look at Câmara (1970), who proposes a para-structuralist analysis of the grammar of Portuguese, function is the distinctive feature. This author states that, between nouns and adjectives, there is no distinction in terms of form, only in terms of function. In Cunha & Cintra (*op. cit.*) the distinction between adjectives and nouns is also syntactically based, as these authors consider that in many cases it can only be achieved in context in a phrase: the noun is the head word[14]. Observations such as this one are based on the fact that, sometimes, there is a single lexical form for the noun and the adjective, as shown in (3) and (4) below, where the form *espanhóis* (Spaniards/Spanish) is either a noun or an adjective, depending on the context[15].

(3) Havia três espanhóis na sala.
'there were three spaniards in the room'

(4) O representante da empresa apresentou-lhes produtos espanhóis.
'the company representative presented Spanish products to them'

Besides this, nouns and adjectives in Portuguese share several morphological features, namely with regard to number and gender inflection. In fact, just as determiners and quantifiers, adjectives necessarily agree with the head noun they are

[13] "O adjectivo (...) serve para caracterizar os seres, os objectos ou as noções nomeadas pelo substantivo" (Cunha & Cintra, 1996:247).
[14] Cf. Cunha & Cintra (1996:248).
[15] We chose this example because English has different forms for the noun and the adjective, *Spaniards* and *Spanish* respectively, both mapping to the Portuguese word *espanhóis*. This allows us to disambiguate the form *espanhóis* and hence identify its POS in each context (cf. the ungrammaticality of sentences like (i) and (ii), caused by the use of the English noun form in the adjective context and vice versa).

(i) *There were three Spanish in the room.
(ii) *The company representative presented Spaniard products to them.

attached to. However, adjectives are distinct from determiners and quantifiers as their presence in a sentence is not sufficient to give referential capacity to an expression, i.e. to make it an expression with reference, an expression that can fill subject or object positions in a sentence.

These syntactic criteria have been used by numerous authors to distinguish adjectives and nouns. Brito (2003) points out two distinguishing features for adjectives: (i) all adjectives occur in attributive position; (ii) many adjectives are gradable, i.e. they can be modified by degree expressions such as the adverb *muito* (very). Nonetheless, these features do not allow for a clear identification of the lexical items belonging to the adjective class, not only because (ii) is only true of a subset of adjectives (cf. examples (5)-(7)), but also because some nouns also show (i) and (ii) (cf. (8)-(10) below).

(5) Adoro as paisagens muito calmas.
'I love the landscapes very calm'

(6) *Adoro as casas muito rurais.
'I love the houses very rural'

(7) *Ele mostrou um prato muito inteiro.
'he showed a plate very whole'

(8) Ele apresentou as ideias-chave da proposta.
'he presented the ideas key of the proposal'

(9) Ela encontrou o vizinho canalizador nas escadas.
'she met her neighbour plumber on the stairs'

(10) Ele era muito criança quando começou a guerra.
'he was very child when the war started'

Although this is not the general strategy used in languages like Portuguese, some Portuguese nouns can in fact be used as modifiers, occurring in attributive position, as illustrated in (8)-(10). Also, we can find some cases of nouns modified by degree adverbs such as *muito* (very). (10) is an example of this kind of contexts. Thus, (ii) not only is not true of all adjectives, but it is also a possible syntactic context for other POS. A rigorous adjective characterisation should therefore account for these facts and be based on stronger criteria.

As previously mentioned, the contexts presented in (8)-(10) are very specific and are not productive in Portuguese. However, they can contribute to a clearer characterisation

of adjectives. In fact, these contexts roughly correspond to an 'adjectivalisation' of the nouns at stake. Demonte (1999) considers that if sometimes certain nouns can occur in typical adjective positions is precisely because the denotation of such nouns in these contexts is the essential or prototypical property (or even the stereotype) of the mentioned entity, i.e. their denotation is somehow changed by context to something quite close to typical adjective features. Demonte (*op. cit.*) also presents exclamation examples such as *Que médico!* (what a doctor!) or *Que concerto!* (what a concert!) to reinforce this idea: in these contexts what is stated is that some entity fully satisfies the characteristics of the set of entities denoted by the noun. In these examples it is the characteristics of the entities denoted by the nouns that are graded, which corresponds to a role played typically by adjectives.

Casteleiro (1981) states that one of the features allowing us to distinguish between adjectives and nouns is the fact that the former do not combine with determiners to form a constituent[16]. Above we put forth some examples for showing that nouns can occur in typical adjective contexts, and hence be 'adjectivalised' to play typical adjective roles. In (11) we submit the example in (10) to Casteleiro's test. The ungrammaticality of (11)d strengthens our observation concerning the adjectival value of the noun *criança* (child) in the contexts at stake, as the ill-formation of this sentence seems to be introduced by the presence of a determiner before this noun.

(11) a. Ele era criança quando começou a guerra.
'he was child when the war started'

b. Ele era uma criança quando começou a guerra.
'he was a child when the war started'

c. Ele era muito criança quando começou a guerra.
'he was very child when the war started'

d. *Ele era uma muito criança quando começou a guerra.
'he was a very child when the war started'

[16] Ellipsis contexts such as (iii) are nonetheless possible:

(iii) a. De entre todos os tipos de paisagens, ele prefere as calmas.
'from all kinds of landscapes, he prefers the calm'

i.e.

b. De entre todos os tipos de paisagens ele prefere as paisagens calmas.
'from all kinds of landscapes, he prefers the calm landscapes'

These examples make apparent that, even if the impossibility of forming a constituent from the combination of a lexical item and a determiner is a good indicator of it being an adjective, this criterion does not allow for distinguishing adjectives, and only adjectives, from other POS, since, as we have seen above, in contexts where nouns have an adjectival value, for instance, they also cannot form a constituent with determiners, cf. (11)b where the combination with *muito* (very) forces the adjective value of *criança* (child). This restriction gives us a strategy to identify an adjective function more than a particular POS.

As mentioned in the previous section, Demonte (1999, forth.) stresses that the most important adjective feature is that these lexical items are general terms which can apply to different objects. This differentiates them from nouns, which determine a set of necessary and sufficient conditions to identify a class of entities. Demonte (1999) proposes a test in order to investigate the kind of contents associated to a given lexical item: only nouns can be modified by identity markers such as *o mesmo* (the same); adjectives cannot co-occur with them.

(12) a mesma criança / a mesma chave / o mesmo canalizador
'the same child' / 'the same key' / 'the same plumber'

(13) *as mesmas calmas / *os mesmos rurais / *o mesmo inteiro
'the same calm' / 'the same rural' / 'the same whole'

In (12) we can verify that the nouns *criança* (child), *chave* (key) and *canalizador* (plumber), which in (8)-(10) were somehow playing the role of adjectives, can be modified by *o/a mesmo/a* (the same). On the other hand, in (13), we can verify that the combination of *calmas* (calm), *rurais* (rural) and *inteiro* (whole) with an identity marker is always ruled out, just as predicted by Demonte (*op. cit.*). The combination with an identity marker such as *o mesmo* (the same) allows us to test the capacity of a lexical item to denote. Thus, with this simple test it is possible to distinguish entity denoting lexical items, such as nouns, from general terms that can be applied to multiple objects, like adjectives. As it has become apparent from the previous discussion, this distinction is independent from the possibility of having the canonical function of these lexical items changed in context, as observed in (8)-(10).

2.2.2. VERBS AND ADJECTIVES

Indo-European grammatical tradition usually approaches adjectives and nouns. Although this is the most common analysis, that has not always been the case. Plato, for instance, considered that adjectives and verbs belonged to the same grammatical class, and so did some of the grammarian-philosophers of the 18th century. Behind analysis such as these ones is the observation that adjectives and verbs play a similar role in language with regard to nouns: they have an attributive and/or predicative function.

Lakoff (1970) also approaches adjectives and verbs. He focuses on lexical items that share a common lexical base to observe that such lexical items are semantically equivalent and establish similar grammatical relations with the items they co-occur with. Brito (2003) also points out that many verb participles and adjectives have a similar syntactic behaviour, appearing in predicative and attributive positions (cf. (14) and (16) respectively) and accepting modification by degree words (cf. (15)).

(14) A agenda do médico estava preenchida.
'the doctor's agenda was booked'

(15) A agenda do médico estava muito preenchida.
'the doctor's agenda was very booked'

(16) A enfermeira consultou a agenda preenchida do médico[17].
'the nurse checked the doctor's booked agenda'

In fact, as noted by Larson (*op. cit.*) and confirmed by the examples below, verbs and adjectives sharing the same lexical base display the same selection restrictions[18].

[17] Although postnominal position is generally the canonical position for adjectives, (iv) is the most natural structure for the sentence in (16).

(iv) A enfermeira consultou a preenchida agenda do médico.
'the nurse checked the booked agenda of the doctor'

The motivation for this fact is due to independent reasons that are not pertinent in the context of our discussion here and which are addressed in detail in chapter 6.

[18] The ill-formation of sentences like (v), in contrast with the soundness of (17) both with or without the preposition *por* (for), apparently constitute a counter-example to our claim that verbs and adjectives sharing the same lexical base display the same selection restrictions. However, we argue that the contrasts observed are due to independent reasons – namely regarding rules of syntactic well-formation – and that the semantic restrictions introduced by *ansiar* (to eager) and *ansioso* (eager) are indeed the same.

(v) *Ele está ansioso ir estudar para o estrangeiro.
'he is eager to go study abroad'

(17) a. Ele anseia (por) ir estudar para o estrangeiro.
'he eagers (for) to go study abroad'

b. Ele está ansioso por ir estudar para o estrangeiro.
'he is eager for to go study abroad'

c. *Ele anseia (por) estudos no estrangeiro.
'he eagers (for) studies abroad'

d. *Ele está ansioso por estudos no estrangeiro.
'he is eager for studies abroad'

e. *Ele anseia de ir estudar para o estrangeiro.
'he eagers of to go study abroad'

f. *Ele está ansioso de ir estudar para o estrangeiro.
'he is eager of to go study abroad'

g. *Ele anseia com ir estudar para o estrangeiro.
'he eagers with to go study abroad'

h. *Ele está ansioso com ir estudar para o estrangeiro.
'he is eager with to go study abroad'

(18) a. Ela apoia causas ecologistas.
'she supports ecological causes'

b. Ela é apoiante de causas ecologistas.
'she is supporter of ecological causes'

c. *Ela apoia defender causas ecologistas.
'she supports to stand for ecological causes'

d. *Ela é apoiante de defender causas ecologistas.
'she is supporter of to stand for ecological causes'

e. *Ela apoia a causas ecologistas.
'she supports to ecological causes'

f. *Ela é apoiante a causas ecologistas.
'she is supporter to ecological causes'

Most of the adjectives Lakoff's (*op. cit.*) work focuses on are past participles behaving as adjectives: past participles occurring after a copula verb or in adnominal position. However, not all past participles occur in adjectival contexts: most intransitive and pronominal verb past participles do not, for instance. Casteleiro (1981) states that even past participles that occur in typical adjectival contexts should not be considered adjectives – in terms of having an independent entry in the lexicon – since their adjectival uses can be naturally derived from verb forms, which always maintain their subcategorisation and semantic properties.

Moreover, even if adjectives and verbs share some syntactic and semantic properties, this observation can also be extensible to nouns. As we have seen in the previous section, in Portuguese, as in other Romance languages, nouns and adjectives share the same inflection forms, a feature that is also shared by past participles and other nominal verb forms. Nonetheless, the similarity between verbs and adjectives cannot be overseen, a similarity that is mostly related to function, particularly to their ability to predicate over nouns.

2.3. CONCLUSIONS

In this chapter, and despite the observation that word classes are not homogeneous sets of lexical items, we show that it is possible to identify a set of common features which generally hold for all adjectives and that we assume here as our operative definition of what is an adjective.

Although this is not a universally accepted idea – some authors consider that the status of adjectives as a lexical category is questionable –, we assume that adjectives are a distinct word class. We show that, despite some shared grammatical properties with other POS, adjectives do have distinctive features that allow us to draw a defining border for this POS. Hence, we provide strong additional evidence supporting and strengthening the thesis that adjectives constitute a separate category, with specific characterising features. We show that adjectives are characterised by their particular and precise function (adjectives are expressions that apply to expressions that denote entities to ascribe a property or a set of properties to them, via modification and predication relations), by their specific semantic properties (adjectives denote states and only exceptionally are transitive) and by a set of 'typical' features (independence from the object, ability to ascribe properties to objects and gradability).

Also, we address the question that not all members of this POS display all these characteristics, arguing that it is precisely the presence or absence of some of these features, in combination with other properties, that is on the basis of the definition of adjective classes. This definition, along with the characterisation of adjective classes, is the object of chapter 3.

CHAPTER 3
ADJECTIVE CLASSES

3.0. INTRODUCTION

In chapter 1, we introduced the discussion on adjective classes. As stated then, we find several possible classifications of adjectives in the literature – semantic based classifications, syntactic based classifications, classifications regarding the relation holding between the adjective and the modified noun, and so on. In this chapter we discuss the main classifications found in the literature, most of which are either based on syntactic or on semantic criteria. However, as our analysis of the data progresses, it will become clear that only a combination of syntactic and semantic criteria can offer interesting insights concerning adjective linguistic behaviour.

In chapter 2 we presented adjectives as an independent word class in natural language, whose members express a specific type of semantic content and show precise formal characteristics. Despite these common features, there are nonetheless significant distinctions to be drawn amongst members of this POS.

In the following sections we focus on adjective classifications based on a combination of syntactic and semantic criteria. There are, nonetheless, considerably different approaches to this question. Dixon (1977), for instance, puts forth a classification according to the semantic fields adjectives are associated to. This author arrives at a ten-class classification, as illustrated in the table below (adapted from Dixon (1991:78-79)).

ADJECTIVE CLASSES	*EXAMPLES*
dimension adjectives	*big, short, narrow, deep*
physical property adjectives	*hard, cold, clean, heavy*
speed adjectives	*fast, quick*
age adjectives	*new, old, modern*
colour adjectives	*black, white, blue, golden*
value adjectives	*good, bad, odd, crucial*
difficulty adjectives	*easy, difficult*
qualification adjectives	*definite, possible, certain*
human propensity adjectives	*jealous, happy, angry*
similarity adjectives	*similar, different, unlike*

Not mirroring any kind of adjective linguistic behaviour, this classification is not a suitable starting point for a semantic analysis of adjectives[1]. It can, nonetheless, be useful for descriptive purposes, for instance, namely for research on semantic fields. However, that is not our perspective, nor our goal here. Thus, in the following sections we focus on adjective classifications available in the literature we consider relevant for the research presented in this dissertation.

3.1. PROPERTY ASCRIBING ADJECTIVES AND NON-RESTRICTING ADJECTIVES

Distinguishing between different adjective classes raises various, sometimes complex, questions, fundamentally related to two main problems: defining adjective classes from a syntactic and semantic point of view; and being able to determine to which particular class a given adjective belongs, a task that amounts to identifying the core properties of adjective classes. Moreover, we should be able to test these properties. In this dissertation we argue that only a combination of syntactic and

[1] Demonte (forth.), for instance, shows that members of Dixon's (*op. cit.*) classes do not display a homogeneous linguistic behaviour, as was to be expected. Under the scope of research on the nature of scales associated to adjectives, Demonte (*op. cit.*) puts forth a battery of tests concluding that, although Dixon's classes are semantically based, their members do not show a homogeneous linguistic behaviour with regard to a semantic feature such as gradability and scale association. Moreover, even from a purely descriptive point of view, there are clear accuracy problems in Dixon's proposal, particularly in terms of the level of granularity of his classes. One of its most obvious setbacks consists on the identification of overlapping adjective classes: although **physical property adjectives**, for instance, subsume both the classes of **dimension adjectives** and **colour adjectives**, Dixon (*op. cit.*) puts all three classes exactly at the same level.

semantic properties is able to adequately characterise adjective classes. In order to do so, we have to establish the kind of denotation associated to adjectives in each class, as well as their distributional properties. Accomplishing this task is the main goal of this chapter.

Demonte (1999) acknowledges the existence of two adjective classes: the larger class, and the most common one, – adjectives that ascribe properties to nouns – and the smaller one – adjectives that are used "to indicate the way a concept or intension of a term applies to a certain referent"[2]. This distinction is based on the way adjectives contribute to the construction of NP meaning.

The most salient role played by adjectives in language consists in NP modification. Being so, and before pursuing our discussion on adjective classes, we have to clearly establish in what consists noun modification. Peres (1992) defines noun modification as "a process involving the definition of a new denotation based on the denotation of a nuclear nominal structure[3], that functions as an operand"[4] (Peres, 1992:2). This definition of noun modification is based on two crucial concepts – **denotation** and **denotation restriction** –, which we also have to clearly establish before pursuing our work in this chapter. Our understanding of these concepts is framed within model theoretic semantics. This framework was developed from Montague's (1970) work, and within it semantics is seen as a system of linguistic interpretation which aims at defining correspondences between expressions in the language and mathematical objects that model the universe represented by language. These mathematical objects – which represent real entities – constitute the **denotation** of linguistic expressions. In this perspective, noun modifiers work as functions that project sets of properties into other sets – the latter being subsets of the former. Hence, in general, noun modifiers **restrict the denotation** of nouns. This way, noun modification plays a crucial role in language, particularly with regard to the identification of entities, as noted by Móia (1993).

As stated above, most adjectives work as operators which restrict the denotation of nouns (or of nominal structures). Moreover, and independently from the way we choose

[2] "Algunos adjetivos, en efecto, sólo sirven para indicar la manera como el concepto o intensión de un término se aplica a un determinado referente." (Demonte, 1999:139)
[3] A nuclear nominal structure is, in Peres (1992), a structure consisting on a head noun plus its internal arguments.
[4] "[a modificação nominal é] um processo que envolve a definição de uma nova denotação a partir de uma estrutura nominal nuclear que funciona como operando" (Peres, 1992:2).

to formally represent these lexical items, we can say that, on the one hand, adjectives like *luzidia* (glossy), in (1), add a restriction to the set of properties denoted by the modified noun. Hence, following Demonte (*op. cit.*), we designate them as **property ascribing adjectives**. On the other hand, there is a relatively small set of adjectives that do not restrict nominal denotation, although they share the distributional properties of noun modifiers, as well as most of their semantic properties. Adjectives like *falso* (false), in (2), are an example of this second group of adjectives, which behave somewhat like a semantic operator. Demonte (*op. cit.*) considers these adjectives to change the intension of the noun they modify and, thus, she names them intension modifying adjectives[5]. Keenan & Faltz (1980) also develop work on this set of adjectives, designating them as **non-restricting adjectives**[6].

(1) a maçã luzidia
'the glossy apple'

(2) o diamante falso
'the false diamond'

Property ascribing adjectives, such as *luzidia* (glossy), attribute properties to the modified noun, contributing to the delineation of the class of objects that the NPs in which they occur refers to. In (1) *luzidia* (glossy) introduces an additional restriction to the set of properties denoted by the modified noun: the NP *a maçã luzidia* picks out, not all objects in a given world that are apples, but a subset of this set, the set of all objects that are simultaneously apples and glossy.

Non-restricting adjectives like *falso* (false) do not deal with the restrictions introduced by the noun to pick out a certain set of entities, but with the way these restrictions apply to entities in the world to make up its referent. Differently from what

[5] In section 3.3 we discuss the choice of the tag used to identify this class of adjectives, as well as its borders and defining properties, providing arguments for adopting Keenan & Faltz's (1980) designation. We will accomplish these tasks starting off from the contrastive description made in this section, which focuses on the aspects that allow us to acknowledge the existence of these two adjective classes and to identify their main distinguishing features.

[6] Keenan & Faltz (1980) further divide this group of adjectives in two subclasses: negatively restricting adjectives and potentially restricting adjectives (which is in turn further broken down into non-restricting and non-negatively restricting adjectives). Although our approach consists on providing a unified treatment for all non-restricting adjectives, and hence on underlining their common distinctive properties, in section 3.3 we present some examples illustrating these different subclasses, discussing their contrasting semantic contribution, but focusing on their shared features. For a detailed analysis on the semantic properties of these adjectives, and particularly on their inferential properties, see Keenan & Faltz (1980).

happens in (1), in (2) the modification of *diamante* (diamond) by *falso* (false) does not determine a subset of the extension of *diamante*: the extension of the NP *o diamante falso* is a set which does not share a single element with the extension of *diamante*. *Falso* somehow changes the way the restrictions introduced by *diamante* apply to entities making up the reference of this NP, altering it in such a way so that this NP can be paraphrased as 'that is not a diamond but seems like one'.

Chierchia & McConnell-Ginet (1990) note that adjectives like *luzidia* (glossy) and *falso* (false) determine different entailment patterns. Following them, let us compare (3) and (4).

(3) a. O objecto que estás a segurar é uma maçã luzidia.
'the object you are holding is a glossy apple'

b. O objecto que estás a segurar é luzidio.
'the object you are holding is glossy'

c. O objecto que estás a segurar é uma maçã.
'the object you are holding is an apple'

(4) a. O objecto que estás a segurar é um diamante falso.
'the object you are holding is a false diamond'

b. O objecto que estás a segurar é falso.
'the object you are holding is false'

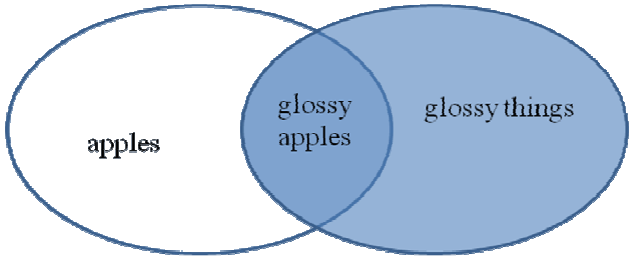
c. O objecto que estás a segurar é um diamante.
'the object you are holding is a diamond'

d. O objecto que estás a segurar parece um diamante, mas não é.
'the object you are holding seems like a diamond, but is not'

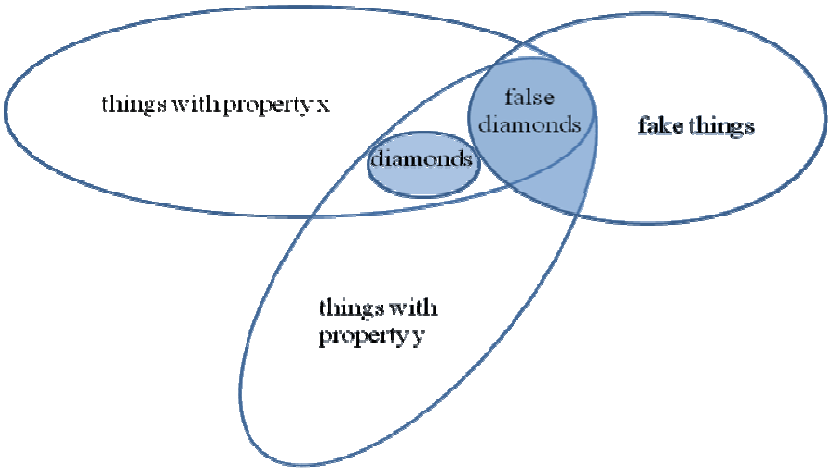
(3)a entails (3)b and (3)c but (4)a entails neither (4)b nor (4)c, although it entails (4)d. As stated above, these data indicate that the semantics of adjectives like *luzidia* (glossy) has to be considerably different from the semantics of adjectives like *falso* (false), as the relations they establish with the noun they modify are different in nature. This fact is surely not independent of the contrasts observed in (3)–(4) with regard to entailment patterns.

Like Keenan & Faltz (*op. cit.*) and Demonte (*op. cit.*), Chierchia & McConnell-Ginet (*op. cit.*) use these contrasts to classify adjectives like *luzidia* (glossy) and *falso* (false) into two separate adjective classes. According to these authors *luzidia* (glossy) and *falso* (false) establish considerably different relations with the noun they modify:

luzidia (glossy) combines semantically with the extension of the noun to produce a new nominal structure which denotes a subset of the extension of the modified noun; whereas *falso* (false) is semantically interpreted as a function that maps the denotation of the modified noun onto a new one, which needs not be related to the first one, in terms of set inclusion. Hence, as illustrated in the Venn diagram below, adjective-noun combination in the first case amounts to set intersection: *maçã* denotes the set of entities in the world that are apples; *luzidia* denotes the set of entities in the world that are glossy; and *maçã luzidia* denotes the set of entities in the world that are simultaneously apples and glossy, i.e. all entities that are in the intersection of the two sets.



For adjectives like *falso* (false), however, adjective-noun combination amounts to a function that operates on the denotation of the modified noun and changes it to some extent. Thus, contrarily to what happened in the example above, adjective-noun combination in this case does not amount to set intersection: *diamante* denotes the set of entities in the world that are diamonds; but *diamante falso* does not denote any subset of the set denoted by *diamante*. It denotes a set that does not share a single element with the set denoted by *diamante*: the set of entities that are not diamonds, but that share some of its properties, such as glitter or colour, for instance.



Contrasts such as these must correspond to differences in the semantic nature of these lexical items, and should be mirrored in their formal representation.

The semantic representation of adjectives has long been an object of discussion in the literature. Kamp (1975) provides an overlook on this subject, presenting two possible analyses to adequately represent adjectives in a formal semantics framework. Let us briefly present the main lines of the two proposals he discusses.

Stated by Parsons (1968) and Montague (1970), the first proposal represents all adjectives as functions which map the meaning of NPs onto other such meanings, i.e. functions from NPs to NPs. Although it is noted that some adjectives have special features which make them behave a little differently, in this proposal all adjectives are considered functions, as these authors judge them to invariantly perform operations on noun extensions.

Kamp (*op. cit.*) considers that this proposal has the advantage of correctly predicting false propositions, like the entailment between (4)a and (4)b, or (4)a and (4)c. Under Parson's and Montague's analysis, these entailments are not considered logically true, as it would happen if adjectives would be represented as regular one-place predicates. However, this proposal does not provide an adequate treatment for typical adjective constructions, such as the comparative and superlative. Hence, starting off from the common knowledge observation that adjectives can apply to entities in various degrees, Kamp (*op. cit.*) develops a semantic framework in which the idea of a predicate applying to an entity to a certain degree can be made coherent and precise. We come back to adjective degree modification further below. What is crucial at this point is that

Kamp (*op. cit.*) goes back to considering most adjectives as one-place predicates, just like nouns and intransitive verbs, leaving adjectives like *falso* (false) outside his analysis.

Chierchia & McConnell-Ginet (1990) also regard adjectives like *luzidia* (glossy) as one-place predicates. According to these authors, these adjectives express properties[7], the extension of *luzidia* being the set of entities that are glossy in the world *w* at time *i*. Adjectives like *falso* (false), on the other hand, do not express properties. They are property operators, functions from properties to properties, i.e. functions that map input properties onto new output properties.

It is not our goal here to discuss the technical details and implications of these analyses in terms of the formal semantics framework they are outlined in. However, discussing the general claims made by these analyses allows us to identify adjective crucial properties, while pinpointing their strong and weak aspects. In fact, as stated by Kamp (*op. cit.*:154), "it does no harm to have two distinct theories which give equally adequate, albeit different, accounts of those phenomena that fall within the province of both".

Before continuing our discussion on adjective classes, let us compare the main ideas stated in the two analyses discussed in Kamp (*op. cit.*), so that the main differences clearly emerge.

	Parsons (1968) and *Montague (1970)*	*Kamp (1975)*
Adj semantic nature	function from NP to NP	one-place predicate
strong aspects of the analysis	correctly predicts false propositions (e.g. entailment between (4)a and (4)b, and (4)a and (4)c)	deals naturally with degree, straightforwardly accounting for comparative and superlative constructions
weak aspects of the analysis	no adequate treatment for comparatives and superlatives	leaves a set of adjectives (adjectives such as *false* and *former*) outside the analysis

Having briefly discussed the main claims and contributions of these different semantic analyses, we pursue our discussion on the identification and characterisation

[7] In the semantic framework used by Chierchia & McConnell-Ginet (1990), NPs are properties, i.e. functions that determine the collection of individuals which satisfy a certain property in a given world. Since, in their approach, adjectives share the semantic nature of NPs, they must also be properties.

of adjective classes. From the discussion presented above, we underline the common acknowledgement of the existence of two contrasting sets of adjectives, here illustrated by *luzidia* (glossy) and *falso* (false), and the identification of their general properties.

But differences between these adjectives amount to more than the semantic contrasts presented above. There are other relevant contrasts in terms of their linguistic behaviour. Comparing the data in (3) and (4) allowed us to identify differences regarding entailment patterns. (5) and (6) display important contrasts, namely concerning degree modification.

(5) a. a maçã luzidia
'the apple glossy'

b. a luzidia maçã
'the glossy apple'

c. a maçã muito luzidia
'the very glossy apple'

d. uma maçã mais luzidia do que a outra
'a glossier apple than the other one'

(6) a. o diamante falso
'the diamond false'

b. o falso diamante
'the false diamond'

c. * o diamante muito falso
'the very false diamond'

b. * um diamante mais falso do que o outro
'a more false diamond than the other one'

With regard to adnominal position, (5) and (6) show that there are no significant differences between **property ascribing adjectives** and **non-restricting adjectives**: both *luzidia* (glossy) and *falso* (false) occur in prenominal – see (5)b and (6)b – and postnominal – see (5)a and (6)a – positions[8]. As to degree modification, there are

[8] Although both adjectives occur in postnominal and in prenominal positions, there are contrasts to be accounted for, both in terms of distribution and meaning. In fact, although that is not the case of *falso* (false), most non-restricting adjectives seem to only occur in prenominal position. Given the complexity of this question and non-homogeneity of the elements belonging to the class of **non-restricting adjectives** in terms of linguistic behaviour, in this chapter we will not analyse this question any further. We come back to it in chapter 6, where we discuss in detail the role of adjective relative position in the NP, proposing an analysis that explains adjective distribution in adnominal position (both for **property ascribing adjectives** and **non-restricting adjectives**) and accounts for the meaning contrasts observed.

important contrasts: **non-restricting adjectives** do not seem to accept degree modification, as evidenced in (6)c and (6)d, while **property ascribing adjectives** combine freely with degree adverbs (see (5)c and (5)d). In the table below we organise the main characteristics we have identified regarding **property ascribing adjectives** and **non-restricting adjectives**.

	property ascribing adjectives	*non-restricting adjectives*
A-N modification	contribute to the delineation of NP denotation by introducing additional restrictions to those introduced by the modified N	determine NP denotation by changing the way the restrictions introduced by the modified N apply to the referent
entailment patterns	when occurring in constructions like (3)a, these adjectives entail sentences such as (3)b and (3)c	when occurring in constructions like (4)a, these adjectives do not entail sentences such as (4)b or (4)c, but they entail sentences like (4)d
degree modification	generally accept degree modification, naturally occurring in comparative and superlative constructions	do not accept degree modification; comparative and superlative constructions are ruled out

We have described and discussed the contrasts between **property ascribing adjectives** and **non-restricting adjectives** in terms of linguistic behaviour and semantic nature, showing that differences are relevant enough for these two sets of adjectives to be considered adjective subclasses. Also, we provided a general characterisation of these two adjective classes. Nonetheless, before pursuing our discussion, we should stress that these are not balanced subclasses, as **non-restricting adjectives** constitute a closed class of a relatively small number of adjectives with very specific properties. This fact has often lead authors to leave them aside and focus on the larger and more productive class of **property ascribing adjectives**[9].

In the following section we analyse this larger class in more detail, as its members, although sharing the common features pointed out above, also show contrasts amongst themselves in terms of linguistic behaviour. We discuss these contrasts in order to arrive at a sound characterisation of these adjectives linguistic behaviour, and to evaluate whether differences are relevant enough for us to consider the constitution of subclasses

[9] Kamp (1975) bases his analysis on this option, arguing for it as follows: "The original intuition which led to the second theory seems to be inapplicable to *alleged*. The same can be said to be true, to an almost equal degree, of adjectives such as *false*, *skilful*, or *good*. (…) This will certainly be unimportant once we have a complementary theory which deals specifically with such adjectives (…)." (Kamp, 1975:154)

of **property ascribing adjectives**. In section 3.3 we come back to **non-restricting adjectives** particularly focusing on the characterisation of their semantic contribution.

3.2. PROPERTY ASCRIBING ADJECTIVES

As previously stated, most adjectives are property ascribing adjectives. But property ascribing adjectives are not a completely homogeneous class, i.e. the way its members ascribe properties to the modified noun is not exactly the same, depending on the adjective we consider. In fact, the number of properties associated with the adjective and the way adjectives relate to the noun they combine with can be considerably different.

3.2.1. DESCRIPTIVE ADJECTIVES *VERSUS* RELATIONAL ADJECTIVES

Along the lines of several authors in the literature[10], Demonte (1999) proposes a classification of property ascribing adjectives based on a combination of syntactic and semantic criteria. Two subclasses are considered: **descriptive adjectives** and **relational adjectives**[11]. Each of these subclasses displays specific syntactic and semantic properties.

In order to investigate this question, let us start with the contrast in the number of properties introduced by members of these two adjective classes, represented in the examples below by adjectives *alto* (high) and *alimentar* (alimentary), and the way these adjectives relate to the noun they modify.

(7) o prédio alto
'the high building'

(8) a indústria alimentar
'the alimentary industry'

[10] See, for instance, Bosque (1993), Schmidt (1972) and Bache (1978).

[11] This is not the terminology used by Demonte (1999). These adjectives have received different names in the literature, depending on the authors analysing them: ***quality***, ***central*** or ***descriptive adjectives*** *versus* ***class***, ***category*** or ***relational adjectives***. We do not aim at providing an exhaustive list here. Our goal amounts just to pointing out the most relevant terms that have been used to talk about the same phenomena.
Our choice of the terms 'descriptive' and 'relational' is based on their transparency with regard to what we consider to be these adjectives characteristic features, namely their main properties and most salient linguistic behaviour.

Looking at (7) and (8), we see that, while *alto* (high) sets the value of the **height** attribute of *prédio* (building) to **high**, *alimentar* (alimentary) does not ascribe an individual property to *indústria* (industry). Instead, it establishes a relation between this noun and a set of properties corresponding to the features describing another noun: *alimento* (food)[12]. More precisely, relational adjectives establish a relation between the modified noun and the domain of another noun, *indústria* (industry) and *alimento* (food), respectively, in (8). Thus, descriptive adjectives, on the one hand, ascribe a single property, setting a value for an attribute. Relational adjectives, on the other hand, establish a link between the modified noun and a set of properties. Also, the way in which properties are ascribed to the modified nouns in (7) and (8) is quite different.

Ascribing a single property usually corresponds to an incidence relation of this property in the nominal referent[13], while introducing sets of properties usually entails more complex and diversified semantic relations. In fact, according to Bosque (1993), relational adjectives "establish a link between [the modified noun] and other domains which are external to them"[14]. Let us look at (9) and (10) to discuss these ideas in more detail.

(9) o vestido vermelho
'the red dress' (there is an X which is simultaneously a dress and a red object)
dress(X) $\wedge$ red(X)

(10) o cais marítimo
'the sea quay' (there is an X which is a quay and which has a relation R1 with the sea)
quay(X) $\wedge$ R1(X,sea)

Vermelho (red), in (9), refers to a constitutive feature of the modified noun *vestido* (dress), a feature that corresponds to a single property, the **colour** of the dress, which is set to **red** in our example. In (10), *marítimo* (related to the sea) introduces the set of

[12] This relation is particularly obvious in languages like English, which have noun-noun modification as a common strategy. In fact, a possible English translation for the NP in (8) is '*the food industry*', which makes apparent the relation between *alimentar* (alimentary) and *alimento* (food) we are acknowledging.
[13] Some cognitive semanticists like Gärdenfors (2000), on the basis of the analysis of expressions such as *red skin* or *red wine*, would like to deny the analyticity of expressions like *vestido vermelho* (red dress), in (9), as the conjunction of two predicates, arguing for a refined relational treatment of the property **red**. Recognising that the problematic data correspond to crystallised expressions, allows us to keep the analyticity hypothesis addressing this kind of adjectives.
[14] "[Los adjectivos relacionales] (…) no denotan cualidades o propiedades de los sustantivos sino (…) que establecen conexiones entre esas entidades y otros dominios o ámbitos externos a ellas" (Bosque, 1993:10).

properties that, together, define the noun **sea** and put them in relation with the noun *cais* (quay). The nature of this relation between the modified noun and the noun introduced by the relational adjective is underspecified and largely dependent on the context, changing from sentence to sentence. Let us look at the examples in (11).

(11) a. as eleições municipais
'the municipal election' (election for administrating a municipality)

b. o orçamento municipal
'the municipal budget' (budget available to a municipality)

c. as obras municipais
'the municipal works' (construction works developed by a municipality)

Although the relational adjective occurring in the NPs in (11) is the same, the relation established between the modified noun and the domain introduced by the adjective in each sentence has significant differences, as made apparent by the paraphrases presented between brackets. So, although in all three examples the adjective *municipal* (municipal) introduces a relation with the domain of *município* (municipality), in (11)a choosing an administration for the municipality is the **goal** of the election, in (11)b the municipality is the **beneficiary** of the budget, and in (11)c the municipality is the **agent** of the construction works. Moreover, differences such as the ones illustrated in (11) emerge from adjective-noun combination, thus being potentially endless. Being so, we argue that they should not be individually encoded in the lexicon, but rather accounted for by a combination of underspecified lexical entries – particularly via modelling these adjectives as introducing an underspecified relation between the modified noun and the domain of another noun (see chapters 4 and 5 for a detailed description of the modelling strategies we propose, mirroring this analysis and accurately accounting for the data) – and generative mechanisms, such as selective binding[15], for instance.

Although this is our general approach to relational adjectives, there are some apparently exceptional data we have to acknowledge and discuss before resuming our comparative description of the linguistic behaviour displayed by descriptive and relational adjectives.

[15] In chapter 5, we present and discuss generative mechanisms allowing for the construction of meaning in context, among which selective binding.

(12) o cais marítimo
'the sea quay' (there is a quay which has a relation with the sea)

(13) o fundo marinho
'the sea ground' (there is ground which has a relation with the sea)

In both (12) – where we recuperate the example in (10) – and (13) the modified noun is put in relation with the domain of the *sea* by a relational adjective. However, in these examples, the relational adjective establishing this relation between the modified noun and the sea is not the same. Moreover, although the domain introduced by both *marítimo* and *marinho* is the same – the sea – these adjectives are not interchangeable, not occurring in the same contexts. Looking closely to their distribution, we realize that *marinho* can only modify nouns which actually belong to the domain of the sea. Thus, while *marítimo* introduces the underspecified relation described above for other examples such as *alimentar* (alimentary), *marinho* seems to denote an inclusion relation, something like a meronymy relation between the modified noun and the sea. So, having argued, based on data in (11), that there were generative mechanisms available in language which allowed us to derive different relations between domains from underspecified lexical items, hence avoiding an approach involving a multiplicity of lexical entries, in the case of the adjectives in (12) and (13), we have to go the other way: although both *marítimo* and *marinho* introduce a relation to the domain of the **sea**, they are not synonyms, as they determine different relations between the modified noun and this domain. Hence, while for (12) we maintain the representation presented in (10) – quay(X) $\wedge$ R1(X,sea) –, with the adjective determining an underspecified relation between the modified noun and *sea*, with regard to *marinho* in (13) we argue that this adjective denotes a meronymy relation between the modified noun and the **sea** – ground(X) $\wedge$ X$\in$ sea. We claim, as stated above, that these examples constitute exceptional data. In fact, there are few lexicalised forms for expressing this meronymy relation, the most common strategy in languages like Portuguese for expressing that a noun belongs to a given domain being its modification by a PP introduced by the preposition *de* (of). (14) illustrates this: the contrast between the acceptability of (14)b and (14)c shows that there is no lexicalised form for expressing the concept of "belonging to the river", the adequate strategy for verbalising this idea being the PP *de rio* (of the river), as made apparent in (14)c.

(14) a. os transportes fluviais
'the river transportation' (there is transportation which has a relation with the river)

b. *os peixes fluviais
'the river fish'

c. os peixes de rio
'the fish of the river' (there are fish which belong to the domain of the river)

Being so, we argue that these lexicalised forms introducing a meronymy relation have to be encoded in the lexicon. This option is far from being significantly costly, as these are exceptional and rather rare forms. With regard to all other relational adjectives we maintain our original hypothesis: they introduce an underspecified relation with a particular domain.

But descriptive and relational adjectives do not show important differences only with regard to their intrinsic meaning and the semantic nature of the relation they establish with the modified noun. There are also crucial syntactic contrasts to be acknowledged. Below we present the distinguishing syntactic properties that are relevant for Portuguese, following work by Casteleiro (1981) and Demonte (1999) on these two adjective classes.

In the examples below, adapted from Casteleiro (1981:52), we can observe that, in Portuguese, descriptive adjectives can occur both in attributive and predicative contexts (see (16)a and (16)d), while relational adjectives occur almost exclusively in attributive contexts (cf. (15)a and (15)d)[16]. Both prenominal and postnominal positions are possible for descriptive adjectives in attributive contexts (vide (16)(15)a and (16)b). Relational adjectives, on the contrary, can only occur in postnominal position (see (15)a and (15)b). Finally, descriptive adjectives are gradable (cf. (16)c), i.e. they co-occur with degree adverbs, which is not the case for relational adjectives (vide (15)c).

[16] As shown in (15)d, predicative contexts with relational adjectives are generally ruled out. However, some specific contexts, such as the one presented in (i), seem to license predicative uses of relational adjectives. Contrastive and emphatic contexts, for instance, are amongst these contexts:

(i) As próximas eleições são autárquicas, não são presidenciais.
'next election will be autarchic, not presidential'

(15) a. Adoro as casas rurais.
'I love the houses rural'

b. *Adoro as rurais casas.
'I love the rural houses'

c. *Adoro as casas muito rurais[17].
'I love the houses very rural'

d. ?*Adoro as casas que são rurais. (*As casas são rurais.)
'I love the houses which are rural' ('the houses are rural')

(16) a. Adoro as paisagens calmas.
'I love the landscapes calm'

b. Adoro as calmas paisagens[18].
'I love the calm landscapes'

[17] As pointed out by González (1995), there is a margin of acceptability for certain constructions where relational adjectives are modified by degree adverbs, such as (ii) and (iii) below.

(ii) Ele comprou uma casa rural.
'he bought a rural house'

(iii) Entre todas as casas da aldeia, a dele é a que tem o ar mais rural.
'from all houses in the village, his is the one with the most rural look'

This acceptability seems to be based on the possibility of reinterpreting certain relational adjectives as descriptive. Looking at the examples above we can verify this possibility. In (ii) the adjective *rural* (rural) behaves like a typical relational adjective, the semantic content it introduces being somewhere along the following lines: 'relating or pertaining to the countryside'. Nonetheless, the same adjective modified in (iii) is interpreted quite differently, ascribing certain qualities to the house, in a way that is closer to the incidence relation typical of noun modification by descriptive adjectives. These qualities generally correspond to some prototypical features of country houses: he owns a masonry house, with wooden doors and windows, built in the middle of a field, for instance. Also, acceptable constructions such as the ones presented above usually appear in the context of expressions involving the subjectivity of the speaker – like *um ar* (a look/an aspect), in (iii). This fact strengthens the hypothesis delineated above, which consists in associating the acceptability of these sentences to a reinterpretation of relational adjectives, particularly of the way these adjectives combine with the modified noun in these contexts: instead of introducing a relation between the modified noun and a domain exterior to it, the adjective ascribes it a set of properties – the most typical properties of country houses according to the speaker.
Demonte's (forth.) analysis is along similar lines: the semantic interpretation received by relational adjectives in these contexts is what this author designates as the prototypicality reading, which consists in projecting the argument of the adjective onto a scale of prototypes. To illustrate this with our example in (iii), if country houses are prototypically **masonry houses**, with **wooden doors and windows**, lying **in the middle of a field**, then if x is above this prototypical standard, it can be considered very rural.

[18] Most descriptive adjectives, like *calmas*, can occur in prenominal position. However, that is not the case of all descriptive adjectives, as made apparent in (iv). In chapter 6 we present a detailed description of the distribution of adjectives with regard to their relative position in adnominal contexts, identifying the restrictions that account for contrasts such as the one presented in (iv).

(iv) a. Adoro o vestido vermelho.
'I love the dress red'

b. *Adoro o vermelho vestido.
'I love the red dress'

c. Adoro as paisagens muito calmas.
'I love the landscapes very calm'

d. Adoro as paisagens que são calmas. (As paisagens são calmas.)
'I love the landscapes which are calm' ('the landscapes are calm')

As these criteria are not always sufficient to make a clear-cut distinction between relational and descriptive adjectives, in particular due to some oscillation concerning predicative structures, Demonte (1999) proposes additional tests for determining which adjectives belong to each of these classes in a more accurate way: their occurrence in comparative structures, and the formation of polarity systems.

(17) a. O sabor desta laranja é mais doce do que o daquela.
'this orange taste is sweeter than that one's'

b. a laranja doce / a laranja amarga
'the sweet orange / the bitter orange'

(18) a. *Este sabor é mais mineral do que aquele.
'this taste is more mineral than that one'

b. o sabor mineral / *o sabor amineral / *o sabor não-mineral
'the mineral taste / the amineral taste / the non-mineral taste'

Although it is not a distributional property like those discussed with regard to the data in (15) and (15), the formation of polarity systems reinforces the idea that has been made apparent: relational adjectives have a more restrictive linguistic behaviour than descriptive adjectives. As it was the case with the distributional properties discussed above, descriptive adjectives form polarity systems (cf. (17)b), relational adjectives do not (vide (18)b). Also, as illustrated below, comparative structures with relational adjectives are generally ruled out (see (18)a), a behaviour which, obviously, is strongly related to the non-gradability observed in (15)c. Once again, descriptive adjectives accept these contexts (vide (17)a), as they co-occurred with degree adverbs in (15)c. These data are additional evidence showing that the distribution of relational adjectives is more restrictive than the distribution of descriptive adjectives. But most of all, besides acknowledging all the syntactical contrasts presented above, it is an important contribution to understanding why the set of occurrence contexts is much more limited for relational adjectives than for descriptive adjectives.

Actually, this is not completely unexpected if we consider the almost nominal status of relational adjectives. In fact, a comparative study of the expression of the kind of semantic content discussed in this section in languages like Portuguese and English strengthens this observation. Although, in order to obtain a more obvious correspondence in the glosses of our examples, we mostly chose to use relational adjectives for which there is a corresponding form in English, the most common way to express the semantic content associated to these NPs, in English, is noun-noun modification. This strategy is not available in Portuguese, but it certainly constitutes additional evidence supporting what we stated above – relational adjectives have an almost nominal status – since in languages like English the role played by relational adjectives is performed by nouns modifying other nouns, as shown in (19), where we illustrate this by presenting corresponding NPs involving relational adjectives in Portuguese and English.

(19) a. a intoxicação alimentar
'the poisoning alimentary'
b. the food poisoning

Jespersen (1924) was the first author to point out that one of the most important distinguishing features between adjectives and nouns was their denotation. According to this author, adjectives denote a single property while nouns denote more complex qualities. Interestingly, as stated above, this observation is also adequate to compare and characterise descriptive and relational adjectives. Hence, more or less in the same way nouns cannot be graded due to the complexity of their denotation – given that nouns denote sets of properties, it would be very difficult to know which of them was being graded –, relational adjectives cannot co-occur with degree adverbs nor participate in comparative structures, either. Concerning predicative contexts, and although that is far from being the general case, just as some nouns can be predicates, in specific contexts, so can some relational adjectives. This fact is consistent with the previously mentioned oscillation in the linguistic behaviour of relational adjectives regarding this aspect.

3.2.2. INDIVIDUAL-LEVEL ADJECTIVES *VERSUS* STAGE-LEVEL ADJECTIVES

Another aspect with regard to which adjectives do not behave in a homogeneous way concerns the internal structure of the property ascribed by the adjective. Nowadays, it is quite standard to acknowledge the role of event structure in verbal semantics. In order to capture phenomena associated with aspect and Aktionsarten, Moens & Steedman (1988) and Pustejovsky (1991b) argue for the need of a fine-grained analysis of verbal semantics, an analysis which provides the means to represent verb internal event structure and express the relations between events and arguments. These internal configurational properties of the event, i.e. the geometry of the event, allow them to account for complex syntactic phenomena, such as argument inversion and to capture the relation between alternations of polymorphic verbs, namely raising/control and causative/unaccusative alternations. In chapter 2 we showed that adjectives as a class are somewhere in between nouns and verbs, sharing properties with both these POS. Starting off with adjective linguistic behaviour that seems to provide evidence of the existence of some kind of internal structure of the property ascribed by the adjective, below we discuss the possibility of associating temporal restrictions – typical of verb semantics – to adjectives, as it has been done for verbs.

Among the crucial aspects regarding the internal structure of the property ascribed by the adjective is its time-stability. Properties ascribed by adjectives can either be circumstantial properties – passing stages of entities – or stable features – permanent properties which characterise a given entity and determine its belonging to a class. Related to the internal structure of the quality ascribed by the adjective, this issue has found particular attention within the scope of formal semantics.

We can track the association of adjectives to time back to Aristotle, who considered that, besides being able to work as predicates, adjectives could also carry a time reference, as they sometimes introduced temporary properties and other times stable ones. Bolinger (1967) was the first to discuss adjective time-stability in detail, identifying a contrast between two kinds of adjectives: temporary and non-temporary adjectives. He first related this contrast to prenominal and postnominal positions of adjectives in the NP, associating postnominal position to a predicative use of adjectives and prenominal position to an attributive use. Thus, within this analysis, the prenominal/postnominal contrast is reduced to the attributive/predicative distinction.

From then on, several authors have developed research on this subject, and used different tags to talk about these two adjective subclasses: episodic, stage-level adjectives; and stable, individual-level adjectives. According to Carlson (1977), the first author to use the designations 'stage-level' and 'individual-level' to characterise adjectives, these lexical items carry a time reference, in a way that may be easily put in parallel with the linguistic behaviour of verbs. Within his analysis, stage-level adjectives predicate over stages, over spatio-temporal fragments of an entity, while individual-level adjectives predicate over the entity itself as a whole. Associating adjectives to time is a crucial contribution for a better understanding of this POS. However, we argue that this approach calls for some precisions. Rather than carrying a time reference themselves – which clearly constitutes a problem, as an important number of adjectives are ambiguous with regard to time-stability –, we follow Higginbotham (1985) in considering that adjectives are associated to an event, a state to be precise, that has to be linked by time. This way, we are able to simultaneously make depend adjectives value for time-stability on the linguistic context in which they occur, and to determine and model adjective association to time as a definitional feature of this POS. We come back to this proposal in chapter 5, where we discuss its technical details and consequences.

The investigation on time-stability was originally developed in the context of research on the semantic nature of different adjective-noun configurations. Bolinger (*op. cit.*) used the temporary/non-temporary contrast to explain adjective distribution: attributive contexts would always convey non-temporary relations between adjectives and nouns, and hence, only non-temporary adjectives would be licensed in these contexts; also, only adjectives associated to temporary values could occur as secondary predicates. As shown below, although there are meaning contrasts between prenominal and postnominal adjectives, they do not correspond to differences in terms of time-stability. Thus, adjective position in the NP cannot account for time-stability contrasts in languages like Portuguese. Also, time-stability contrasts can hardly be fully explained by context: some restrictions in terms of adjective distribution show that, for some adjectives, the time-stability value is not context-dependent.

In order to test these time-stability contrasts, Bolinger (*op. cit.*) postulated the existence of two verbs *to be* with which these two sets of adjectives could combine: a

temporary one (be_{temp}), which combined with adjectives introducing a passing quality, a transitory state, situation or quality, hence entailing change and spatio-temporal restrictions; and a non-temporary *to be* ($be_{non\text{-}temp}$), that co-occurred with adjectives determining stable situations, permanent properties that characterise an entity, and are therefore outside the scope of any spatio-temporal restrictions. In Portuguese, as in other Romance languages such as Spanish and Italian, for instance, this contrast is clearly expressed in the syntax, making this difference, which in most languages can only be conceived at the interpretation level, explicit. In most Romance languages, there is no need to postulate two verbs *to be,* they exist. In Portuguese, for instance, the time-stability aspect is incorporated into two different lexicalisations: verb *ser*[19] ($be_{non\text{-}temp}$) and verb *estar*[20] (be_{temp}). Hence, we can use adjective distribution with regard to these verbs as a syntactic test which makes adjective time-stability apparent.

This syntactic test makes it possible to straightforwardly formulate some generalisations. If we test property ascribing adjectives against the co-occurrence with *ser* and *estar*, we verify that relational adjectives are always individual-level adjectives, since they only combine with verb *ser* in the few predicative contexts they occur in (see (20) below). As shown in (21)-(23), descriptive adjectives, on the other hand, have a less homogeneous behaviour: most descriptive adjectives, as *magra* (thin) in (21), co-occur with both copula verbs, i.e. are ambiguous with regard to time-stability. Nonetheless, there are some which can only co-occur with either *ser*, like *capaz* (capable) in (22), or *estar*, illustrated by *descalço* (barefoot) in (23), for instance.

(20) a. As eleições que se realizam hoje são autárquicas.
'the election taking place today $is_{non\text{-}temp}$ autarchic'

b.*As eleições que se realizam hoje estão autárquicas.
'the election taking place today is_{temp} autarchic'

(21) a. A Maria é magra.
'Maria $is_{non\text{-}temp}$ thin'

b. A Maria está magra.
'Maria is_{temp} thin'

[19] *ser* in Spanish and *essere* in Italian.
[20] *estar* in Spanish and *stare* in Italian.

(22) a. O João é capaz de resolver o exercício.
'João is$_{non\text{-}temp}$ capable of solving the exercise'

b. *O João está capaz de resolver o exercício[21].
'João is$_{temp}$ capable of solving the exercise'

(23) a. *O João é descalço.
'João is$_{non\text{-}temp}$ barefoot'

b. O João está descalço.
'João is$_{temp}$ barefoot'

Naturally, this so-called ambiguity is only relevant in predicative contexts such as those presented above since, as mentioned earlier in this section, adjectives occurring within an NP have an individual-level reading by default. This does not mean that adjectives like *descalço* (barefoot), which can only have a stage-level reading, cannot occur in attributive contexts. However, as shown in (24)a and (24)b, prenominal position is ruled out for these adjectives. We discuss phenomena related to adjective position in chapter 6.

(24) a. A Maria brincou com o rapaz descalço.
'Maria played with the boy barefoot'

b. *A Maria brincou com o descalço rapaz.
'Maria played with the barefoot boy'

Actually, adjective individual or episodic nature affects more aspects of its distribution than the co-occurrence with *ser* and *estar*. Bolinger (1967) notes a systematic contrast regarding adjective position: when the adjective occurs postnominally it seems to attribute a temporary property to the modified noun. As indicated by (24), in languages like Portuguese, which have two possible adnominal positions – before and after the modified noun – the individual or episodic nature of adjectives also has some influence on adjective adnominal distribution: stage-level adjectives do not occur in prenominal position. Participation in secondary predication constructions is also constrained by the internal structure of the property ascribed by the adjective: only stage-level adjectives can be secondary predicates (cf. the data in (25)).

[21] This sentence is sound for the interpretation that João is more than willing to solve that exercise, which is a possible reading of the Portuguese expression *estar capaz de* (be willing to), but this is not the sense in which the adjective *capaz* (capable) is used in (22)a. Hence, this interpretation, which would result in a well-formed sentence, cannot be considered a counterpart of (22)a, hence the grammaticality judgement associated to (22)b.

(25) a. *A Maria brincou inteligente.
'Maria played intelligent'

b. A Maria brincou descalça.
'Maria played barefoot'

Considering these data, there are two main families of analyses to account for the ambiguity of descriptive adjectives concerning time-stability: adjectives are marked for one of these values in the lexicon; these values are possible adjective readings and emerge from the context.

Assuming the first position has one major setback: if adjectives are marked in the lexicon as either individual-level or stage-level, we will need to have two different lexical entries for 'ambiguous' adjectives, like *magra* (thin) in (21), i.e. we have to duplicate them in the lexicon. Alongside with this position, according to which adjectives are marked for one of these values in the lexicon, it is also possible to assume the existence of some grammatical mechanism for changing the lexically marked value in specific circumstances. However, an operation such as this one is always computationally costly.

Cunha & Cintra (1984) adopt the second approach to this question. These authors defend that time-stability contrasts are only relevant in predicative contexts, as they consider this relation with time not to exist in adnominal contexts. Hence, according to them, it is the verb that establishes the link between the adjective and the noun that is responsible for marking adjectives as either individual-level or stage-level, i.e. adjective time-stability values are completely dependent from the context in which they occur. Ultimately, there is no internal event structure for adjectives. But, there are important problems regarding an analysis such as this one: if the internal structure of properties ascribed by adjectives is dependent on the context in which they occur and nothing else, it is hard to explain why not all descriptive adjectives can oscillate between individual and episodic values, as noted by Bosque (1993). The contrast between (22)a and (22)b, and between (23)a and (23)b, regarding adjectives *capaz* (capable) and *descalço* (barefoot) illustrates the problematic data.

Moreover, although adjectives that cannot alternate between individual and episodic values are those that more clearly show that there is a problem with the analysis mentioned above, when we consider that most descriptive adjectives have a preferred

reading – all speakers agree that, although the proper context can determine different time-stability values for the following adjectives (as illustrated in (26)-(27), where the sentence in (26)b and (27)a are less neutral to any speaker than (26)a and (27)b, as indicated by the propositions they entail, presented in brackets), *alto* (tall) preferentially denotes an individual property, while *doente* (sick) tends to be associated to an episodic value –, it becomes apparent that the linguistic adequacy of Cunha & Cintra's (*op. cit.*) approach still is not satisfying.

(26) a. A Maria é alta.
'Maria is$_{\text{non-temp}}$ *tall'*

b. A Maria está alta. (Maria has grown and is now tall)
'Maria is$_{\text{temp}}$ *tall'*

(27) a. A Maria é doente. (Maria has a very fragile health, constantly suffering from some disease)
'Maria is$_{\text{non-temp}}$ *sick'*

b. A Maria está doente.
'Maria is$_{\text{temp}}$ *sick'*

Demonte (1999) advances a proposal somewhere in between the two positions discussed above: 'ambiguous' adjectives are marked by default in the lexicon as individual-level predicates. Being a default value, it can be changed into a stage-level predicate by context with less important computational costs. There are very specific conditions for this operation to take place, such as co-occurrence with *estar* or with space-time expressions which promote a stage-level reading. This means that there is no need for duplicating lexical entries or for developing elaborated grammatical mechanisms for changing adjective features set in the lexicon. Demonte (*op. cit.*) does not elaborate on a proposal for accounting for the ungrammaticality of (22)b and (23)a, but we can assume that adjectives like *capaz* (capable) and *descalço* (barefoot) are marked in the lexicon as individual-level and stage-level, respectively. Not being default values, they block the time-stability changing operation, which is set for default values, and not for lexically marked values, i.e. being lexically marked, these values cannot change, no matter the contexts they occur in.

We assume Demonte's (*op. cit.*) approach with a slight modification: as shown by (27), not all 'ambiguous' adjectives are individual-level predicates by default. We argue that all 'ambiguous' adjectives are associated to a time-stability value by default, this

value being either individual-level or stage-level, depending on the specific adjective considered. Moreover, as any default value, these can be changed by context without very costly computational mechanisms. These small refinements in Demonte's (*op. cit.*) analysis allow us not only to account for the possibility of changing adjective time-stability values in context, but also to explain and model the existence of preferred readings.

3.2.3. INTERSECTIVE ADJECTIVES *VERSUS* NON-INTERSECTIVE ADJECTIVES

In section 3.1 we discussed contrasts regarding the relations established between the modified noun, and property ascribing adjectives and non-restricting adjectives. The generalisation presented then, according to which the denotation of NPs with property ascribing adjectives was built by set intersection, allowed us to distinguish these adjectives from non-restricting adjectives. However, as we have been showing in previous sections, property ascribing adjectives do not always show a homogeneous linguistic behaviour. In this section, we analyse the relation established between property ascribing adjectives and the noun they modify, in order to build NP denotation, in more detail.

(28) Ele tem tinta verde no quintal.
'he has green paint in the backyard'

(29) Ele tem um elefante pequeno no quintal.
'he has a small elephant in the backyard'

Although apparently similar, the relation established between adjectives and nouns presented in (28) and (29) shows relevant contrasts in terms of the way the property introduced by the adjective is ascribed to the modified noun. Demonte (1999, forth.) identifies these contrasts and, as illustrated in (30) and (31), uses two tests to make them apparent: 'ADJ for a N' paraphrases; and negation without entailing contradiction.

(30) a. Este produto é tinta verde.
'this product is green paint'

b. #Este produto é verde para uma tinta.
'this product is green for paint'

c. #Este produto, que não é verde, é tinta verde.
'this product, that is not green, is green paint'

(31) a. Este animal é um elefante pequeno.
'this animal is a small elephant'

b. Este animal é pequeno para um elefante.
'this animal is small for an elephant'

c. Este animal, que não é pequeno, é um elefante pequeno.
'this animal, that is not small, is a small elephant'

(30) and (31) show that *verde* (green) and *pequeno* (small) behave quite differently with regard to contexts such as 'ADJ for a N' paraphrases, and the introduction of negation without entailing contradiction. Adjectives like *verde* (green) do not accept these constructions, as shown by the ill-formation of (30)b and (30)c, clearly contrasting with the well-formed (31)b and (31)c. From data such as these, Demonte (1999, forth.) generalises that adjectives like *verde* (green), on the one hand, apply to the noun in an absolute way, i.e. if we place ourselves in a set theory framework, the denotation of NPs in which these adjectives occur results from a set intersection operation between the denotation of the modified noun and the denotation of the adjective, or, if we prefer, from a conjunction of one-place predicates, in a predicate calculus framework. On the other hand, adjectives like *pequeno* (small) apply to the noun in a relative way, and that is why (31)b and (31)c are possible Portuguese sentences. These adjectives, mostly dimension and psychological evaluation adjectives, refer to a comparison class, ascribing properties whose interpretation is considerably context-dependent. Thus, for this second set of adjectives, set intersection cannot be used to calculate NP denotation exactly in the same way as we did for the first set. These main ideas are further analysed in Demonte (forth.). In this work, Demonte (*op. cit.*) establishes a connection between scales and these adjective classes, particularly the type of linguistic behaviour illustrated in (30) and (31). We come back to this analysis in more detail in chapter 5, when we discuss the role played by the standard of comparison in the construction of NP meaning.

For Wheeler (1972) and Platts (1979)[22], some descriptive adjectives have a relational structure instead of being one-place predicates. According to these authors,

[22] Sharing the same basic ideas, these two proposals differ on a technical detail regarding the semantic nature of the second argument of the two-place predicates they postulated. In Wheeler (1972), the second argument is a set, while in Platts (1979) it is a property abstract, i.e. the former works on extensionality, and the latter on intensionality. The crucial difference between these two hypotheses is that properties are richer objects than sets.

these adjectives are two-place predicates and it is this internal structure that accounts for the comparison class introduced by these adjectives. However, as Larson (1999) remarks, these analyses do not provide an answer to the question of the ambiguity between intersective and non-intersective readings illustrated in (32).

(32) Olga is a beautiful dancer.
'Olga is beautiful & Olga is a dancer' (intersective reading)
'Olga dances beautifully' (non-intersective reading)

(example taken from Larson (1999))

The main reason for this is that they mix phenomena that are considerably different: non-intersectivity and comparison class relativity. Although these two phenomena are not the same thing, Wheeler (*op. cit.*) and Platts (*op. cit.*) use the same mechanism to account for both of them: appeal to a second argument in adjective semantics. As noted by Larson (*op. cit.*), this mechanism seems correct for accounting for comparison class determination, which was the purpose for which it was first introduced by Wheeler (1972). With regard to non-intersectivity, it fails to explain various aspects, namely, the relation between non-intersective readings and its adverbial counterpart (*Olga is a beautiful dancer – Olga dances beautifully*), a relation that is generally recognised by speakers' intuition. Thus, another mechanism is called for. This ambiguity involves complex phenomena that are outside the scope of this chapter. We come back to a thorough discussion of the data in chapter 5, where we present our analysis. In this section we continue with a description of the relevant data for establishing adjective classes.

Relational adjectives have always showed great homogeneity with regard to the linguistic aspects discussed throughout this chapter. Also in terms of the intersectivity *versus* non-intersectivity contrast, relational adjectives show a homogeneous behaviour: they are always intersective. This is not surprising given the properties we have already associated to this class, particularly features regarding degree.

Going back to descriptive adjectives, we have to underline that, naturally, not all examples are as clear as the ones provided above, and it is not always easy to establish the comparison class or the average value considered relevant for every specific context.

Larson (1999) was particularly interested in ambiguous contexts and presented a detailed analysis of adjective constructions showing ambiguity between intersective and non-intersective readings, such as the one presented in (32).

We find two main families of analyses for this question in the literature: those stating that this kind of ambiguity is due to the semantic complexity of the modified noun; and those that consider that it is the adjective that is at the origin of the ambiguity. Let us go through the main aspects of these two proposals, hand in hand with some illustrative examples, to conclude that both these approaches lack to account for part of the data.

Like Wheeler (1972) and Platts (1979), Siegel (1976) considers that it is the adjective that is at the origin of the ambiguity in (32), but her approach is completely different from theirs: the explanation for ambiguous sentences such as the one presented above is the existence of homonymic adjectives. This author bases her analysis on morphological data in Russian and, according to her, there are two distinct adjective classes whose members often share the same form, i.e. are homonyms, in English. The lack of economy of this proposal, which duplicates an important amount of entities in the lexicon, is, nonetheless, a weak point that is hard to ignore.

Moreover, and independently of the analysis we might assume, there are data which consist a problem to the general hypothesis that adjectives be the sole element responsible for the ambiguity in (32).

(33) a. O Carlos é um bom guitarrista. (non-intersective reading)
'Carlos is a good guitar player'
"Carlos is good as a guitar player, i.e. Carlos plays the guitar well"

b. O Carlos é um guitarrista bom. (ambiguous)
'Carlos is a guitar player good'
"Carlos is a guitar player & Carlos is good (a good person)"
(intersective reading)
"Carlos is good as a guitar player, i.e. Carlos plays the guitar well"
(non-intersective reading)

(34) a. O Carlos é um bom rapaz. (intersective reading)
'Carlos is a good boy'
"Carlos is a boy & Carlos is good"

b. O Carlos é um rapaz bom. (intersective reading)
'Carlos is a boy good'
"Carlos is a boy & Carlos is good"

Minimal pairs like these make it hard to maintain the general hypothesis that the adjective is the only element responsible for the ambiguity in sentences like (32): the contrast between (33) and (34) in terms of the number of possible readings can only amount to the nouns *guitarrista* (guitar player) and *rapaz* (boy), since the rest of the lexical material in these examples, as well as the syntactic structure in which it occurs, are exactly the same.

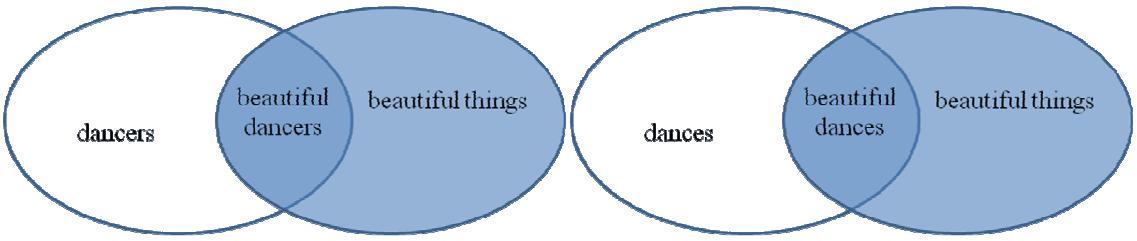
In an approach opposite to the ones we mentioned above, Larson (1999) states that it is the noun, and not the adjective, that is behind the ambiguity in (32). Along the lines of work on adverbs (Davidson, 1967), Larson (*op. cit.*) adopts an Event Semantics framework to account for the possible readings of sentences like (32). In order to do so, he associates events to activity nouns like *guitarrista* (guitar player) or *dancer*. The ambiguity of (32) and (33) is due to the complexity of the nouns *dancer* and *guitarrista* (guitar player), which make two features available for the adjective to modify. Let us look again at the sentence in (32), renumbered in (35).

(35) Olga is a beautiful dancer.
a. 'Olga is beautiful & Olga is a dancer' (intersective reading)
b. 'Olga dances beautifully' (non-intersective reading)

According to Larson's (1999) analysis, the ambiguity in (35) is due to the fact that *beautiful* can modify either the entity denoted by the noun *dancer* in (35)a or the event that is associated to this same noun in (35)b. Adopting a proposal along these lines allows us to explain the contrast between (33) and (34): *rapaz* (boy), unlike *guitarrista* (guitar player), is not associated to any event. Thus, there is only one semantic feature available to be modified by *bom* (good), and therefore there is no ambiguity.

This Davidsonian analysis of non-intersective adjective readings has some direct and wide-range consequences. Among them we underline the fact that non-intersective adjective readings – and, thus, the ambiguity of some adjective structures – are explained by the semantic structure of the modified noun and not by the semantic structure of the adjective. Also, the so-called non-intersective readings are not really non-intersective – the denotation of these readings is also built by set intersection, the difference being the intersected sets (dancer *versus* dance), as illustrated in the Venn

diagrams below. This allows for a unified analysis of all descriptive adjectives with regard to the way they contribute to NP denotation.



Moreover, this analysis offers an explanation for the relation between '*beautiful dancer*' and '*dances beautifully*', which is intuitively recognised by speakers. Also, it provides a similar approach for adjectives and adverbs, i.e. for all modifiers. Given this, this kind of ambiguity is no longer accounted for in terms of an intersectivity/non-intersectivity opposition. Thus, for the sake of accuracy in the use of terms, henceforth we designate these two readings as intersective and adverbial readings, respectively.

However, there are some data which are not accounted for by this analysis. Contrasts illustrated in (36)–(37) seem to indicate that there are other aspects to be considered besides the semantic structure of the modified noun, particularly its association to events.

(36) a. Foi uma invasão rápida. (adverbial reading)
'it was an invasion quick'
"something was invaded quickly"

b. Foi uma rápida invasão. (adverbial reading)
'it was a quick invasion'
"something was invaded quickly"

(37) a. *Aquilo é um saco rápido.
'that is a bag quick'

b. *Aquilo é um rápido saco.
'that is a quick bag'

The examples presented above, particularly the grammaticality contrasts between (36)a and (37)a, seem to indicate that not only the noun, but also the adjective must have certain specific characteristics for ambiguous cases to emerge. Adjectives like

rápido/a (quick), for instance, only modify events. That is why none of the examples above shows the kind of ambiguity observed in (32).

(38) a. Ela é uma bailarina rápida. (adverbial reading)
'she is a dancer quick'
"she dances quickly"

Not even an example like (38) displays the type of ambiguity under discussion here, even though the modified noun, *dancer/bailarina*, is the same in (32) and (38). This fact also explains the ill-formation of (37): differently from *invasão* (invasion) and *bailarina* (dancer), that are associated to events, there is no event in the semantic structure of *saco* (bag), thus making it impossible for it to be modified by an event modifying adjective like *rápido* (quick). We can also observe contrasts with regard to the occurrence of adjectives in prenominal position, which we discuss in detail in chapter 6. Moreover, if we take an adjective which only modifies first-order entities, we obtain the complementary results.

(39) a. *Foi uma invasão estreita.
'it was an invasion narrow'

b. *Foi uma estreita invasão.
'it was a narrow invasion'

(40) a. Aquilo é um saco estreito. (intersective reading)
'that is a bag narrow'
"that is a bag & that is narrow"

b. Aquilo é um estreito saco. (intersective reading)
'that is a narrow bag'
"that is a bag & that is narrow"

Contrastingly to what happened with *rápido/a* (quick), adjectives like *estreito/a* (narrow) only modify entities. That is why, once again, the examples in (39) and (40) show no ambiguity. But this time the ungrammaticality appears in (39): *invasão* (invasion) denotes an event, no first-order entity being available for modification in its semantic structure, thus making it impossible for *estreito/a* (narrow) to modify it.

These data lead us to conclude that the distribution of intersective and adverbial adjective readings cannot be explained neither only by the semantic structure of nouns, nor only by the semantic structure of adjectives. These readings, as well as the

ambiguity of sentences like (32), result from the combined semantic properties of both adjectives and nouns, namely adjective selection restrictions and the semantic nature – complex or not – of nouns.

3.2.4. RESTRICTIVE ADJECTIVES *VERSUS* NON-RESTRICTIVE ADJECTIVES

Besides the aspects discussed in previous sections, adjectives also do not behave homogeneously in what concerns their contribution to setting the denotation of the NP in which they occur: **restrictive adjectives**, or determinative adjectives, operate on the extension of the modified noun, setting the denotation of the NP to a subset of that extension; **non-restrictive adjectives**, also called by different authors adjectives of subjective quality, affective adjectives or valuing attitude adjectives, simply underline a feature of the entity denoted by the modified noun, imposing no changes to the denotation of the NP in which they occur. Let us clarify these ideas by looking again at the first example presented in this chapter, renumbered below.

(41) a maçã luzidia
'the apple glossy'

(42) a luzidia maçã
'the glossy apple'

As commonly acknowledged in the literature, the different readings mentioned above essentially depend on adjective position within the NP, i.e., in languages like Portuguese, whether it occurs in prenominal or postnominal position. Being so, the contrast between restrictive and non-restrictive readings can only be observed in descriptive adjectives, since relational adjectives do not occur in prenominal position.

Besides, since the contrasts discussed in this section deal with NP reference, particularly with the way adjectives change it or not, the restrictive/non-restrictive opposition is almost only relevant for definite NPs, as these NPs preferably have a referential reading, contrasting with indefinite NPs which tend to introduce new information.

Restrictive readings, illustrated in (41), are associated to postnominal positions and correspond to set intersection operations between the extension of the modified noun and the extension of the adjective, like the ones we have seen in previous sections of

this chapter. Thus, the adjective contributes to the delineation of the extension of the NP in which occurs, ascribing a property which is not necessarily nor generally associated to the modified noun. In our example in (41), the NP *a maçã luzidia* denotes the subset of apples that are glossy (as opposed to those that are dim, for instance).

Non-restrictive readings, exemplified in (42), are associated to prenominal positions and simply underline a property which is associated to the entities denoted by the modified noun beforehand in a given context. In (42), the NP *a luzidia maçã* simply stresses one of the distinguishing features of **that** apple we are referring to – the fact that it is glossy – thus having no impact on the denotation of the NP in which it occurs. The examples below provide additional data supporting these observations.

(43) *a maçã luzidia baça
'the apple glossy dim'

(44) a luzidia maçã baça
'the glossy apple dim'

(45) a maçã luzidia madura
'the apple glossy ripe'

The most salient aspect shown by the examples in (43)–(45) consists on the contrast between (43) and (44). Since *luzidia* (glossy) and *baça* (dim) somehow denote opposite states – although not contradictory –, when both of them simultaneously impose a restriction on the set denoted by the modified noun the result is an ill-formed NP (cf. (43)). The NP in (45) makes apparent that the ill-formation of this NP is not due to some restriction on the number of postnominal adjectives modifying a given noun: in this example, which shows a sound NP, two postnominal descriptive adjectives occur and impose restrictions of the modified noun *maçã* (apple), determining that the denotation of this NP consist on the set of apples that are simultaneously glossy and ripe. So, the reason for ruling out (43) must be linked to the specific characteristics of the adjectives occurring in this NP – particularly the opposition holding between *luzidia* (glossy) and *baça* (dim). However, if instead of a double restriction one of the adjectives considered in this example occurs in prenominal position, hence underlining one of the properties characterising the set of entities about which something is stated, instead of imposing an extra restriction to it, the well-formation of the NP is preserved,

as made apparent in (44). It is true that the example in (44) is a little bit unexpected, given the opposition relation between the two adjectives at stake. Nonetheless, despite the strangeness effect introduced by this opposition, the phrase in (44) is a well-formed and perfectly acceptable NP in Portuguese, which makes apparent the existence of a crucial difference in the role played by prenominal and postnominal adjectives.

It is commonly acknowledged that the contrast between restrictive and non-restrictive adjectives is a function of its position in the NP. Thus, it is probably more accurate to refer to restrictive and non-restrictive readings or functions, than to consider them adjective subclasses. In fact, it is generally accepted in the literature that restrictive/non-restrictive contrasts emerge from the syntactic contexts in which adjectives occur (in languages like Portuguese, postnominal or prenominal positions in the NP, respectively) and, hence, adjectives do not seem to be lexically marked neither for restrictiveness nor for non-restrictiveness. Nonetheless, not all adjectives occur in prenominal position. Thus, although most descriptive adjectives can have both restrictive and non-restrictive readings, this is not the case for all of them. We come back to this question, namely to the conditions determining adjective distribution with regard to their position in the NP, in chapter 6.

3.3. NON-RESTRICTING ADJECTIVES

In section 3.1 we described the linguistic behaviour of **non-restricting adjectives**, distinguishing them from **property ascribing adjectives**. In section 3.2 we focused on the latter, considering a large set of data which allowed us to see that, although they share a number of basic features, **property ascribing adjectives** are not a homogeneous class, and that it is possible to recognise well distinguished subclasses whose main characteristics have been established. Having done so, we will now focus on **non-restricting adjectives**.

As aforesaid, **non-restricting adjectives** constitute a closed class, relatively small and with very specific properties, facts that strengthen their kinship with semantic operators. As pointed out by Demonte (1999:139), unlike **property ascribing adjectives**, which contribute to the delineation of NP denotation by further restricting the set of entities denoted by the modified noun, these adjectives are used "to indicate the way a concept or intension of a term applies to a certain referent". Data in (4)

allowed us to confirm Chierchia & McConnell-Ginet's (1990) observation that adjectives like *falso* (false) show special entailment patterns, which distinguish them from **property ascribing adjectives**. These different entailment patterns indicate that the semantics of **non-restricting adjectives** has to be quite different from the semantics of **property ascribing adjectives**.

In the beginning of this chapter we discussed work by Kamp (1975) concerning the semantic representation of adjective meaning. We have seen that this author develops a semantic framework in which the idea of a predicate – and we should underline that for Kamp (*op. cit.*) most adjectives are one-place predicates – applying to an entity to a certain degree is made coherent and precise. However, adjectives like *falso* (false), i.e. **non-restricting adjectives**, as they are not properties but rather property operators, are not accounted for by this analysis. In fact, just like Kamp (*op. cit.*), we are considering these adjectives to behave like semantic operators, as functions. Being so, resistance to degree modification – in section 3.1 we have seen that **non-restricting adjectives** do not accept degree modification – is far from being surprising. In fact, it proceeds quite naturally from the semantic nature of this class of adjectives: functions cannot operate only "to a certain degree", they either do or they do not. Therefore, it is only natural that **non-restricting adjectives** do not co-occur with degree adverbs nor participate in comparative structures.

In this section we focus on these semantic aspects, as we aim at accurately establishing the semantic contribution of **non-restricting adjectives**. This will allow us to delineate precise and linguistically motivated modelling strategies for representing this adjective class in the lexicon (see chapter 5).

We have seen that the relation these adjectives establish with the noun they modify is considerably different in nature from what happens with the larger class of **property ascribing adjectives**: *falso* (false), for instance, is semantically interpreted as a function that maps the set of restrictions denoted by the modified noun onto a new one, this way determining NP semantic contribution as a set that needs not be related to the set of entities associated to the modified noun, in terms of set inclusion. This is surely not independent of the contrasts observed with regard to entailment patterns.

Recognising some similarities between these adjectives and adverbs – in particular, the fact that one can be paraphrased by the other –, Demonte (1999) designates these

adjectives as 'adverbial adjectives'. However, Demonte's (*op. cit.*) 'adverbial adjectives' include more items than those we are willing to classify as **non-restricting adjectives**, namely, adjectives that modify entities or processes occurring in time and in a given manner, instead of modifying their constitutive facet. As they modify entities occurring in time – i.e. entities which somehow denote an event – such adjectives are in fact considerably close to adverbs. Despite this, these adjectives behave like any other **property ascribing adjective**, the only difference being the type of object they select for and modify: they make the same type of semantic contribution to the construction of NP denotation, introducing an additional restriction to the set of properties determining the class of objects denoted by the modified noun (cf. section 3.2.3, particularly the discussion of (32)-(40)). Thus, we see no reason why we should not include them in the class of **property ascribing adjectives**. In fact, in order to account for the syntactic and semantic behaviour displayed by these adjectives we only have to assume that they select event denoting nouns. Also, this makes apparent that a designation such as 'adverbial adjectives' covers too many objects, a fact which has determined our choice for a more suitable and transparent tag for the group of adjectives we are discussing in this section: **non-restricting adjectives**.

In chapter 7 we discuss event modifying adjectives in detail. We will focus on their particularities in terms of linguistic behaviour, investigating whether their behaviour emerges from selection restrictions, and presenting an analysis to account for it. In the context of our discussion on **non-restricting adjectives**, the relevance of this group of adjectives simply concerns the fact that, by including event modifying adjectives in **property ascribing adjectives**, we are able to narrow down the group of **non-restricting adjectives**, obtaining a more homogeneous and consistent class of lexical objects this way.

Only adjectives determining the way the set of restrictions introduced by a term applies to a given referent will be considered to belong to this class, namely adjectives expressing the necessity or possibility of certain states of affairs, as well as the singularity, exclusivity or exhaustivity of a reference. Once again, this kind of semantic contribution reveals a kinship between these adjectives and semantic operators: both of them introduce changes to the way the denotation of nouns applies to the referent. So, the crucial common characteristic of these lexical items consists on the fact that they

work as functions, operating over the set of restrictions introduced by nouns. With the support of some examples, let us state this idea more clearly.

Adjectives like *falso* (false), *verdadeiro* (true), *suposto* (supposed), *presumível* (so-called), *alegado* (alleged), *mero* (mere), *mesmo* (same) or *único* (single) are among the more common non-restricting adjectives. In section 3.1 we discussed the case of *falso* (false) showing that, in contexts like (46), adjective-noun combination amounts to a function that operates on the set of restrictions denoted by the modified noun and somehow changes it. Thus, contrarily to what has been shown to happen with **property ascribing adjectives**, as previously noted, adjective-noun combination in this case does not amount to set intersection: *diamante* denotes the set of entities in the world that are diamonds; but *diamante falso* does not denote any subset of the set denoted by *diamante*, it denotes the set of entities that are not diamonds, but share some of its properties, such as glitter or colour, for instance.

(46) A polícia apreendeu o diamante falso.
'the police seized the false diamond'

(47) O juiz interrogou o alegado assassino.
'the judge questioned the alleged murderer'

(48) O inspector interrogou a única testemunha do acidente.
'the inspector questioned the only witness of the accident'

Let us now focus on (47) and (48). The semantic contribution of *alegado* (alleged) in (47) also does not amount to set intersection: *assassino* denotes the set of entities in the world that are murderers; but *alegado assassino* does not necessarily denote a subset of the set denoted by *assassino*, it determines the way the denotation of *assassino* (murderer) applies to the referent, more precisely that it is possible that the entities referred do not belong to the set of entities in the world that are murderers, i.e. that they may not be murderers. The semantic contribution of adjectives like *alegado* (alleged) consists on the introduction of a modality operator with scope over the denotation of the modified noun. In chapter 5 we propose a way to straightforwardly model this kind of semantic contribution in the GL framework. *Única* (only), in (48), expresses a different modality: exclusivity of the reference, indicating that the properties denoted by the modified noun exclusively apply to the referred object, excluding all other entities that might satisfy that set of restrictions.

Analysing these examples allows us to better understand the distinguishing features characterising **non-restricting adjectives**: instead of attributing properties to the modified noun, these adjectives determine the way its denotation applies to the referent. Moreover, the semantic contribution of **non-restricting adjectives** can be expressed in terms of modality values. This way, considering the examples presented above, *falso* (false) is associated to *negation*, *alegado* (alleged) to *possibility* and *única* (only) to *exclusivity*.

This analysis of **non-restricting adjectives** semantic contribution not only conforms to the data, but also explains why this is a closed class with a considerably reduced number of elements: the number of modalities being limited, it is only natural that the number of lexical items introducing them also be limited.

3.4. CONCLUSIONS

In chapter 2 we showed that, despite the differences between adjectives, it is possible to identify a set of common features which generally hold for all adjectives. We defined adjectives both as a syntactic and as a semantic category. However, as mentioned then, not all adjectives display all the characteristic features identified in chapter 2.

In this chapter, we take the presence or absence of some of these characteristic features, in combination with other properties, to establish adjective classes. We focus on contrasts that allow us to group adjectives together, and use them to characterise adjective subclasses.

First, we defined and characterised two adjective classes based on adjective intrinsic meaning – **non-restricting adjectives** and **property ascribing adjectives** –, the former being a relatively small class, with a very peculiar linguistic behaviour. As for the latter group, two subclasses were identified and characterised – **descriptive adjectives** and **relational adjectives** –, the latter subclass showing a very homogeneous linguistic behaviour, as repeatedly noted throughout this chapter, thus reinforcing its status as a subclass.

In a second moment, we discuss and characterise groups of adjectives with regard to the basic semantic relations they establish with the modified noun. We arrive at the following groups of adjectives: **individual-level** *versus* **stage-level** adjectives;

intersective *versus* **non-intersective** adjectives; and **restrictive** *versus* **non-restrictive** adjectives. Also, we show that not all of these are lexically marked, some of them being context dependent. Therefore, for the sake of precision we should designate them as adjective readings, rather than as adjective classes.

Finally, we analysed the syntactic and semantic behaviour of **non-restricting adjectives**, particularly focusing on the characterisation of the semantic contribution made by these adjectives. We showed how these adjectives are associated to modal values, and how they operate on the nouns they modify, this way, determining how the denotation of a term applies to a given referent. This allowed us to show **non-restricting adjectives** kinship with semantic operators.

Ideally, the syntactic and semantic properties identified in this chapter would be encoded in lexical models, as shown in chapter 4. In chapter 5 we pursue our proposal for modelling adjectives in the lexicon, discussing the need for fine-grained, rich and structured representations.

CHAPTER 4

MODELLING ADJECTIVES IN COMPUTATIONAL RELATIONAL LEXICA

4.0. INTRODUCTION

In chapter 3 we took the presence or absence of some adjective characteristic features, in combination with other properties, to establish adjective classes. Following previous work (cf. Casteleiro (1981), Chierchia & McConnell-Ginet (1990), Demonte (1999, forth.), among others), we identified and characterised two adjective classes based on adjective intrinsic meaning – **non-restricting adjectives** and **property ascribing adjectives** –, the former being a relatively small class, with a very peculiar linguistic behaviour. As for the latter group, two main subclasses were described – **descriptive adjectives** and **relational adjectives**.

Ideally, the syntactic and semantic properties identified in chapter 3 as crucial properties of each adjective class would be encoded in lexical models.

Research in several domains, such as generative models of the lexicon (cf. Pustejovsky, 1995) and lexicalist models of grammar (cf. Pollard & Sag, 1994), has offered evidence sustaining the relational nature of the lexicon. Also, relational models of the lexicon have played a leading role in machine lexical knowledge representation.

Computational relational lexica, and wordnets in particular, are extensively used in language engineering and computational linguistics applications. Princeton WordNet (henceforth, WordNet) is recognised as a revolutionary reference system which combines a thesaurus with an ontological database, and is said to be the lexical resource which probably has the widest field of application in the domain of language engineering and computational linguistics (see Hanks, 2003). Moreover, originating from an experiment on the organisation of the mental lexicon conducted by George Miller in the early 80s, the WordNet model has strong psychological motivation.

Wordnets are electronic databases developed along the same general lines of the so-called Princeton WordNet (Miller, 1990; Fellbaum, 1998), an electronic database of English containing nouns, verbs, adjectives and adverbs, and structured as a network of relations between synsets (a set of roughly synonymous word forms, representing the same concept). In other words, in WordNet the meaning of lexical units is defined by their relations to each other. Several other wordnets have been developed for many other languages over the years, and the number of relations adopted by the system has been enlarged (see, for instance, EuroWordNet (Vossen, 1998)). However, in order to allow computational linguistics applications to cope with a number of different lexical semantics phenomena, concept-based computational lexica, such as wordnets, should adequately model non-explicit information and include information on event and argument structures (see Marrafa (2005) and Amaro et al. (2006)). In this chapter we show how wordnets can be integrated with a finer-grained lexical description framework, through the definition of new relations, in order to deal with various complex lexical semantics phenomena in a general and systematic way. Such an extension can be used both for deep lexical semantics analysis in computational grammars, and as a finer-grained linguistic knowledge-base in inference systems.

Having discussed the relevant empirical issues in the previous chapter, here we show that, despite the importance of the information that can be extracted from the hierarchical organisation of lexical items, extending wordnets to all the main POS, and particularly to adjectives, involves a revision of certain commonly used relations and the specification of several cross-POS relations. We propose a small set of lexical conceptual relations which allow for encoding adjectives in computational relational lexica in a principled and integrated way, presenting some strategies in order to mirror adjective definitional features in the network, so that adjective classes emerge from the relations expressed in the database. The results of our research were encoded in WordNet.PT, in order to test the adequacy of the set of relations established in this chapter, particularly whether it allows for a straightforward and intuitive representation of adjectives in relational models of the lexicon.

4.1. WORDNET, EUROWORDNET AND WORDNET.PT

As well known, the experiment conducted by George Miller on the properties of the mental lexicon in the early 80s pointed out that lexical meaning is derived from a set of lexical and conceptual relations among concepts. Subsequently, a computational lexicon conceived as a semantic network has been built: the Princeton WordNet (Miller, 1990; Fellbaum, 1998). Given its psychological plausibility and its crucial role for applications like machine translation, information retrieval and language learning systems, among many others, this relational model of the lexicon is being extensively adopted for machine lexical knowledge representations, playing a leading role in this field.

One of the most salient undertakings in this domain is EuroWordNet (Vossen, 1998), a multilingual database which stores wordnets for several European languages that follow the same main lines of the Princeton WordNet and are inter-related amongst themselves.

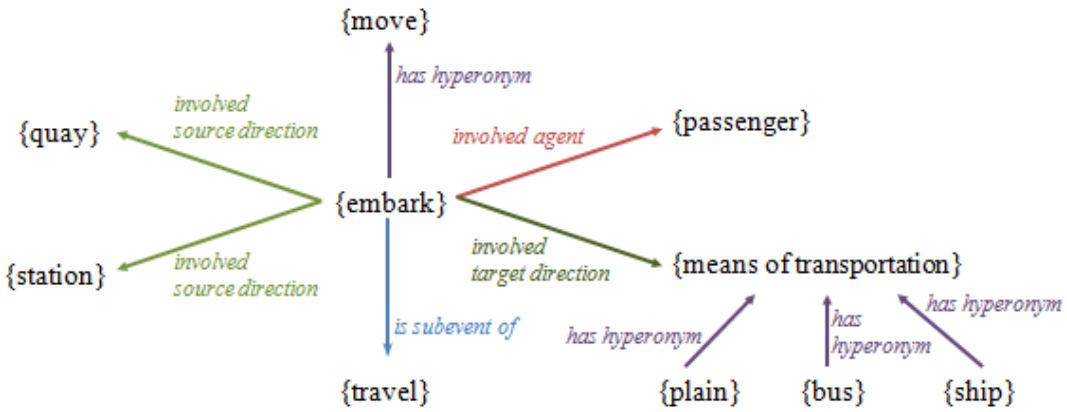
EuroWordNet wordnets follow the Princeton WordNet model, but are richer concerning both the number and the nature of conceptual relations. WordNet.PT, a wordnet for Portuguese (Marrafa, 2001, 2002), is being developed in the general EuroWordNet framework. However, basic research has been carried out on Portuguese in order to guarantee the accuracy of WordNet.PT, a work that has already led to some changes and new directions (cf. Amaro et al. (2006), Marrafa et al. (2006), and Marrafa & Mendes (2006)).

Also, WordNet.PT reflects a more extensive use of relations encoding information related to the event and argument structure of lexical items (see Marrafa (2005) and Amaro et al. (2006) for more details). Hence, the WordNet.PT network is considerably denser than WordNet. On one side, the system, following the general framework of EuroWordNet, allows the encoding of non-hierarchical information. On the other, partially as a result of the work developed within the scope of this dissertation, a small set of new relations, particularly a few cross-POS relations, has been defined to encode information which is not usually specified in wordnets.

As WordNet reveals some shortcomings for some computational linguistics applications, various authors have developed strategies for combining several information databases in order to overcome the lack of information for application purposes. Dorr & Olsen (1996) and Dorr et al. (1998), for instance, in the context of a

multilingual generation task for machine translation, combine the information encoded in WordNet with a repository of verb Lexical Conceptual Structures (Jackendoff, 1990), LCSs, henceforth, in order to be able to distinguish between semantically close lexical items. This repository of verb LCSs is used to add semantic information to the knowledge base when the WordNet hierarchy is shallow, which is common for verbs. Although enhancing the WordNet model for application purposes is far from being the main concern of this dissertation, it is nonetheless a relevant issue to be considered in the design of lexical models, always hand in hand with linguistic adequacy naturally. In this chapter we show how language-descriptive richness can allow for interesting results in specific language engineering subtasks, namely word-sense disambiguation.

In WordNet.PT, the lack of information related to shallow hierarchies, particularly in the case of verbs and adjectives, is internally overcome, without the need to create a parallel database to encode non-hierarchical information. As in other EuroWordNet wordnets, the WordNet.PT network includes several conceptual relations that allow for encoding information concerning the participants in the event denoted by a lexical item, as well as the role they play. The scheme presented below, presenting a part of the network of relations of *embark*, illustrates this.



Dense local networks of relations, such as the one above, encode information concerning the argument structure of verbs. Hence, no parallel database is needed to make the semantic content of lexical items available, neither to distinguish between semantically close lexical items.

WordNet.PT also encodes information not usually specified in this kind of lexical resources. The work depicted in this chapter deals with the specifications for an accurate modelling of lexical knowledge in what concerns the lexical semantics of adjectives, in a EuroWordNet wordnet database for Portuguese: WordNet.PT.

4.2. ADJECTIVES IN WORDNET AND IN EUROWORDNET

Hyponymy is the main structuring relation both in WordNet and in EuroWordNet. However, as pointed out by Fellbaum et al. (1993) and Miller (1998), the semantic organisation of adjectives is entirely different from that of other POS: nothing like the hierarchies of hyponymic (in the organisation of nouns) and troponymic relations (in the organisation of verbs) is available for adjectives. Even if it is possible to find some small local hierarchies, *hyperonymy* is far from being the crucial semantic relation in the organisation of adjectives in relational lexical databases such as wordnets.

Despite these conclusions of research developed on adjective lexical organisation, namely within the scope of WordNet, some authors working within the EuroWordNet framework have considered the possibility of using *hyperonymy* as a structuring relation for adjectives. Hamp & Feldweg (1997), in the development of GermaNet, abandon the cluster organisation of WordNet[1] in favour of a hierarchical structuring of adjectives, arguing for a uniform treatment of all POS. Even though taxonomic chains of adjectives yield rather flat in comparison to those of nouns and verbs, these authors claim to derive more structural information from these small taxonomies than from clusters, as they seek to eliminate what they designate as the "rather fuzzy concept of indirect antonyms". However, although we agree with them in considering that the concept of *indirect antonymy* is not completely clear, it is not obvious to us why this fact should entail that adjectives must show a hierarchical organisation instead.

In ItalWordNet, Alonge et al. (2000) also organise adjectives into classes sharing a superordinate. These classes correspond to adjectives sharing some semantic features, essentially related to semantic domains, and are generally rather flat. These authors argue for the possibility of inferring semantic preferences and syntactic characteristics of adjectives found in the same taxonomy. The SIMPLE project addresses the semantics

[1] Cluster organisation corresponds to the strategy used in WordNet to encode adjectives, particularly descriptive adjectives. This strategy emerges from fundamental research results on the mental organisation of this POS, as described in detail further below.

of adjectives in a similar way, identifying a set of common features relevant for classifying and describing adjective behaviour. However, as noted by Peters & Peters (2000), even though similarities exist, "adjectives belonging to the same semantic class may differ from each other in numerous ways", i.e. the classes established in this way are not homogeneous in terms of linguistic behaviour.

As mentioned at the beginning of this section, WordNet preconizes a completely different approach: the hyponymic chains used for other POS[2] give place to adjective clusters. Also, descriptive and relational adjectives are distinguished in the database, first, by being encoded in separate files, and second, by the relations expressed in the network.

Descriptive adjectives are organised in clusters of synsets, each cluster being associated by semantic similarity to a focal adjective which is linked to a contrasting cluster through an *antonymy* relation. Therefore, *antonymy* is a basic semantic relation used in WordNet to encode descriptive adjectives. As argued for in Miller (1998), this cluster organisation of adjectives seems to mirror psychological principles. In fact, this organisation is clearly motivated if we consider that the main function of these adjectives regards the expression of attributes, and that an important number of attributes are bipolar, or at least considered as such (see section 4.3.1.1 for a detailed discussion on types of attribute values). Let us consider adjectives like *high* and *low*, illustrated below. The schema represents a partial view of the network of relations encoded for these two adjectives in WordNet 3.0.

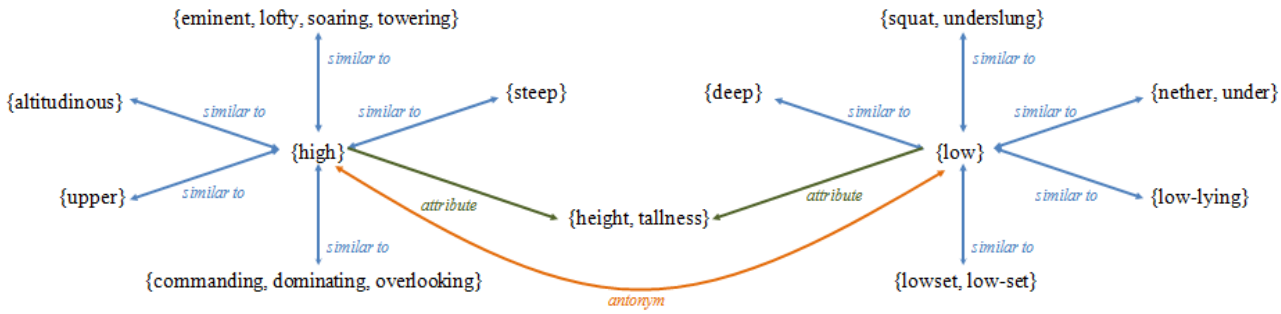


Fig. 1 – WordNet 3.0 representation of the network of relations of descriptive adjective synsets {high} and {low}

[2] In the case of verbs, these are troponymic chains.

In this schema the cluster effect around the two focal adjectives, *high* and *low*, is made apparent. There are nonetheless some shortcomings regarding the approach used in WordNet, namely regarding straightforwardness and redundancy of the relations expressed in the network. These aspects are discussed in sections 4.3.1.1 and 4.3.1.2, as we present and motivate our approach for modelling descriptive adjectives in wordnets.

With regard to relational adjectives, things are considerably different. Relational adjectives do not have antonyms. Therefore, they cannot be organised in opposite clusters. As thoroughly discussed in the previous chapter and as pointed out by Levi (1978), the intrinsic meaning of relational adjectives is something along the following lines: 'of, relating/pertaining to, associated with' some noun. In WordNet, relational adjectives are encoded as *pertainyms* of the nouns they are associated to. But not all, apparently. In the example below, taken from WordNet 3.0, we present four relational adjectives: *amphibious*, *aquatic, marine* and *terrestrial*. All four adjectives being typical relational adjectives, *marine* is encoded as a pertainym of *sea*, while *aquatic* shows a derivational relation with the noun *aquatic*, but no link to *water*. Even more surprising is the absence of any relation linking *amphibious* and *terrestrial* with *amphibian* and *earth*, respectively, as was to be expected (see Fig. 2). However, this does not seem to be a problem in the general approach designed to model these adjectives, but a problem in the development of the database, namely related to a lack of uniformity in the application of the criteria used for encoding relational adjectives in the network. The need for clarification with regard to the criteria applied in the modelling of adjectives is particularly apparent as we consider Fig. 2: *amphibious* characterising **beings** both adapted to life on **earth** and in the **water**, why is it represented as an *antonym* of *aquatic* and *terrestrial* and not as being *similar to* both these concepts?

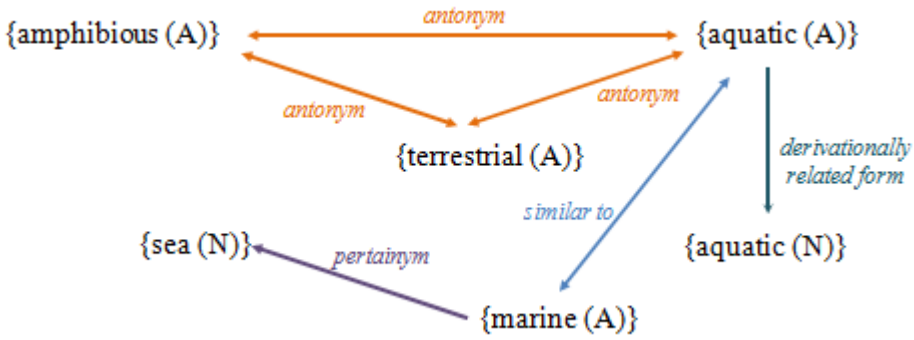


Fig. 2 – WordNet 3.0 representation of the network of relations of relational adjective synsets {amphibious}, {aquatic}, {marine} and {terrestrial}

The following, however, constitutes a challenge and an issue to be considered in the evaluation of the strategy used for modelling relational adjectives. In the schema above we chose some examples of relational adjectives encoded in WordNet 3.0 which exceptionally show *antonymy* relations[3]. The observation of the schema makes it obvious that the network of relations of relational adjectives is considerably sparser than what is generally the case for descriptive adjectives. This can constitute a problem for applications using wordnets as a resource. As noted by Boyd-Graber et al. (2006), WordNet potential as a resource for language engineering tasks such as automatic word-sense disambiguation is limited because of its small number of relations. We come back to the question of the density of the wordnet network further below. In our approach, presented in the following sections, we put forth some strategies for increasing the number of relations connecting synsets, thus refining the relationship between that synset and other concepts in the database.

Pursuing our general overview of adjective modelling in wordnets, let us go back to GermaNet. In GermaNet a distinct treatment of relational and descriptive adjectives is abandoned, as the distinction between these two classes is considered to be 'not at all clear'. Nonetheless, although adjective classes considered relevant are not the same in

[3] We discuss the status of the relation holding between these lexical items further below (cf. section 4.3.1.2), since, although conceptual opposition between these lexical items is undeniable, it is not clear whether we should be using an *antonymy* relation to link them.
Antonymy is a symmetric relation that seems to encode a large range of phenomena of opposition (Cruse, 1986), but this relation amounts to more than conceptual opposition: *antonymy* is a lexical relation, holding between word forms and not between word meanings (Fellbaum, 1998).

WordNet and in GermaNet[4], the strategy used for distinguishing between them is the same: listing lexical items in different files. This is a mere methodological option, but it can have an impact on the adequacy of the modelling strategy, since the 'tools' used in these wordnets for characterising lexical items are external to the model. Ideally, an adequate modelling strategy should be able to express the characterising features of each lexical item within the model itself, and doing so by only using its tools: if we place ourselves in a relational model of the lexicon like the WordNet model, semantic relations should be the only 'tool' used.

As pointed out in the previous chapter, even if the distinction between descriptive and relational adjectives is not always clear-cut, testing adjectives against the set of syntactic and semantic criteria presented there allows us to distinguish between these two adjective classes. Also, we consider that this distinction can be mirrored in the database via the semantic relations expressed in the network, adjective listing in different files not being therefore necessary. This approach means that no *a priori* classes are needed to model adjectives. Wordnet developers only have to consider adjective specific properties and use the relevant semantic relations to encode them in the database. Like this, adjective belonging to a given adjective class can be deduced solely from the semantic relations expressed in the database. In order to do this we propose several cross-POS relations. Such an approach has the advantage of coping with adjective representation in lexical semantic databases without using strategies external to the lexical model, such as *a priori* semantic classes or separate files corresponding to different classes.

4.3. MODELLING ADJECTIVES IN COMPUTATIONAL RELATIONAL LEXICA: ENCODING CROSS-PART-OF-SPEECH RELATIONS

Given that the semantic organisation of adjectives is unlike that of nouns and verbs, as this POS does not generally show a hierarchical organisation, encoding adjectives in wordnets calls for the specification of a number of cross-POS semantic relations. In the following subsections we propose some strategies in order to mirror adjective main

[4] GermaNet classifies adjectives into 15 semantic classes, consisting on the classes proposed by Hundsnurscher & Splett (1982) with some minor changes: perceptional, spatial, temporality-related, motion-related, material-related, weather-related, body-related, mood-related, spirit-related, behaviour-related, social-related, quantity-related, relational and general adjectives. One special class is added for pertainyms.

definitional features in wordnets, making it possible for adjective classes to emerge from the relations expressed in the network. We focus on property ascribing adjectives, leaving out, like Kamp (1975), non-restricting adjectives for the time being. We base our option on the following: non-restricting adjectives are a small adjective class, whose linguistic and logic behaviour is closer to semantic operators than to other adjectives, and semantic operators are not encoded in wordnets for the time being.

The strategies presented here were tested and implemented during the encoding of adjectives in the WordNet.PT database. Thus, most examples used to illustrate our arguments are taken from WordNet.PT.

4.3.1. STRUCTURING RELATIONS

In chapter 3 we have distinguished between descriptive and relational adjectives, showing that these adjectives differ in terms of their intrinsic meaning, as well as with regard to their syntactic and semantic behaviour. In the table below we present a brief summary of the properties presented then (for a detailed description and discussion of the data see section 3.2, in the previous chapter).

	descriptive adjectives	*relational adjectives*
differences in terms of intrinsic meaning		
number of properties introduced	ascribe a single property	introduce a set of properties
A-N modification	correspond to an incidence relation of the ascribed property in the nominal referent	establish a link between the modified noun and domains external to it
formation of polarity systems	yes	no
syntactic contrasts		
occurrence in attributive contexts	yes	yes
occurrence in predicative contexts	yes	no[5]
adnominal position	both prenominal and postnominal positions are possible	only occur in postnominal position
modification by degree adverbs	yes	no[6]

[5] Although, predicative contexts with relational adjectives are generally ruled out, there are some specific contexts, namely contrastive and emphatic constructions, which license predicative uses of relational adjectives (see chapter 3, footnote 16).

Having these properties as a starting point, we have established a small set of conceptual relations, some of which inherited from the general EuroWordNet framework, and others emerging from basic research on modelling adjectives, in computational relational lexica. Naturally, our approach is specifically concerned with the linguistic modelling of adjectives. However, besides being linguistically motivated, the approach we propose here overcomes some of the shortcomings of WordNet as a resource for computational linguistics applications: it allows for avoiding over-differentiation and under-differentiation of senses (see Marrafa & Mendes (2007) for a detailed discussion on this subject); also, by enhancing the language-descriptive richness of the database, it makes wordnets denser, and hence even more appealing for the NLP community (see section 4.3.2 for more details on the relevance of increasing the density of lexical databases in the perspective of language-based applications).

One of the major differences between WordNet and wordnets developed within the general EuroWordNet model is that WordNet was originally implemented in four distinct semantic networks, one for each of the major POS. This means that, even if they exist in later versions, few cross-POS relations are encoded in WordNet[7]. As mentioned above, adjectives show a very particular semantic organisation. Thus, encoding adjectives in wordnets calls for the specification of a number of cross-POS semantic relations. Developed within the general EuroWordNet framework, in WordNet.PT all POS are encoded together, and adjectives are no exception, making it easier to define and implement cross-POS links between synsets. We use these cross-POS semantic

[6] As discussed in detail in chapter 3, footnote 17, and following González (1995), there is a margin of acceptability for constructions with relational adjectives modified by degree adverbs, such as (i) and (ii) below.

(i) Ela viu um rapaz francês.
'she saw a french boy'
(ii) Ela viu um rapaz muito francês.
'she saw a very french boy'

We assume this acceptability to be based on the possibility of reinterpreting certain relational adjectives as descriptive: while in (i) *francês* (french) behaves like a typical relational adjective, the semantic content it introduces being somewhere along the following lines: 'relating or pertaining to France'; in (ii), the same adjective *francês* (french) modified by adverb *muito* (very) has a considerably different interpretation, ascribing certain internal qualities to the boy, in a way that is closer to the incidence relation typical of noun modification by descriptive adjectives. These qualities generally correspond to some prototypical, or even stereotype features of French boys: she saw a **flirty boy** wearing a **striped shirt** and a **beret**, for instance. For more details on this issue, see section 3.2.1, footnote 17.

[7] Essentially, WordNet contains links between words from different syntactic categories that are morphologically and semantically related (cf. Fellbaum & Miller (2003)).

relations to mirror adjectives main features in wordnet-like databases, hence making adjective classes emerge from the relations expressed in the database. The relations we argue to be appropriate to encode adjectives are presented below. We also show how they are more linguistically motivated than other approaches in the literature and how they conform to some complex phenomena.

4.3.1.1. LINKING ADJECTIVES AND ATTRIBUTES

In the previous chapter we have concluded that descriptive adjectives typically introduce an incidence relation of a single property in the nominal referent. Put somewhat simplistically, descriptive adjectives ascribe a value of an attribute to a noun, even though it has to be noted that there are different types of values associated to these adjectives: some introduce boolean values, others scalar values, and others, still, values that are neither one nor the other. Let us illustrate this with some simple examples. *dead* and *alive*, for instance, are adjectives associated to boolean values, respectively associating a **no** or a **yes** value of the **life attribute** to the modified noun. Among adjectives associated to scalar values we can mention forms like *hot*, *warm*, *lukewarm*, *fresh* or *cold*, which determine values along the **temperature** scale. With regard to the last case, adjectives that are neither boolean nor scalar, we can illustrate it with the example of colour adjectives like *black*, *white*, *red*, *green* or *yellow*, which ascribe a singular possible value of the **colour attribute** to the modified noun. So, boolean adjectives ascribe one of two possible values, whereas scalar adjectives determine one of many possible values organised along a scale. In the case of adjectives that are neither boolean nor scalar, these ascribe one of a closed set of possible values, characterised by not showing any particular relative order.

So, on the one hand, we have a common feature shared by all descriptive adjectives – all of them ascribe a value of an attribute to the modified noun –, that should be mirrored in lexical models. On the other hand, we have identified an aspect allowing for a finer-grained characterisation of adjectives and the establishment of subgroups of descriptive adjectives: the type of value ascribed. Encoding both these features in wordnets will naturally contribute to a more accurate lexical representation of this POS, in general, and particularly of descriptive adjectives.

As shown in section 4.2, the relation between adjectives and a given attribute is encoded in WordNet by linking some adjectives – cluster focal adjectives – to nouns lexicalising the relevant attribute, using the *attribute* relation. In WordNet.PT we use a semantic relation close to the *attribute* relation used in WordNet. However, since WordNet.PT is mostly used online as an electronic dictionary, we use the label *characterises with regard to*/*is characterised by* to make it more straightforward to the common user. With this semantic relation nouns are linked to adjectives as follows:

(1) a. {alto} **caracteriza quanto a** {altura}
'{tall} ***characterises with regard to*** *{height}'*

b. {altura} **é caracterizado por** {alto}
'{height} ***is characterised by*** *{tall}'*

Naturally, changing the tag used to identify this semantic relation from *attribute* to *characterises with regard to* is not our major claim with regard to this issue. Before pursuing our discussion on this matter, let us look at the following example, taken from WordNet 3.0.

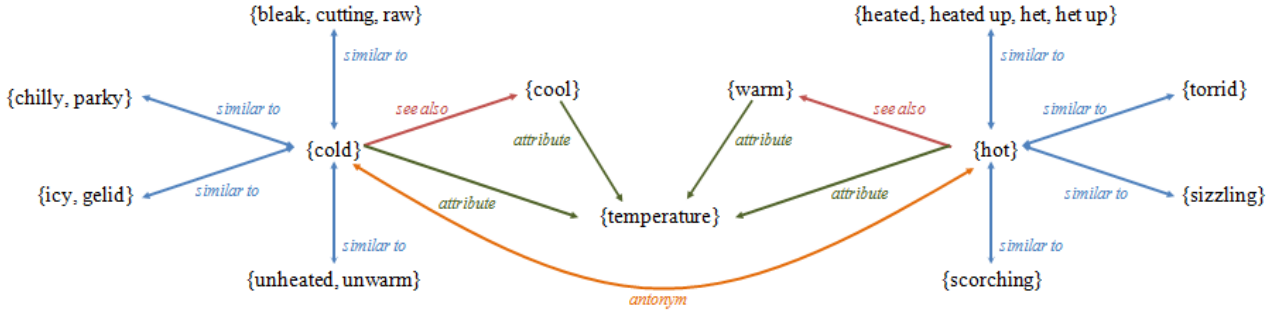


Fig. 3 – WordNet 3.0 representation of the adjective cluster around the {cold}/{hot} adjective pair

As mentioned, in WordNet 3.0, in each cluster, only focal adjectives, *hot* and *cold* in the schema above, are linked to the attribute whose value is ascribed by the adjective. This is considerably counter-intuitive, as most speakers agree that the relation holding between *cold* and *temperature* is just as strong as the relation linking *gelid* and *temperature*, or *scorching* and *temperature*.

Another problem concerning the strategy used in WordNet regards the relations used for the definition of adjective clusters. Besides the *antonymy* relation[8] opposing the two focal adjectives, a semantic relation tagged as *similar to* is used to group adjectives around each focal adjective. In Fig. 3, we also have another relation linking focal adjectives to other adjectives modifying the same attribute: *see also*. The linguistic motivation for using these two different links is not made very clear. In fact, it seems to be an effect of the strategy used to encode certain descriptive adjectives: **temperature** being a scalar attribute, there are lexicalisations of middle values, such as *lukewarm*, for instance, that can hardly be classified as being similar to *cold* or to *hot*. Thus, encoding adjectives that ascribe values of scalar attributes becomes a problem. As *cool* and *warm* are opposing concepts that correspond to less extreme values on the **temperature** scale, they are also used as focal adjectives. Even if this strategy masks the basic problem wordnet developers are confronted with when modelling adjectives, it is not exactly the ideal modelling strategy, as it goes against speakers' intuition on two aspects: the use of two different semantic relations, *similar to* and *see also*, to encode the same basic lexical-semantic relation between synsets; modelling all attributes as bipolar, when some are not, as it is the case of colour adjectives[9]. In fact, if we look at the WordNet 3.0 representation for colour adjectives presented in Fig. 4, the result is even more counter-intuitive, as there is no apparent linguistic motivation for the contrasts between the set of relations used to encode *black* and *white*, on the one hand, and the rest of colour adjectives, on the other hand. As mentioned earlier, colour is not a scalar attribute, but it is not bipolar either. Thus modelling it in WordNet is bound to make some problems arise.

[8] See section 4.3.1.2 for a detailed discussion on the *antonymy* relation.
[9] See Demonte (forth.) for a detailed discussion on the nature of scales associated to adjectives, particularly dimension adjectives, value adjectives and colour adjectives. We come back to the semantic nature colour adjectives further below in this section.

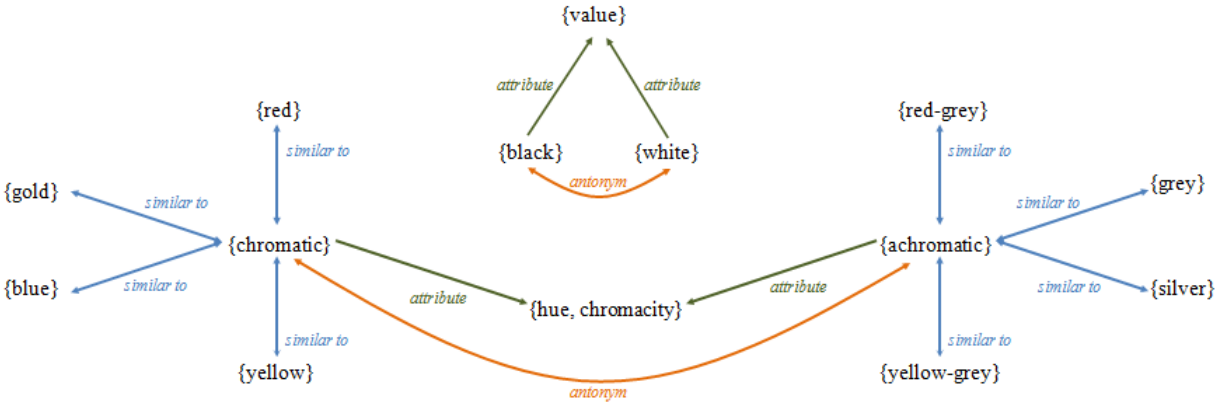


Fig. 4 – WordNet 3.0 representation of adjective clusters for **colour adjectives**

In Fig. 4, the focal adjectives around which colour adjectives are organised are somewhat artificial. But the most striking aspects are the following facts: there is no relation between *black* and *white*, and all the other colours; the attribute to which *black* and *white* are linked is not the same that is indirectly associated to the other colours; finally, some colours like *red*, *blue* or *gold* are *similar to chromatic,* while others, *silver* and *grey*, for instance, are *similar to achromatic*.

Thus, instead of linking adjectives amongst themselves by a similarity relation that clearly poses problems whenever we are not dealing with bipolar attributes, we argue that it is more informative and intuitive to link all adjectives ascribing values of the same attribute to the lexicalisation of this attribute. Like this, we no longer need the not very clear *similar to* and *see also* relations. Moreover, without having to encode it directly – and somewhat artificially – in the network, we obtain the cluster effect argued to be on the basis of the organisation of adjectives (Fellbaum et al. (1993) and Miller (1998)). The difference is that the cluster is not formed around pairs of opposite adjectives, but around a common attribute. This approach eliminates the representation problems illustrated in Fig. 3 and Fig. 4.

So, going back to our example in (1), along with *alto* (tall), an adjective such as *elevado* (high) or *baixo* (short), will be linked to *altura* (height).

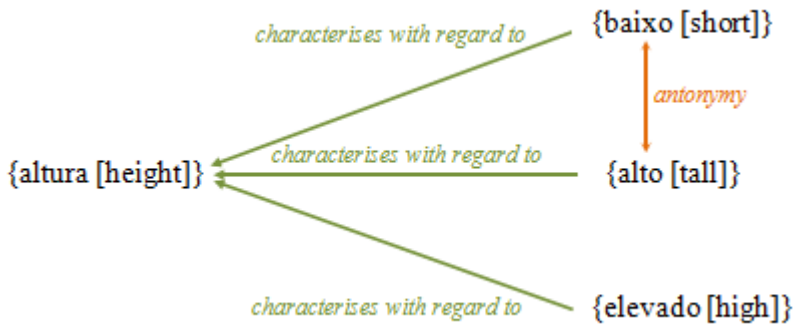


Fig. 5 – WordNet.PT partial representation of the adjective cluster around the attribute synset {altura [height]}

With this strategy, attributes become the crucial element determining adjective clusters, instead of the pairs of opposite adjectives, which is a more intuitive and motivated approach. This solution overcomes another sometimes problematic issue we have not mentioned yet: the need for defining the focal adjectives for each adjective cluster. If in many examples this is not a problem, in some cases, like that of colour adjectives in Fig. 4, the encoding solution can be very strange: considering that *chromatic* and *achromatic* be the central adjectives in this cluster is far from mirroring speakers' intuitions concerning which are the most salient lexical items in this adjective cluster. However, just as it overcomes the shortcomings mentioned above, this strategy also results in a loss of information, particularly relevant in the case of scalar attributes: although, in WordNet, this is not explicitly stated in the network, by choosing two focal adjectives and organising the other adjectives around them often results, in the case of scalar adjectives, in the linkage of adjectives associated to values roughly situated in the same area of the scale.

But, before discussing this question in detail and showing how we overcome this loss of information, let us consider adjectives that are not associated to scalar attributes, as in this case our strategy is clearly much more accurate. Colour adjectives are an example of such adjectives. In her discussion of scales and comparison standards Demonte (forth.) points out that colour adjectives are typical examples of intersective predicates, being very similar in this regard to certain shape adjectives. In fact, as pointed out by this author, all these adjectives fail to originate pairs of forms, one describing lack of a property and the other its existence. Moreover, although colour

adjectives appear to be gradable, accepting various types of degree modifiers, degree modification in this case entails considerable differences in meaning. Degree adverbs co-occurring with colour adjectives project the argument of the colour adjective onto a scale containing prototypes of that colour rather than onto one containing an ordered set of degrees.

(2) a. O vestido dela é demasiado vermelho.
'her dress is too red'

b. O vestido dela é muito vermelho.
'her dress is very red'

Both examples is (2) are acceptable, but the meanings of *demasiado vermelho* (too red) and *muito vermelho* (very red) are a bit special. Demonte (forth.) designates these readings as prototypicality readings and argues that the reading in (2)a can be obtained if we compare the **colour** of the **dress** in (2) with a second one which is closer in certain features (brightness, quality, etc.) to the colour that defines a **'typical' red**. Similarly, but not exactly in the same way, in (2)b we are confronting the **dress** with our subjective expectations regarding its colour. Hence, in Demonte's (*op. cit.*) words "degree, prototypicality/subjective expectation and quantity are the concepts we need to describe how modifiers interact with nouns in expressions with colour adjectives" (Demonte, forth.:28).

Fig. 6 presents a partial view of the network of relations of colour adjectives in WordNet.PT. In this network all colour adjectives display the same relations with the attribute **cor** (colour) and between themselves, which is a more faithful representation of how speakers organise these lexical items in their mental lexicon, as discussed above. *Antonymy*, which is the object of the following section, is the only exception with regard to this uniform 'distribution' of relations between colour terms.

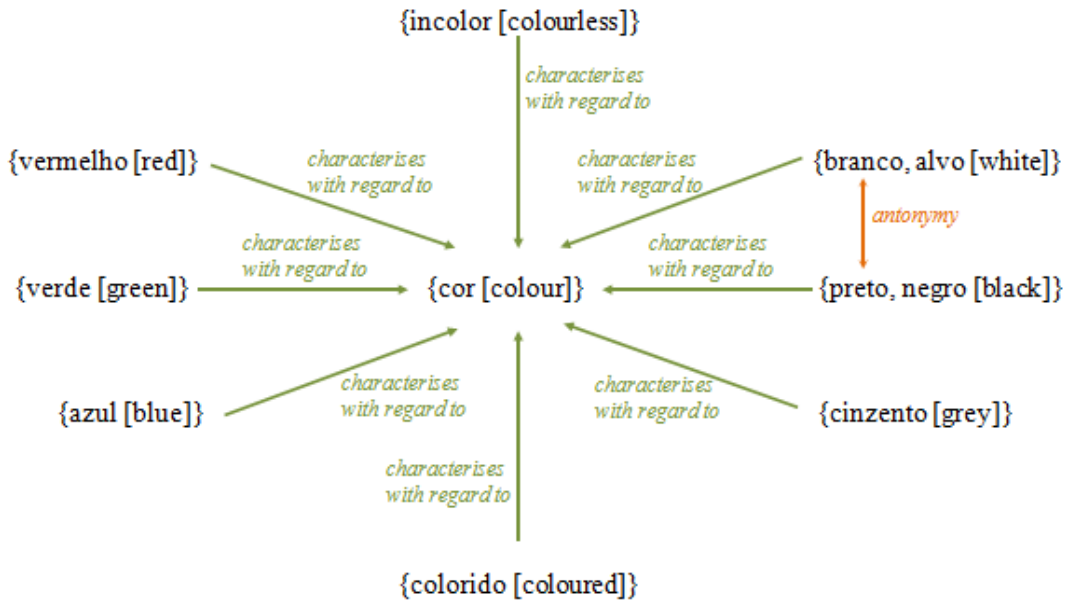


Fig. 6 – WordNet.PT representation of colour adjectives

So, using the *characterises with regard to/is characterised by* relation for encoding descriptive adjectives in wordnets allows us to accurately and straightforwardly model this adjective class without the need for artificial relations for establishing the cluster organisation characteristic of adjectives. However, if for adjectives such as the ones presented in Fig. 6 letting go of some of the relations used in WordNet results in a clear improvement in the accuracy and adequacy of the network, in the case of scalar adjectives the improvement also brings about some loss of information. We argue that introducing another relation for encoding the value of the attribute established by the adjective in the database prevents this loss of information.

Since the need for a new relation became apparent during the analysis of scalar adjectives, we begin by discussing this particular group of adjectives. Naturally, we do not advocate the encoding of a quantitative value associated to these adjectives, since, on the one hand, not all scalar adjectives are associated to easily quantifiable values and, on the other hand, establishing such values would be highly questionable. For instance, the concept of *tall* or *chilly* depends to some extent on the linguistic community considered: a *tall person* in Japan would probably be a rather **short** individual in Sweden; also, a *chilly day* in Greece is probably quite **warm** in Iceland. Moreover, such absolute values would potentially be endless in number. Besides, what is crucial with

regard to scalar adjectives is that they determine values that are organised relatively to each other. In fact, the schemas presented earlier in this chapter seem to indicate that scalar adjectives are somehow organised around areas of the relevant scale: two extremes and a middle value. Being so, we argue that what is relevant for the sake of the lexical encoding of scalar adjectives in wordnets is stating to which zone of the relevant scale belongs the attribute value ascribed by a given adjective. Once again, we stress that we are not talking about absolute values. So, if we consider adjectives associated to the **temperature** scale, and we state that an adjective like *cold* is on the **minus** side of the scale this does not correspond to saying that *cold* determines that the modified noun has a **temperature** below zero. In fact, the **plus** and **minus** sides of these scales are determined according to a **neutral point** which is sometimes lexicalised, but does not necessarily have to be. This neutral point corresponds to an average value recognised by the linguistic community, and not to a scientific standard such as the often conventionally defined zero value of a scale. Still considering the example of the **temperature** scale, this neutral point is lexicalised by an adjective like *lukewarm*, which determines a temperature roughly corresponding to human bodily temperature, minus-value adjectives determining temperatures clearly below this value, and plus-value adjectives temperatures above it. If we consider the **height** scale, however, no adjective lexicalising this neutral value is to be found.

What is crucial for the sake of our argument is that speakers in a linguistic community know which value is this, as well as which adjectives determine values on the positive and negative zones of the relevant scale. Hence we introduce a new semantic relation linking the adjective and the attribute value it ascribes, generally lexicalised by adverbs as shown in (3). We use the label *sets attribute value to/is the attribute value set by* to link adjectives as follows:

(3) a. {alto} **estabelece como valor do atributo** {mais}
'{tall} ***sets attribute value to*** *{plus}'*

b. {mais} **é estabelecido como valor do atributo por** {alto}
'{plus} ***is the attribute value set by*** *{tall}'*

The association of scalar adjectives to a **plus** or **minus** value, by linking adjectives to the relevant lexicalisation of these concepts, allows us to overcome the information

loss mentioned above. In order to do so, and before establishing any links in the database, we have to define these two concepts and encode them in the wordnet network. Being antonym concepts, both **plus** and **minus** evoke an **average value** within a scale: **plus** denotes values above this average value; **minus** denotes those that are below it. Hence, among these concepts characterising features is the fact that they determine relative values – or, more precisely, sets of values –, highly dependent on the scale considered. More importantly, these two concepts are obviously distinct from **yes** and **no** values, which determine the presence or absence of a given attribute. We come back to the latter further below, when we discuss boolean adjectives, specifically their main features and representation strategies for encoding them in wordnets.

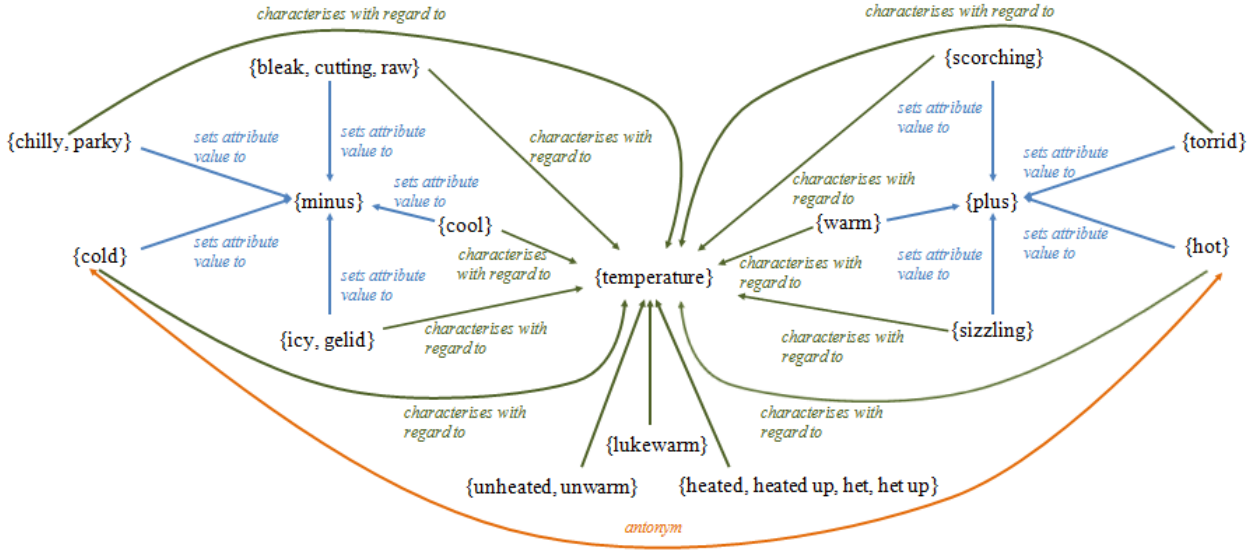


Fig. 7 – WordNet.PT representation of scalar adjectives: temperature adjectives

Going back to how the association of scalar adjectives to a plus or minus value allows us to overcome information loss, it becomes apparent in Fig. 7. In the schema above we present the WordNet.PT representation for adjectives ascribing different values along the **temperature** scale. Through the combination of the two relations put forth in this section – *characterises with regard to/is characterised by* and the *sets attribute value to/is the attribute value set by* – we are able to make the cluster effect to surface, without the need for using fuzzy relations nor for *a priori* choosing pairs of focal adjectives, often considerably artificial. In our proposal for representing

descriptive adjectives in wordnets, cluster formation is determined by adjective association to an attribute and, in the case of scalar adjectives represented in Fig. 7, to the general value set for that attribute by each particular adjective.

However, as mentioned at the beginning of this section, not all descriptive adjectives introduce scalar values. Some, like *dead* and *alive*, for instance, introduce boolean values. Unlike what has been shown to be the case of temperature adjectives, *dead* and *alive* are not associated to either positive or negative values of a given scale, but rather to the presence or absence of the relevant attribute – **life** – in the modified noun. If a given entity is *alive* then it has **life** in it, if it is *dead* it does not. So, boolean adjectives "mark" the modified noun either with a **yes** or a **no** value of the relevant attribute. In order to encode this in the lexicon, we can use the same relation put forth for representing scalar attributes. But this time the link has to be established with **yes** or **no** values, rather than **plus** or **minus**. Also, as no scale is involved in boolean adjectives, the number of adjectives associated to this kind of attribute is much smaller, the cluster to which they belong resulting considerably less dense.

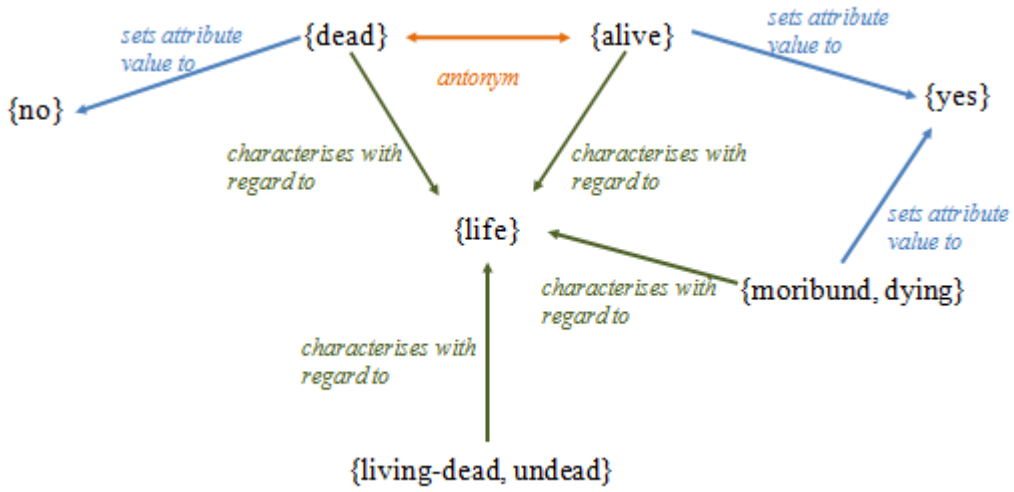


Fig. 8 – WordNet.PT representation of boolean adjectives: *dead* and *alive*

Given this, by using the two relations proposed in this section we are able to mirror the main definitional features of descriptive adjectives, and to make subgroups of this adjective class to emerge from the relations expressed in the database, particularly subclasses of adjectives that ascribe different types of attribute values to the modified noun. This fact is crucial not only from a purely linguistic perspective, as it contributes

for increasing the adequacy of the wordnet model, but also from the point of view of applications, particularly those involving inference engines. In fact, these adjective classes display different inference patterns, as shown in section 4.3.1.2, below (cf. (4) and (5)).

4.3.1.2. ANTONYMY

As shown by results obtained with word association tests, *antonymy* is also a basic relation in the organisation of descriptive adjectives. But before anything else, it is important to clearly characterise *antonymy*.

Unlike most of the semantic relations encoded in wordnets, *antonymy* is more than just a conceptual relation. As pointed out by Fellbaum et al (1993), this relation involves more aspects than simple conceptual opposition. Antonyms typically form contrasting categories within the same dimension, i.e. antonyms are competitors within a reasonable denotational range. This means that antonyms, on the one hand, contrast with each other in one or more features, but, on the other hand, they also share some features. Thus, testing *antonymy* has to consider these two aspects: the contrast; and the shared dimension. In the case of adjectives, the shared dimension is, for instance, the attribute involved in the semantics of the adjective, and the contrast, the different values of the attribute ascribed by antonym adjectives[10]. Both *hot* and *cold*, represented in Fig. 7, involve **temperature**, but *hot* sets this attribute to a high value, while *cold* determines a low value for it. Also, it has been noted that antonym adjectives share the same contexts (Deese, 1964)

Moreover, *antonymy* is a symmetric relation holding between lexical opposites and encoding a large range of opposition phenomena (Cruse, 1986). Naturally, here we focus on the kind of opposition phenomena observed in adjectives. In the previous section we already approached this question, although not from an opposition point of

[10] These aspects are explicitly encoded in WordNet.PT as shown in section 4.3.1.1. Particularly in the case of antonym pairs such as *hot* and *cold*, represented in Fig. 7: the shared dimension between these two lexical items consists on the attribute they set a value to – **temperature**, in this case –, to which both *hot* and *cold* are linked through the *characterises with regard to* relation; whereas the contrast corresponds to the value each adjective ascribes – **minus** for an adjective like *cold* and **plus** for *hot* –, to which they are respectively linked via the relation *sets attribute value to*.
This is particularly relevant as it can contribute for testing and, thus, guaranteeing the quality of the network of relations encoded in the database, since crossing the information represented through these different relations, *characterises with regard to/is characterised by* and *sets attribute value to/is the attribute value set by*, on the one hand, and *antonymy* on the other hand, allows to automatically test the integrity of our lexical network.

view, as we argued for the existence of different types of values ascribed by descriptive adjectives. Let us now consider these differences in the context of opposition relations to evaluate the impact they have on them. *Antonymy* links scalar opposites, with many values in between the extremes of the relevant scale (e.g. *hot* and *cold*), as well as complementary opposites (e.g. *dead* and *alive*). As can be observed in (4) and (5), the kind of opposition phenomena involved in these two antonym pairs shows different entailment patterns. (4)a and (5)a present the general test for *antonymy*: for an antonym pair X and Y, if something is X, than it is not Y. But, while in complementary opposites the non verification of one of the elements of the pair implies the verification of the other (see (5)b), in scalar opposites that is not the case (see (4)b).

(4) a. If something is **hot**, than it is **not cold**.
b. #If something is **not hot**, than it is **cold**. (it can be *warm*, for instance)

(5) a. If something is **dead**, than it is **not alive**.
b. If something is **not dead**, than it is **alive**.

This effect also proceeds from the relations we proposed for encoding these adjectives in wordnets. While in the case of boolean adjectives the value ascribed by the adjective is either **yes** or **no**, with scalar adjectives, even when the value ascribed by the adjective is **minus**, there is a presence of the relevant attribute in the modified noun to a certain degree. For instance, even when something is *freezing* it has some **temperature**, whereas when something is *dead* it has **no life**.

Another very important aspect regarding *antonymy* is the status of this semantic relation. As mentioned above, *antonymy* is more than just a conceptual relation. Naturally it involves a specific conceptual relation, opposition, but conceptual opposition is not enough for two lexical items to be considered antonyms. For example, in Portuguese, *comprido* (long) and *longo* (long) are synonyms. They also are conceptual opposites of *curto* (short): *comprido* and *longo* set the **length** attribute to a **plus** value; *curto* sets it to a **minus** value. However, any Portuguese speaker will agree that *antonymy* only holds between *curto* and *comprido*, and not between *curto* and *longo*. This fact allows us to understand better the nature of the *antonymy* relation: unlike most of the semantic relations encoded in wordnets, *antonymy* is a lexical relation. As it has been demonstrated, it obviously involves an opposition relation, but

the determination of whether it holds or not between two lexical items is made at the lexical level[11]. Thus, *antonymy* holds between word forms and not between word meanings as most of the lexical-conceptual relations encoded in WordNet, i.e., in the WordNet model, *antonymy* does not link synsets, it links word forms.

With regard to encoding *antonymy* in wordnets, there are no important differences to be acknowledged. There are nonetheless aspects worth discussing with regard to conceptual opposition.

In WordNet, conceptual opposition is used for the delineation of adjective clusters, via the encoding of *indirect antonymy* relations. As previously mentioned in this chapter (see section 4.2) the concept and the status of this relation is not very clear, and, it yields strange effects, namely when attributes are not bipolar and can take many values along a continuum.

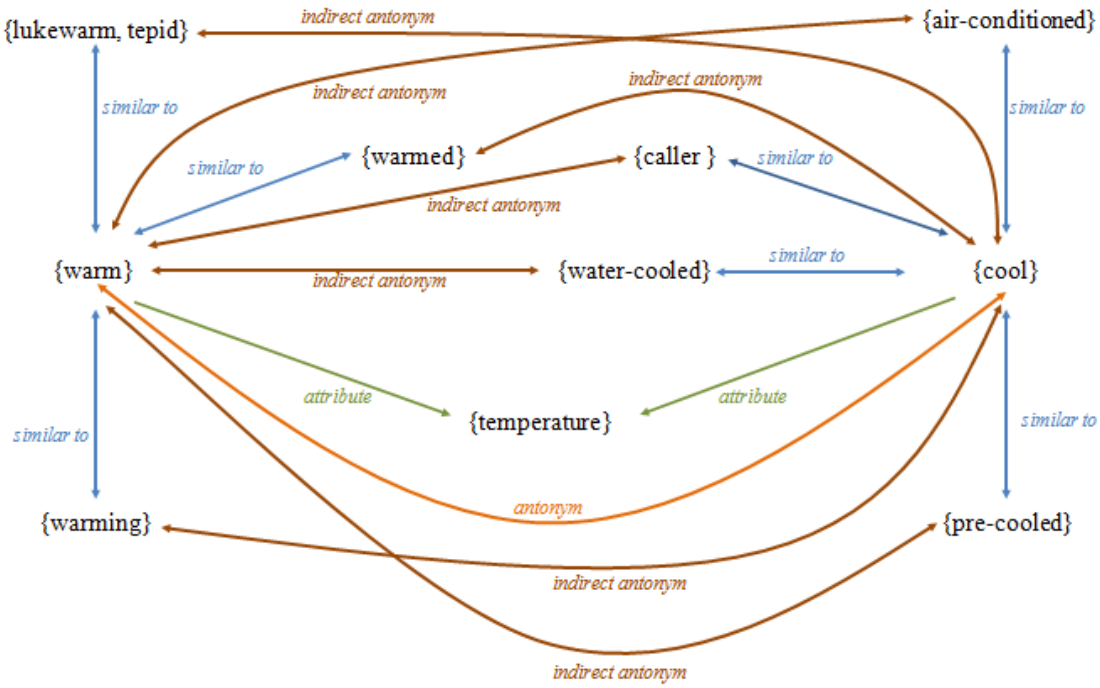


Fig. 9 – WordNet 3.0 representation of the adjective cluster around the {warm}/{cool} adjective pair

[11] Realising that not all opposition relations holding between synsets have the same status raises a fundamental theoretical question. The evidence provided that some opposition relations hold simply at the semantic level but others also hold at lexical level make the modular organisation of grammar become apparent, hence strengthening modular theories of grammar. Also, these data raise a theoretical question that remains unanswered: how is the interface between the different modules of grammar established? Clearly, this is a wide-range question calling for comprehensive basic research that is, nonetheless, outside the scope of this dissertation.

In WordNet, all adjectives *similar to* a certain focal adjective are *indirect antonyms* of the opposite focal adjective. For the sake of clarity of what was being discussed then, we chose not to represent *indirect antonymy* in the schemas presented up to this moment. We do now in Fig. 9, as we go back to our example of temperature adjectives.

Considering that *indirect antonymy* encodes conceptual opposition, this linking strategy has, as aforementioned, some strange results. Taking some examples from Fig. 9, we obtain, for instance, the following conceptual opposites:

- **{water-cooled} is an *indirect antonym* of {warm}** – and yet it is possible to imagine a context where something is cooled by means of water to a point where it is less hot, but still warm (and, thus, not necessarily cool);
- **{lukewarm, tepid} is an *indirect antonym* of {cool}** – although *lukewarm* corresponds by definition to a neutral temperature, neither cool nor warm.

Besides these undesirable effects, we argue that conceptual opposition does not have to be explicitly encoded in relational lexica, since it is possible to make it emerge, when it does exist. Earlier in this section we have shown how it can be deduced from the combination of *characterises with regard to/is characterised by* and *sets attribute value to/is the attribute value set by* relations, as the first allows us to identify a shared dimension and the second, when adjectives are associated to opposite values, depicts a contrast. Moreover, making conceptual opposition dependent on the combination of these two relations allows us to straightforwardly overcome the undesirable effects mentioned above. In section 4.3.1.1 we described in detail the encoding of scalar adjectives such as *water-cooled*, *warm*, *lukewarm*, *tepid* or *cool*. As shown in Fig. 7, we argue that synsets like {lukewarm, tepid}, which denote a neutral point in the **temperature** scale are not linked either to a **minus** or to a **plus** value. Along similar lines, but due to its underspecification with regard to the **temperature** value ascribed by *water-cooled*[12], this adjective is also only linked to the **temperature** attribute. Being so, and as they are not associated to any particular zone of the **temperature** scale, there is no conceptual opposition holding between *lukewarm*, *tepid* and *water-cooled* and any

[12] The concept associated to this synset focuses on a process undergone by the modified noun – it is submitted to water being used as a cold source in order to decrease its original temperature –, its result remaining underspecified: all we know is that its temperature has decreased, remaining underspecified to which level.

other synset linked to the **temperature** attribute. This way the undesirable effect described above is avoided. Moreover, and besides simultaneously taking into consideration *characterises with regard to/is characterised by* and *sets attribute value to/is the attribute value set by* relations, the combination of *synonymy* and *antonymy* relations also allows for the identification of conceptual opposition between lexical items. Let us look at the example presented in Fig. 10.

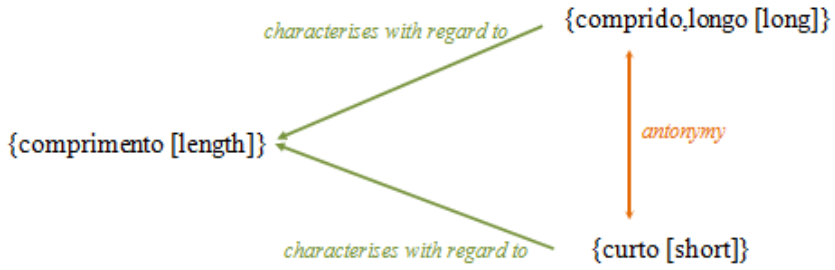


Fig. 10 – Conceptual opposition between *curto* (short) and *longo* (long): representation in WordNet.PT

In this case we have the antonym pair *curto* (short) / *comprido* (long), both linked to the nominal synset {comprimento [length]} via the *characterises with regard to/is characterised by* relation. Also, *comprido* (long) and *longo* (long) belong to the same synset, i.e. they are synonyms. Expressing this set of relations in the network entails that *longo* (long) is a conceptual opposite of *curto* (short), although it is not its antonym. This strategy enables us to discard the 'rather fuzzy concept of indirect antonyms introduced by WordNet' (Hamp & Feldweg, 1997). As shown, we can cope without the concept of *indirect antonymy*, which is not very clear. Actually, *indirect antonymy* is only used in WordNet to define adjective clusters. Since our approach allows us to obtain the cluster effect by combining *synonymy*, *antonymy*, *characterises with regard to/is characterised by* and *sets attribute value to/is the attribute value set by* relations, we do not need this somewhat problematic relation. Moreover, our strategy is more intuitive and descriptively adequate, since many attributes are not bipolar, but can take many values along a continuum.

In section 4.3, we have focused until this moment on structuring relations for descriptive adjectives. We pursue now with opposition relations for relational adjectives.

As pointed out in section 4.2, most relational adjectives do not have antonyms. This is not a surprising fact: differently from what is the case for descriptive adjectives, relational adjectives do not regard the expression of attribute values, and the fact that an important number of attributes are bipolar is the main motivation behind the crucial role of *antonymy* in the organisation of descriptive adjectives. Being 'pointers' to an exterior domain, typically lexicalised by a noun, relational adjectives ascribe sets of properties, which naturally do not show bipolar opposition with regard to other sets of properties. However, these adjectives sometimes have semantic opposites. In the EuroWordNet framework there is a separate relation used when "antonymy also holds for the other variants of the synset" (Vossen, 2002) and not only for a pair of word forms, i.e. when antonymy does not hold, but two synsets are conceptual opposites. The relation used in EuroWordNet to encode this information is *near antonymy*. In WordNet.PT we use this same relation to encode semantic opposites, namely in the case of relational adjectives.

(6) *terrestre* **é quasi-antónimo de** *aquático* and
aquático **é quasi-antónimo de** *terrestre*

'*terrestrial* ***is near_antonym of*** *aquatic* and
aquatic ***is near-antonym of*** *terrestrial'*

This relation should not be confused with the Princeton WordNet *indirect antonymy* relation, as we use *near antonymy* to express very different phenomena in the database[13].

4.3.1.3. LINKING ADJECTIVES AND SETS OF PROPERTIES

The observation that the distinction between descriptive adjectives and relational adjectives is such an important and obvious one that the way it is encoded in lexical models such as wordnets should allow these classes to emerge has been crucial in the delineation of our approach.

As previously mentioned, relational adjectives introduce sets of properties and determine a relation between them and the noun they modify. Being property ascribing

[13] This semantic relation is the object of ongoing research outside the scope of this dissertation as it involves complex and heterogeneous phenomena, namely of cognitive nature. Preliminary results seem nonetheless to indicate a dependency between human perspective and lexical opposition, as speakers tend to oppose, for instance, *terrestre* (terrestrial) to *aquático* (aquatic) and to *aéreo* (aerial), on the one hand, but usually do not oppose *aquático* (aquatic) to *aéreo* (aerial), on the other.

adjectives, along with descriptive adjectives, relational adjectives usually entail more complex and diversified semantic relations between the set of properties they introduce and the modified noun than descriptive adjectives do. In fact, relational adjectives establish a link between the modified noun, and a domain that is exterior to it. In WordNet.PT, like in WordNet, we encode this link through the symmetrical semantic relation *is related to*, as shown in (7).

(7) a. {aquático} **tem relação com** {água}
*'{aquatic} **is related to** {water}'*

b. {água} **tem relação com** {aquático}
*'{water} **is related to** {aquatic}'*

The *is related to* link is a very underspecified relation, mirroring the also underspecified nature of the link between the domain introduced by relational adjectives and the nouns they modify. All that can be generally stated in the lexicon to describe the semantic content introduced by relational adjectives is that they have a semantic link with the noun that lexicalises the set of properties they introduce. Thus, a very general and underspecified relation such as the *is related to* semantic relation serves well the purpose of expressing this semantic link.

In this dissertation we have repeatedly referred that relational adjectives are associated to a set of properties that, in general, corresponds to the denotation of a noun, hence establishing a link between the modified noun and a domain that is exterior to it. However this is not always the case. In (8) the set of properties ascribed by the adjective *sedativo* (sedative) corresponds to the denotation of the verb *sedar* (sedate), and not to the denotation of a noun.

(8) Alguns antidepressivos têm efeitos sedativos.
'some antidepressives have sedative effects'

⇨ Alguns antidepressivos têm efeitos que sedam.
'some antidepressives have effects that sedate'

Since the semantic relation we are using for encoding relational adjectives in WordNet.PT is very underspecified, data like (8) do not constitute a problem: we can use the same *is related to* relation to link adjectives and verbs, as shown in (9). The only adjustment to be made in the model consists in determining that this semantic relation

can be used both to link adjectives and nouns (see (7)), and adjectives and verbs (see (9)).

(9) a. {sedativo} **tem relação com** {sedar}
*'{sedative} **is related to** {sedate}'*

b. {sedar} **tem relação com** {sedativo}
*'{sedate} **is related to** {sedative}'*

Thus, in WordNet.PT, the main structuring semantic relations for encoding **descriptive adjectives** and **relational adjectives** in the network are: *antonymy* and *characterises with regard to/is characterised by* and *sets attribute value to/is the attribute value set by* relations, for the former; and *is related to*, for the latter. These semantic relations allow us to encode the basic definitional characteristics of these adjective classes in the database in a linguistically motivated way. In fact, given that the relations expressed in the network mirror the distinctive and contrastive linguistic behaviour of these adjective classes, it is possible for membership to these classes to emerge from the network of relations encoded in the database, without having to put any external mechanism to work for establishing to which class each adjective belongs.

4.3.2. ADDITIONAL RELATIONS

In previous sections we have delineated an approach for encoding the distinctive syntactic and semantic properties of adjectives in relational models of the lexicon such as wordnets. We introduced the basic structuring relations we are using in WordNet.PT to encode adjectives. In this section we present, discuss and motivate some additional semantic relations.

As briefly commented above, WordNet potential as a resource for NLP applications is limited because of its small number of relations (Boyd-Graber et al., 2006). In fact, given the absence of large corpora manually and reliably disambiguated to serve as "gold standards", WordNet has been used to solve the primary barrier in the development of reliable information retrieval, machine translation, summarisation and language generation systems: word-sense disambiguation. The rich semantic structure of WordNet can be used to solve the ambiguity of highly polysemous words. As well known, wordnets represent word senses in terms of the relationships they have to other

word senses. Thus, the internal structure of wordnets can be exploited, for instance, to help discriminate the multiple senses of a word form. Just to illustrate this, a noun like *bank* can be disambiguated by an automatic system if it considers the different hyperonyms of the synsets in which the form *bank* occurs, namely {slope}, {financial institution}, and {reserve}. Crossing this information with the context in which the ambiguous word occurs will allow the system to distinguish and identify the relevant word sense: if, on the one hand, there are contents regarding geological formations in the context, sense number 1 is to be selected; if, on the other hand, financial institutions are to be found, sense number 2 is probably the relevant one; for sense number 3 to be chosen, there should be a context concerning goods and their storage. An experience on applying a strategy along these lines to automated text summarization was developed by Chaves (2001) with promising results.

But because the WordNet network is relatively sparse, word-sense disambiguation methods using WordNet achieve only limited results. Thus, augmenting the density of wordnets can be decisive from the point of view of applications using it as a resource. Some WordNet users have tried to overcome the lack of relations by exploiting the definition and the example associated to each synset. In this context, Mihalcea & Moldovan (2001) automatically link each content word in WordNet definitions to the appropriate synset. Also, the Princeton WordNet team is now manually developing the same task (cf. Boyd-Graber et al. (2006)). However, even if this strategy increases the number of links expressed in the database, it still leaves many synsets unconnected, while simultaneously duplicating part of the information already contained in WordNet, since most definitions contain the hyperonym of the synset. Another way to link synsets is to assign them to domain fields (Magnini & Cavaglia, 2000), but often the domain labels are not a well-structured set and they cannot account for many of the associations we would like to encode in wordnets, in order to considerably improve the performance of applications.

Previously on this dissertation we have shown that adjective organisation in terms of semantic fields fails to provide crucial and general insights on adjective linguistic behaviour. Nonetheless, it is a salient classification approach, as proven by the amount of research work where semantic fields were the chosen criteria.

The SIMPLE project addresses the semantics of adjectives in this way (Peters & Peters, 2000), identifying a set of features claimed to be relevant for classifying and describing the linguistic behaviour of lexical items belonging to this POS. In this project, adjectives are organised in terms of semantic fields, but Peters & Peters (2000) note some important shortcomings of this approach: even though similarities exist, the classes proposed in SIMPLE are not homogeneous, as adjectives belonging to the same semantic field often differ from each other in various ways. This observation corroborates the reasons presented at the beginning of chapter 3 for discarding Dixon's approach (Dixon, 1977; 1991) – also an organisation of adjectives by semantic domains – as a crucial starting point for the research work presented in this dissertation.

The authors of GermaNet also split adjectives in 15 semantic classes (taken from the classes defined by Hundsnurscher & Splett (1982)) largely corresponding to the semantic domains they apply to (see section 4.2 for more details).

Despite the already sufficiently discussed shortcomings of the results of such research, these are fruit of serious and valid work that can be useful for other purposes besides identifying adjective distinctive and characteristic syntactic and semantic properties. Hence, it would be wrong to ignore them.

In WordNet.PT, we introduce a new relation, presented in (10), to encode salient characteristics of nouns expressed by adjectival expressions: *is a characteristic of/has as a characteristic*.

(10) a. {carnívoro} **é característica de** {tubarão}
*'{carnivorous} **is a characteristic of** {shark}'*

b. {tubarão} **tem como característica** {carnívoro}
*'{shark} **has as a characteristic** {carnivorous}'*

Despite the fact that we can object that the status of this relation in terms of lexical knowledge is not clear, it regards crucial information for many wordnet-based applications, namely those using inference systems, allowing for richer and clearer synsets. This relation allows us to express the most salient – often definitional – features of nouns in the network, thus contributing for making the sense of each synset clearer and richer. Many would consider this information to be outside the domain of lexical knowledge. We do not intend to make any strong claims about the limits of lexical

knowledge and meaning here, as this remains an open question in Lexical Semantics. However, we do claim that this relation may play a distinctive role in a lexical database like WordNet.PT. For instance, the possibility of, not only ascribing, but also of negating this relation allows us to encode contrasting definitional features of certain nouns in the database, as shown in Fig. 11.

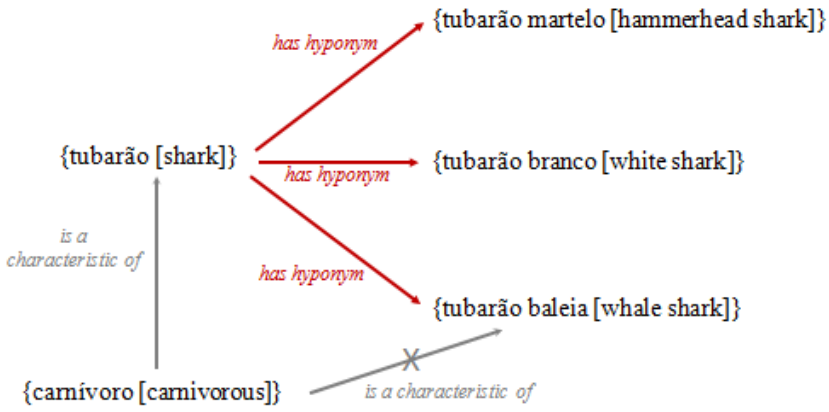


Fig. 11 – *is a characteristic of* relation around the synset {carnívoro[carnivorous]}: representation in WordNet.PT

Briefly commenting on the example presented in Fig. 11, one of the prototypical features of *tubarão* (shark) is that it is *carnívoro* (carnivorous). Nonetheless, this feature may not be a characteristic of all hyponyms of *tubarão* (shark). One of the distinctive features of an hyponym such as *tubarão baleia* (whale shark), for instance, is the fact that it is not *carnívoro* (carnivorous), and this is its specific difference, distinguishing it from its sisters. Being able to express this in the database is therefore interesting, not only because it meets speakers' lexical knowledge, but also because it can constitute crucial information for many wordnet-based applications, namely all those using inference systems. In fact, it expresses information just as crucial as the one encoded by some *meronymy* relations: *cafeína* (caffeine) being a *meronym* of *café* (coffee), and the negation of this *meronymy* relation being the specific difference of *descafeinado* (decaf), for example.

Moreover, this kind of data offers crucial insights on the organisation of the lexicon, particularly with regard to the way lexical meaning is shared between hyperonyms and hyponyms. In wordnets, it is generally assumed that the features of the mother are inherited by its daughters: daughters meaning consists on their mother features plus their own specific difference. However, the examples discussed above show that

inheritance mechanisms in relational models of the lexicon such as wordnets should be defined more thoroughly. Clearly, inheritance mechanisms are a pillar of the internal organisation of wordnets, since they are crucial in the definition of hyperonym relations, as made apparent in the beginning of this paragraph. Also, they contribute significantly to the economy and parsimony of the WordNet model, as only new specific information needs to be associated to each synset and, thus, encoded in the database. Significant and determining in the design of wordnets, it has, nonetheless, been understood in a sense that is too wide, hence overgenerating. The empirical data illustrated by the examples mentioned earlier provide solid evidence that the inheritance between hyperonyms and hyponyms is, in fact, inheritance by default. Defining inheritance in wordnets in this way allows us, not only to straightforwardly incorporate concepts like *tubarão baleia* (whale shark) and *descafeinado* (decaf) in the network, as they no longer constitute a problem, but also to use the network of relations as a knowledge base for computational applications, particularly for inference tasks. This way, implementing the results of our research contributes not only to the empirical accuracy of the model, but also to its usability. Along these lines, Ribeiro et al. (2004) and Marrafa et al. (2204) describe an experience, and a prototype resulting from it, consisting in using WordNet.PT simultaneously as a lexicon and as a knowledge base for a question-answering system. Being a prototype, the domain of the questions accounted by the system was limited, but its results were promising. Moreover, basing its inference engine only on the relations expressed in the database, this experience showed that computational relational lexica, and wordnets in particular, are very powerful resources for any natural language-based system.

Also, it may allow for deducing semantic domains from the relations expressed in the database. If, for instance, we analyse the *is a characteristic of* links of an adjective like *carnívoro* (carnivorous), we verify that it typically modifies living things. Therefore, if synsets are encoded in this fine-grained way, it will be possible to deduce the typical semantic domains of application of adjectives. This would allow us to overcome some difficulties identified by Magnini & Cavaglia (2000) with regard to establishing stable and well-structured sets of domain fields to which associate lexical items, as these would emerge from the network of relations encoded in the database. Once again, this has the advantage of coping with adjective representation in relational

lexica without convening strategies external to the lexical model, such as *a priori* semantic classes. Research on classes and semantic domains emerging from the relations expressed in the database is still exploratory. Future work should include a comparative study between the classes extracted from the database and classes defined in the literature, namely the Hundsnurscher & Splett (1982) classes, the Dixon (1977; 1991) classes and those used in the SIMPLE project.

Following Marrafa (2004) and further work, WordNet.PT also encodes information not usually specified in computational relational lexica. This is the case of telicity, mostly considered a compositional property of meaning[14]. Contrarily to what is commonly done in this domain, WordNet.PT encodes verb telicity. As argued in Marrafa (2005) and previous work the facts render evident that the representation of LCS deficitary telic verbs has to include information regarding the telic expression. In WordNet.PT the telicity of these verbs is captured by including a new relation in the set of internal relations of wordnets: the *telic subevent* relation, as exemplified in (11). This relation is different from the existing *subevent* relation in the EuroWordNet framework, as the latter only stands for lexical entailment involving temporal proper inclusion, therefore, not accounting for the geometry of the event. On the contrary, the *telic subevent* relation regards the atomic subevent that is the ending point of the global event denoted by the verb.

(11) a. {tornar} **has telic subevent** {estado}
'{make} ***has telic subevent*** *{state}'*

b. {estado} **is telic subevent of** {tornar}
'{state} ***is telic subevent of*** *{make}'*

By relating *make* to *state* by means of this relation, as defined in Marrafa & Mendes (2006), the telic properties of the verb are captured while the specific nature of the final state is left underspecified. This way, the weakness of the verb selection restrictions is also accounted for. This relation is also used in WordNet.PT to encode telicity in the case of *make* troponyms that incorporate the telic state: the *telic subevent* relation is used to relate the verb to the expression corresponding to the incorporated final state. The global solution is schematically presented below:

[14] Although telicity is mostly considered a compositional property of meaning, Marrafa (2004) and further work shows that it is also a lexical feature which, as a consequence, should be represented in the lexicon.

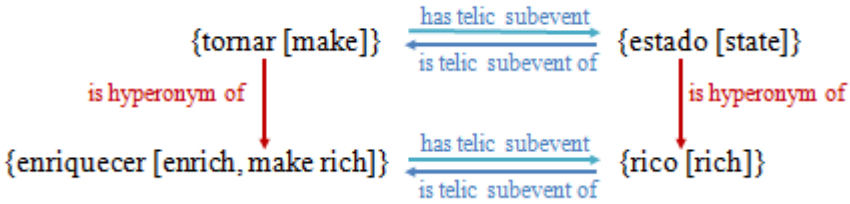


Fig. 12 – *telic subevent* relation: representation in WordNet.PT

As adjectives are often the lexicalisation of the telic expression incorporated in these verbs, encoding this relation in WordNet.PT, not only provides a linguistically motivated approach for modelling complex phenomena involving telic verbs, but also contributes to denser networks of relations, particularly in what concerns adjectives.

As it has been demonstrated, the combination of the small set of relations we use to model adjectives in computational relational lexica allows us to encode a less sparse network of adjectives. Besides the already discussed importance of having a denser net from the point of view of wordnet-based applications, this aspect is also crucial with regard to relational models of the lexicon themselves: since the meaning of each unit encoded in the network is determined by the set of relations it holds with other units, a denser network of relations results in richer and clearer synsets. Fig. 13 below illustrates this idea, presenting an overview of how adjectives are being encoded in WordNet.PT, taking advantage of results from fundamental research, mostly developed under the scope of this dissertation.

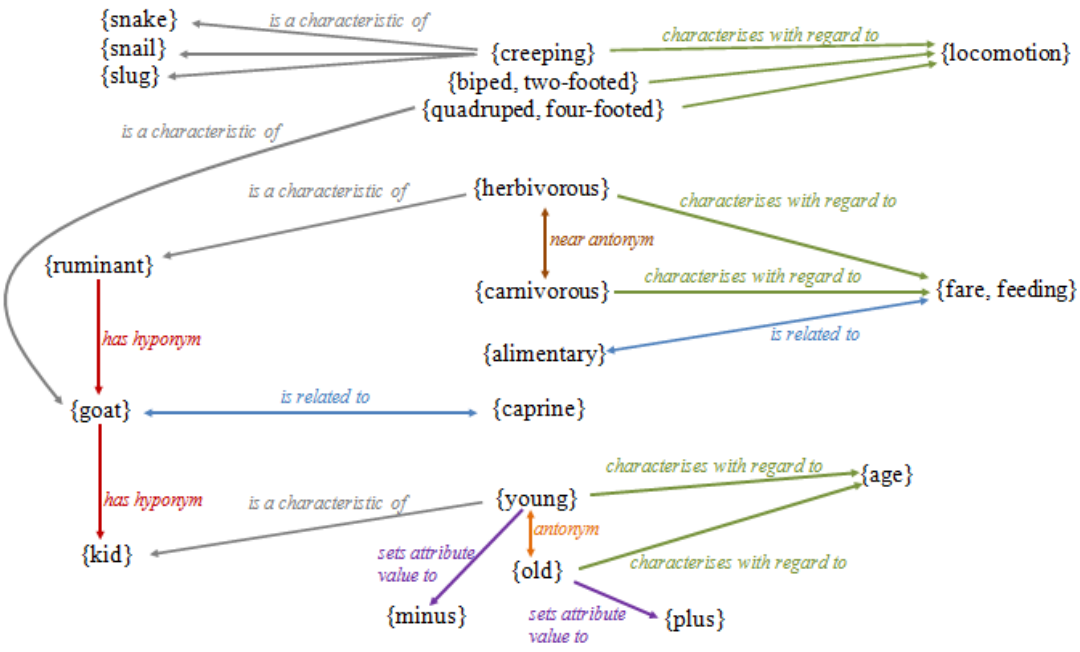


Fig. 13 – WordNet.PT fragment showing cross-POS relations involving adjectives

4.4. CONCLUSIONS

In this chapter we have delineated a linguistically motivated approach for modelling adjectives in computational relational lexica such as wordnets. As previously mentioned, the proposal presented in this chapter is mainly concerned with the specification of the appropriate cross-POS relations to model adjectives in relational models of the lexicon. We argue that the semantics of adjectives can be appropriately captured in wordnet-like lexica by means of the implementation of a small set of relations, which have a strong linguistic motivation and preserve the coherence of the model.

We use a small set of cross-POS relations to model adjective distinguishing properties, the main structuring relations for this POS being *characterises with regard to/is characterised by*, *sets attribute value to/is the attribute value set by* and *antonymy* to model descriptive adjectives, and *is related to* to model relational adjectives. We also use some additional relations which contribute to richer and clearer synsets and, thus, to the accuracy of the model.

In order to test the adequacy of the set of relations established in this chapter and whether it allows for a straightforward and intuitive encoding of adjectives in

wordnet-like lexica, we implemented a selection of Portuguese adjectives in WordNet.PT. Being a representative sample of Portuguese adjectives, the implemented data show that the cross-POS relations we are using effectively allow for a fine-grained encoding of adjectives in wordnet-like lexica. Also, the relations used result in the specification of a denser network of relations. This is particularly relevant since it boosts WordNet.PT usability as a resource in NLP applications such as information retrieval, machine translation, summarisation and language generation systems, which benefit from the rich semantic structure of the network.

Thus, we make apparent that increasing the expressive power of the system has an important impact in precision concerning the specifications of all POS, a fact that is mainly induced by the cross-POS relations. This way, we provide a simple and integrated solution for a complex and heterogeneous problem.

CHAPTER 5

ADJECTIVE LEXICAL STRUCTURE

5.0. INTRODUCTION

In chapter 3 we classified adjectives on the basis of the presence or absence of some adjective characteristic features we argued to be definitional of different adjective classes. We particularly considered adjective intrinsic meaning and some syntactic contrasts. Accepting our argument that the syntactic and semantic properties identified in chapter 3 are crucial properties for delimiting and characterising adjective classes, we have to consider they should be mirrored in lexical models.

Thus, in chapter 4, we delineated a linguistically motivated approach for modelling adjectives in computational relational lexica such as wordnets. We propose a small set of lexical conceptual relations which allow for encoding adjectives in computational relational lexica in a principled and integrated way. We argue that the semantics of adjectives can be appropriately captured in wordnet-like lexica by means of the implementation of a small set of relations, which have a strong linguistic motivation and preserve the coherence of the model. We implemented the strategies delineated in chapter 4 in WordNet.PT and, as stated in the previous chapter, the data encoded show that the cross-POS relations we are using effectively allow for a fine-grained representation of adjectives in wordnet-like lexica. Also, the set of relations used results in the specification of a denser network of relations, making apparent that increasing the expressive power of the system has an important impact in precision concerning the specification of all POS[1]. However, our approach provides a simple and integrated solution for a complex and heterogeneous problem.

[1] This increasement in the expressive power of the wordnet model guarantees its accuracy without any loss in parsimony: lexical items are straightforwardly modeled in a very economic way. Our approach is particularly concerned with the relevance of the information encoded, namely in avoiding redundancy in the system (see section 4.3).

However, not all empirical aspects discussed in chapter 3 are accounted for in the modelling strategies delineated in chapter 4. In fact, these are mostly concerned with definitional properties and essentially account for adjective properties regarding their intrinsic meaning. Through the use of a small set of semantic relations, we mirror the number of ascribed properties for each adjective: as they set a value for an attribute, descriptive adjectives are linked to the noun that lexicalises the relevant attribute, i.e. nouns denoting a single property – state denoting nouns, as will be argued in this chapter; relational adjectives, on their side, establish a link between the modified noun and the domain of another noun and are, thus, related to nouns denoting sets of properties. These different conceptual relations encoded for descriptive and relational adjectives, in combination with additional relations linking nouns to definitional features often lexicalised as descriptive adjectives, also account for differences in terms of the relation established between the adjective and the modified noun. We also model adjective ability to form polarity systems by linking pairs of adjectives ascribing opposite values of the same attribute, and, when pertinent, relate each adjective to the region of the scale relevant for them. This relation often amounts to *antonymy* between descriptive adjectives (see section 4.3.1.2 for a detailed contrastive discussion on *antonymy* and conceptual opposition).

However, some of the syntactic contrasts described in chapter 3 remain unaccounted for in the modelling strategies presented in chapter 4. Since "there is no way in which meaning can be completely divorced from the structure that carries it" (Pustejovsky, 1995:5), we will use these syntactic contrasts as indicators of differences in adjective content at the lexical level. In the previous chapter we presented a modelling strategy that allowed for representing adjective main definitional features in a relational model of the lexicon. In this chapter we argue that, in order to enable a principled account of the way the meaning of compound expressions is built, wordnets should include information on event and argument structures. This general approach is relevant both for allowing computational grammars to cope with a number of different lexical semantics phenomena, as well as for enabling inference applications to obtain finer grained results[2]. Our goal is to enrich wordnets with a lexical semantics framework

[2] See Amaro et al. (2006) for a detailed discussion on the relevance of adding this kind of information to computational relational lexica for a more accurate encoding of all the main POS.

which allows for better descriptions of the nature of lexical meaning. In order to achieve this objective, we have adopted the Generative Lexicon framework (Pustejovsky, 1991a, 1995). Motivating our choice for this model of the lexicon is the fact that it links the different modules of Grammar in a very intuitive way, allowing for a simultaneously thorough and economic modelling of the data.

In this chapter we present the main lines of the Generative Lexicon framework (henceforth GL), showing how this model allows us to represent lexical items as complex and dynamic objects (section 5.1). Based on these main lines, in section 5.2 we discuss adjective representation in GL. We present the main adjective GL representations put forth in the literature and show how some adjective classes call for alternative representation strategies. Using them as a starting point for our work, we delineate modelling strategies to accurately represent descriptive adjectives, conforming to the empirical data thoroughly described in chapter 3. Moreover, we design modelling strategies for representing relational and non-restricting adjectives in the lexicon, as there are no available analyses for these adjective classes in the GL framework. We present our approach in detail, showing how the lexical representations we put forth account for the relevant syntactic and semantic behaviour shown by these adjective classes.

5.1. THE GENERATIVE LEXICON

The Generative Lexicon (Pustejovsky, 1991a, 1995) conceives the lexicon as a complex and dynamic system. In this model of the lexicon, the structured representation of lexical entries follows a closed set of rules and allows for capturing the creative use of words in context and the interface between syntax and semantics. GL uses a systematic and declarative approach for representing lexical items and accounting for their syntactic behaviour. Lexical information is represented in Attribute-Value Matrixes (AVMs). Values for the attributes can consist in either atomic or complex values, i.e. another AVM, a fact that allows for encoding the relevant information coherently, systematically and recursively.

Also, it provides a straightforward way of representing shared information between structures – the unification mechanism. This is particularly crucial when we aim at modelling adjectives. In fact, in the introductory chapters of this dissertation, we stated

that adjective semantic representation is far from being a trivial issue, as adjectives show a very particular linguistic behaviour, namely in what concerns sense change depending on linguistic context: adjectives, more than any other POS, can take different meanings depending on their linguistic context. As will be made apparent in this chapter, representing shared information between structures will allow us to account for this kind of phenomena.

Moreover, lexical items are classified according to semantic types. This not only offers a type structure that organises the lexicon[3], but also provides highly efficient mechanisms to express the relations among semantic objects and between them and their syntactic realisations.

5.1.1. REPRESENTATION LEVELS

In order to represent the features that characterise lexical items – features such as the number and type of arguments selected by a predicate, the events associated to a lexical item, the kind of semantic objects that define its meaning, and the relations between a particular lexical structure and others existing in the lexicon –, GL uses four representation levels:

- Argument Structure;
- Event Structure;
- Qualia Structure;
- Lexical Inheritance Structure.

5.1.1.1. ARGUMENT STRUCTURE

The Argument Structure (ARGSTR) of a word can be seen as a minimal specification of its lexical semantics. One of the most important contributions recently made to the theory of grammar has been the view that argument structure is highly structured in itself (see for instance Williams (1981) and Grimshaw (1990)). In GL the notion of argument covers, not only the syntactic constituents selected by a lexical item, in the traditional sense of this word, but also all the semantic objects that are incorporated in

[3] In chapter 4 we presented some advantages of having an organisation of the lexicon. We particularly focused on hierarchical and relational organisations. These advantages are also valid for our discussion here, and are amongst the criteria that led us to choose the GL model.

the meaning of a word, including information regarding the lexical item itself[4]. Pustejovsky (1995) distinguishes the following types of arguments[5].

TRUE ARGUMENTS (ARG_n): syntactically realised parameters of the lexical item[6]

(1) a. John ran yesterday.
b. *Ran yesterday.
c. John ran.

As shown in (1), the absence of a true argument results in the ill-formation of sentences (cf. (1)b). Being so, true arguments are parameters necessarily expressed at syntax, i.e. parameters that correspond to the domain generally covered by the θ-criterion (Chomsky, 1981).

DEFAULT ARGUMENTS ($D\text{-}ARG_n$): parameters which participate in the logical expressions in the qualia of a lexical item, but which are not necessarily expressed syntactically

(2) a. John built the house out of bricks.
b. John built the house.

[4] Particularly information regarding the semantic nature of the lexical item at stake. Cf. the AVM representing a fragment of the lexical entry of *house* in section 5.1.2.1, for an illustrative example: the semantic nature of *house* - a **physical object** - is encoded in its Argument Structure (ARGSTR) as ARG_1.

[5] In the examples presented below, we identify the syntactic constituents corresponding to the type of argument under discussion by underlining them.

[6] In order to account for the data in null-subject languages, like Portuguese, Pustejovsky's (1995) definition of TRUE ARGUMENTS has to be reformulated, as sentences like (i) are perfect Portuguese sentences.

(i) Corri ontem.
'ran yesterday'

In (i), the inflected form of the verb *correr* (to run) determines that, in this sound Portuguese sentence, the subject is the speaker, although it does not have to be overtly realised at syntax. This indicates that TRUE ARGUMENTS are required parameters, hence necessarily present, although not always syntactically realised. Making this precision in the defnition of TRUE ARGUMENTS conforms to the data both in null-subject and null-object languages, thus contributing for the accuracy of the model. This small reformulation in the definition of TRUE ARGUMENTS also has relevant effects on English data: ellipsis contexts like (ii), for instance, no longer constitute problematic data.

(ii) Yesterday, he arrived and went straight to bed.

c. John built the house out of wood.

Differently from what happened with true arguments, default arguments are characterised by their optionality: they can be absent, as shown in (2)b; but they can also be expressed syntactically by different phrases playing similar roles in the logical expressions in the qualia (cf. (2)a and (2)c). In (2)a and (2)c, for instance, the phrases *out of bricks* and *out of wood* express the material out of which the house was built, i.e. its constitutive role.

SHADOW ARGUMENTS (S-ARG$_n$): parameters that are semantically incorporated into the lexical item and that can only be expressed syntactically by subtyping operations

(3) a. Anne poisoned the cat.
b. *Anne poisoned the cat with poison.
c. Anne poisoned the cat with rat poison.

Since shadow arguments are already incorporated in the semantics of the lexical item, they cannot be realised at syntax, as shown in (3)b, except under special conditions such as the subtyping context illustrated in (3)c.

TRUE ADJUNCTS: parameters which modify the logical expression, but that are part of the situational interpretation, and are not tied to the semantic representation of any particular lexical item

(4) a. Anne arrived on Sunday.

These parameters are different from the previous three, as they are not associated to any particular lexical item. However, since they include adjunct expressions of time or space modification, they are often associated to verb classes.

5.1.1.2. EVENT STRUCTURE

Nowadays it is standard to acknowledge the role of events in verbal semantics. Introducing Event Structure (EVENTSTR) as one of the representation levels in GL emerges from the need to represent the internal structure of events. This way it is possible to represent the type(s) of event(s) that are associated to a given lexical item. Pustejovsky (*op. cit.*) considers three types of events: states, processes and transitions. As we show below, the different properties of these types of events are responsible for certain grammaticality contrasts.

Following Marrafa (1993:27-28), STATES are atomic events that are not evaluated with regard to any other: given a time interval *I*, a state is an event that occurs during the whole interval *I*. This blocks durative (see (5)b) and resultative constructions (cf. (5)c) with states.

(5) a. Anne fears the problem.
b. *Anne is fearing the problem.
c. *Anne fears the problem nervous.

A PROCESS is a sequence of equal events: given a time interval *I*, a process is a sequence of events that occurs in every sub-interval of *I*. Differently from what was said about states, processes enter both durative and resultative constructions, as can be observed in (6)b and (6)c, respectively.

(6) a. Anne runs.
b. Anne is running.
c. Anne runs happy.

Finally, a TRANSITION is an event evaluated with regard to another event: a transition event has an initial state as a starting point, is followed by a process, and culminates in a final state, which is different from the initial one. So, transitions are complex events made up of a process plus a state. In the examples below we confirm this complexity, by introducing adjunct phrases that work as focusing mechanisms within the event structure, fixating one of the two subevents of the transition: the process in (7)b, and the final state in (7)c.

(7) a. Anne tore the newspaper.

b. Anne tore the newspaper for ten minutes.

c. Anne tore the newspaper in little pieces.

In terms of representation in the lexical entries, event structure involves a declarative statement of the event(s) that is(are) associated to a given type of event. As mentioned above, states are atomic events, thus, there is only one event represented in the lexical entry of a STATE. With regard to PROCESSES and TRANSITIONS, these are complex events. This complexity in terms of event structure is represented by enumerating the simple events which make up PROCESSES and TRANSITIONS and by stating ordering restrictions over these events. There are four types of ordering restrictions: parcial order ($\leq$), strict parcial order ($<$), overlap ($\circ$) and inclusion ($\subseteq$). Also, complex events can be headed, i.e. one of the events in the event structure can be marked as a head. Pustejovsky (*op. cit.*) lists head events in the attribute HEAD in the EVENTSTR and marks them with an "*".

5.1.1.3. QUALIA STRUCTURE

Qualia structure (QUALIA) is the level of representation in which the semantic content of a lexical item is encoded, through the properties and events which best define it. Qualia structure determines the lexical-semantic structure of a lexical item. There are four basic qualia roles:

- CONSTITUTIVE (CONST): expresses the relation between an object and its constituent parts;
- FORMAL: represents the features which distinguish an object within a larger domain;
- TELIC: states the purpose and function of an object;
- AGENTIVE (AGENT): enumerates the factors involved in the origin or 'bringing about' of an object.

Qualia structure establishes the set of semantic restrictions introduced by a word in context. Although these semantic restrictions can sometimes undergo semantic change – in metaphoric contexts for instance –, generally they impose themselves on the

linguistic context in which words occur, being sometimes responsible for the ill-formation of certain structures.

(8) a. Anne scaled the fish.
b. *Anne scaled the chicken.
c. *Anne plucked the fish.
d. Anne plucked the chicken.

In (8), for example, the ill-formation of (8)b and (8)c can be explained by the different values for the constitutive role of *chicken* and *fish*, as shown in their qualia structure, presented below.

$$\begin{bmatrix} \textbf{chicken} \\ \text{QUALIA} = \left[\text{CONST} = \textbf{has\_feathers(x)}\right] \end{bmatrix} \qquad \begin{bmatrix} \textbf{fish} \\ \text{QUALIA} = \left[\text{CONST} = \textbf{has\_scales(x)}\right] \end{bmatrix}$$

This fact, in combination with the semantic restrictions introduced by the main verbs in (8) – both *to scale* and *to pluck* have shadow arguments incorporated in their semantics: *scale* and *feather*, respectively –, justifies the syntactic contrasts between (8)a and (8)b, and between (8)c and (8)d.

In (9), the same kind of process is behind the ill-formation of (9)b, but this time it is the formal role in the qualia of *ball* and *tile* that explains the contrasts.

(9) a. The ball rolled down the hill.
b. */?The tile rolled down the hill.

The verb *to roll* is a verb of movement which incorporates manner: to move by turning over or rotating. Hence, the formal characteristics of the entity performing this type of movement, in particular its shape, has to allow it to move in this way.

$$\begin{bmatrix} \textbf{ball} \\ \text{QUALIA} = \left[\text{FORMAL} = \textbf{spherical(x)}\right] \end{bmatrix} \qquad \begin{bmatrix} \textbf{tile} \\ \text{QUALIA} = \left[\text{FORMAL} = \textbf{flat(x)}\right] \end{bmatrix}$$

So, while the *ball* spherical shape is ideal for the type of movement denoted by *to roll*, the *tile* flatness makes it impossible, or at least highly improbable.

(10) a. John is starting the house.

b. = John is starting <u>to build</u> the house.

(11) a. John is starting the book.

b. = John is starting <u>to write</u> the book.

c. = John is starting <u>to read</u> the book.

Let us now consider (10) and (11). Differently from the previous examples, in (10) and (11) there are no grammaticality contrasts. In this case the challenge consists in explaining how the readings in (10)b, (11)b and (11)c are derived. As mentioned above, qualia structure enables the association of particular properties and activities to nouns. This in turn provides the verb that selected the NP in which these nouns occur with the information for contextualising its sense.

$$\begin{bmatrix} \textbf{house} \\ \text{QUALIA} = \left[\text{AGENT} = \textbf{build(y,x)}\right] \end{bmatrix} \quad \begin{bmatrix} \textbf{book} \\ \text{QUALIA} = \begin{bmatrix} \text{AGENT} = \textbf{write(y,x)} \\ \text{TELIC} = \textbf{read(z,x)} \end{bmatrix} \end{bmatrix}$$

As shown in the AVMs above, *house*, in (10), is associated to a **building** event in the agentive role of its qualia structure and this is how this event is made available to the reading of the verb *to start* presented in (10)b. In (11), we have two different possible readings of (11)a, presented in (11)b and (11)c, because *book* is associated to two events in its qualia structure: a **writing** event in the agentive role and a **reading** event in the telic role, thus making both events available to the verb *to start*.

5.1.1.4. LEXICAL INHERITANCE STRUCTURE

Pustejovsky (1995) argues that, for a lexical item to obtain its semantic representation, it has to have access to a semantic type in a network of types so that it can inherit features of its mother type(s). Thus, there must be mechanisms for controlling the way the information percolates along the specification links, for determining how structures are ascribed to lexical items and how to express the relations holding between lexical items when these share only certain aspects of their lexical structures. In order to do this, a mechanism for multiple inheritance must be defined.

In GL, lexical items only inherit information according to their qualia structure. This way, different meanings of a word can be established in orthogonal networks. Let us illustrate this with an example. Nouns like *dictionary* and *novel* should be considered types of *books*. However, these two nouns behave differently with regard to the predicates they combine with. This is why a single inheritance network does not seem adequate for capturing the different meaning facets of words.

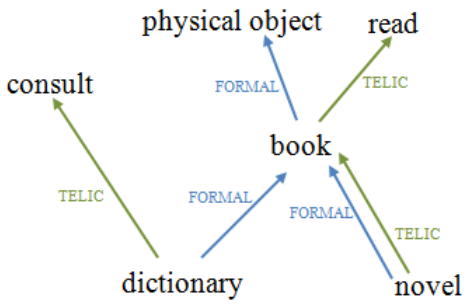
(12) a. John read the novel

b. *John read the dictionary.

(13) a. *John consulted the novel.

b. John consulted the dictionary.

In order to account for the different relations existing between lexical items, made apparent by the examples in (12) and (13), the lexical inheritance theory proposed by Pustejovsky (*op. cit.*) presents a separate network of relations for each qualia role, as shown in the schema below (adapted from Pustejovsky, 1995:145). This intuition that lexical items can integrate different specification networks and have several supertypes, depending on the facet we focus on, is on the basis of proposals by Mendes & Chaves (2001) and Amaro et al. (2006) to address phenomena of compatible co-hyponymy.



In conclusion, in GL lexical items are considered complex objects, characterised at several levels of semantic representation. Besides the shared information, which is inherited according to the lexical inheritance theory discussed above, not all levels of representation have to be filled in. Underspecification is, in fact, one of the major

characterising features of this framework, since only distinctive information, specific of each lexical item, has to be made explicit in lexical entries. The combination of these two factors – shared lexical information and semantic underspecification – considerably contributes to the economy and non-redundancy of the GL model.

However, the complexity and the richness of the information associated to lexical items in GL is not sufficient to account for their dynamic behaviour in context. In order to do so, three generative mechanisms have been defined. They are the object of the next section.

5.1.2. GENERATIVE MECHANISMS

Generative mechanisms are devices connecting the four levels of representation presented above and accounting for the compositional interpretation of words in context. These mechanisms formally attribute new meanings to complex expressions. There are three major generative operations, all involving well-formedness conditions on type combinations:

- Type Coercion;
- Selective Binding;
- Co-composition.

5.1.2.1. TYPE COERCION

Type Coercion is a semantic operation that converts an argument into the type expected by the predicate that selected it – or more precisely by the argument selection of the predicate. Note that this operation does not involve changes in the syntactic type of the item.

Type Coercion is formulated by Pustejovsky (1995:111) as follows:

If α is of type c, and β is of type <a,b>, then
(i) if type c = a, then β(α) is of type b.
(ii) if there is a σ ∈ Σ_α such that σ(α) results in an expression of type a, then β(σ(α)) is of type b.
(iii) otherwise a type error is produced.

This way, if the situation described in (ii) occurs, type coercion is applied and there is a type change of the argument guaranteeing the well-formedness of the expression. Non-verification of either (i) or (ii) results in the ill-formation of the expression. It is important to underline that the semantic type selected by the predicate has to be a part of the semantic content – the qualia structure – of the argument that is undergoing Type Coercion. Let us look at the example in (14) to illustrate this.

(14) a. John started the house.

b. John started to build the house.

Only through the application of a generative operation like Type Coercion can sentences like (14)a be interpreted without the need for multiplying lexical entries for the verb *to start*. (14)a and (14)b are equivalent sentences despite the fact that the verb *to start* co-occurs with arguments of different syntactical types: a noun phrase and a sentence, respectively[7].

$$\begin{bmatrix} \textbf{start} \\ \text{ARGSTR} = \begin{bmatrix} \text{ARG}_1 = \textbf{x : human} \\ \text{ARG}_2 = \textbf{e}_1 \end{bmatrix} \end{bmatrix} \quad \begin{bmatrix} \textbf{house} \\ \text{ARGSTR} = \left[\text{ARG}_1 = \textbf{y : physical object}\right] \\ \text{QUALIA} = \left[\text{AGENT} = \textbf{build}(\textbf{e}_1, \textbf{x}, \textbf{y})\right] \end{bmatrix}$$

Also, as made apparent by the AVM above, the verb *to start* subcategorises for sentences, more precisely for event-denoting objects (cf. value for the attribute ARG_2), and *house* – a physical object (i.e. an entity) and not an event – does not correspond to that type. Thus, in order to guarantee the well-formedness of (14)a, some semantic operation has to take place. Given that there is an event in the qualia structure of *house*,

[7] Regarding the information expressed in the Argument Structure (ARGSTR) of lexical items, it is important to note that the arguments encoded in the selection restrictions of verbs and nouns have different status, as can be observed below: in verbs – as well as in the case of other predicates – the arguments expressed correspond to types of arguments discussed in section 5.1.1.1., corresponding to items in the selection grill of the lexical item at stake; in the case of nouns, the first argument in the argument structure, which in most cases is the only one, encode the entity denoted by the nominal expression at stake. This is a type of argument that is not described by Pustejovsky (1995), which, informally, corresponds to the 'noun itself'. The discussion on the accuracy of this contrast, particularly on expressing the denotation of a lexical item in its argument structure, is outside the scope of this dissertation, and, hence, about which we do not wish to make any claims. However, we consider it a question to be equated in future work in this field.

this can be coerced into the semantic type expected by the predicate *start*: an event, concretely, the **building** event in (14)b.

5.1.2.2. SELECTIVE BINDING

Selective Binding is the most suitable generative mechanism to account for the relation between modifiers and modified entities, being therefore particularly crucial in the context of our work. This semantic operation consists on a linking mechanism which allows a given lexical item to select for the relevant argument, i.e. the one expected by it, from the set of objects in the semantic content of another lexical item.

Pustejovsky (1995:129) formalises Selective Binding as follows:

> **If α is of type <a,a>, β is of type b, and the qualia structure of β, QS_β, has quale q of type a, then αβ is of type b where** $\|\alpha\beta\| = \beta \cap \alpha(q_\beta)$

Despite the fact that, in general, adjectives are semantically underspecified lexical items, whose interpretation depends to a great extent on the meaning of the modified noun, with this generative mechanism it is possible to represent them economically and straightforwardly.

Also, Selective Binding allows us to make one of the characterising aspects of the adjective-noun relation explicit: most adjectives do not modify nouns as a whole, they rather modify a single aspect of the meaning of that noun. The examples below illustrate this.

(15) a. a good knife

b. = a knife that cuts well

(16) a. a good teacher

b. = a teacher that teaches well

$$\begin{bmatrix} \textbf{knife} \\ \text{QUALIA} = \left[\text{TELIC} = \textbf{cut}(\textbf{e}_1, \textbf{x}, \textbf{y})\right] \end{bmatrix} \quad \begin{bmatrix} \textbf{teacher} \\ \text{QUALIA} = \left[\text{TELIC} = \textbf{teach}(\textbf{e}_1, \textbf{x}, \textbf{y})\right] \end{bmatrix}$$

So, in the examples above, adjective *good* evaluates the performance of the modified noun positively, i.e. it selects information in the qualia structure of the lexical items it combines with – their telic role, in our examples – and evaluates it. This allows us to straightforwardly derive the meaning change of *good* in (15) and (16). In section 5.2 we come back to the crucial behaviour of this and other adjectives in more detail.

5.1.2.3. CO-COMPOSITION

Co-composition is a semantic operation which allows for the meaning of a given lexical item to be completed with the semantic content of its arguments. The identification and description of this mechanism emerges from the observation of verbs like *to bake*, for instance, which can either be interpreted as a change of state or a creation (see (17)a and (17)b, respectively), depending on the internal argument they combine with.

(17) a. Anne baked the potatoes.
b. Anne baked the cake.

Normally, the forms corresponding to these readings would have to be doubled in the lexicon and both forms entered as separate lexical entries (cf. Levin & Rappaport, 1995). In order to capture the relation between these cases – linked by logical polysemy –, simultaneously avoiding the need for multiplying lexical entries, Pustejovsky (1991a) proposed that complements carry information which acts on the main verb, shifting its event type. Pustejovsky (1995:124) describes and defines the co-composition mechanism, making this proposal more explicit. This author points out that co-composition generally corresponds to qualia unification. He bases his formulation of the conditions under which this operation can apply on work by Keenan & Faltz (1985), and presents it as follows:

> **For two expressions α, of type <a,b>, and β, of type a, with qualia structures QS_α and QS_β, respectively, then, if there is a quale value shared by α and β, [QS_α... [Q_i = γ]] and [QS_β... [Q_i = γ]], then we can define the qualia unification of QS_α and QS_β, $QS_\alpha \cap QS_\beta$, as the unique greatest lower bound of these two qualia structures. Further, α(β) is of type b with $QS_{\alpha(\beta)} = QS_\alpha \cap QS_\beta$**

Let us go back to our example in (17). The general claim is that there is only one sense for *bake*, and that the different readings observed are derived in composition with its arguments through generative mechanisms. But why is *bake* a creation verb when it takes nouns like *cake* as its object, but not when the object at stake is a noun like *potatoes*? The main difference is that nouns like *cake* (or *cookie*, *bread*, etc.) are prototypically brought about by the activity they are in composition with – *baking*. This information is expressed at the lexical level, being encoded in their qualia structure, namely on the agentive role, which is thus the same for the main verb and for its internal argument (cf. agentive role (AGENT) in the AVMs presented below, representing the lexical entries for *bake* and *cake*).

$$\begin{bmatrix} \textbf{bake} \\ \text{EVENTSTR} = \begin{bmatrix} \text{E}_1 = \textbf{e}_1 \textbf{ : process} \\ \text{HEAD} = \textbf{e}_1 \end{bmatrix} \\ \text{ARGSTR} = \begin{bmatrix} \text{ARG}_1 = \boxed{1} \begin{bmatrix} \textbf{entity} \\ \text{FORMAL} = \textbf{animate entity} \end{bmatrix} \\ \text{ARG}_2 = \boxed{2} \begin{bmatrix} \textbf{mass} \\ \text{FORMAL} = \textbf{physical object} \end{bmatrix} \end{bmatrix} \\ \text{QUALIA} = \begin{bmatrix} \textbf{change of state} \\ \text{AGENT} = \textbf{bake}(\textbf{e}_1, \boxed{1}, \boxed{2}) \end{bmatrix} \end{bmatrix}$$

$$\begin{bmatrix} \textbf{cake} \\ \text{ARGSTR} = \begin{bmatrix} \text{ARG}_1 = \textbf{x : food entity} \\ \text{D - ARG}_1 = \textbf{y : mass} \end{bmatrix} \\ \text{QUALIA} = \begin{bmatrix} \text{CONST} = \textbf{y} \\ \text{FORMAL} = \textbf{x} \\ \text{TELIC} = \textbf{eat}(\textbf{e}_2, \textbf{z}, \textbf{x}) \\ \text{AGENT} = \textbf{bake}(\textbf{e}_1, \textbf{w}, \textbf{y}) \end{bmatrix} \end{bmatrix}$$

In these examples, the verb *to bake* has a stable basic meaning – a **transition** that culminates in the final state of **being cooked** – that is co-specified by its complement through an operation consisting in filling in the verb semantic structure with values

encoded in the semantic structure of the complement. This operation is a type feature unification licensed by the identity of the qualia roles for agentive in the verb and its argument.

The resulting qualia structure is shown below and reflects aspects of both constituents: a derived sense of the verb where the agentive role (AGENT) of the verb and the complement match and the formal role (FORMAL) of the complement becomes the formal role of the entire VP.

$$\begin{bmatrix} \textbf{bake the cake} \\ \text{EVENTSTR} = \begin{bmatrix} E_1 = \mathbf{e_1 : process} \\ E_2 = \mathbf{e_2 : state} \\ \text{RESTR} = < \boldsymbol{\alpha} \\ \text{HEAD} = \mathbf{e_1} \end{bmatrix} \\ \text{ARGSTR} = \begin{bmatrix} \text{ARG}_1 = \boxed{1} \begin{bmatrix} \textbf{entity} \\ \text{FORMAL} = \textbf{animate entity} \end{bmatrix} \\ \text{ARG}_2 = \boxed{2} \begin{bmatrix} \textbf{artifact} \\ \text{CONST} = \boxed{3} \\ \text{FORMAL} = \textbf{physical object} \end{bmatrix} \\ \text{D - ARG}_1 = \boxed{3} \begin{bmatrix} \textbf{material} \\ \text{FORMAL} = \textbf{mass} \end{bmatrix} \end{bmatrix} \\ \text{QUALIA} = \begin{bmatrix} \textbf{create} \\ \text{FORMAL} = \textbf{exist}(\mathbf{e_2}, \boxed{2}) \\ \text{AGENT} = \textbf{bake}(\mathbf{e_1}, \boxed{1}, \boxed{3}) \end{bmatrix} \end{bmatrix}$$

5.2. ADJECTIVES IN THE GENERATIVE LEXICON

Pustejovsky (1995) does not define adjective semantic properties within the GL framework in an exhaustive way, but he discusses adjective classes. This author states that there are several possible ways of classifying adjectives in a coherent way, but not all of them are framed by the general goal of representing the lexicon as a dynamic object and providing a description of the mechanisms that generate meaning in context. Like it is done for other predicates, Pustejovsky (*op. cit.*) defines adjectives according to the type of arguments they select.

We have previously mentioned that classifications based on semantic fields fail to fulfil the objective mentioned above. Grouping adjectives this way does not contribute to the identification of the relevant semantic properties – and, since meaning cannot be completely divorced from the structure that carries it (Pustejovsky, 1995:5), to the identification of the syntactic ones either –, as these classes include lexical items with very distinct characteristics. So Pustejovsky (*op. cit.*) focuses on structural distinctions, i.e. on adjective syntactic behaviour, as a starting point for his characterisation of the members of this POS. He considers attributive *versus* predicative position contrasts, complementation patterns and movement. This way, this author arrives at structurally determined adjective classes. Besides this Pustejovsky (*op. cit*.) also contemplates some semantic properties in his description of adjectives: semantic co-composition and properties regarding the selection of semantic objects.

Interestingly, but not exactly surprisingly, the classes identified by Pustejovsky (*op. cit.*) and those that we arrived at in previous chapters are not contradictory. In fact, this is quite natural because the adjective classes we argued to be relevant and coherent in the context of our work are also based on syntactic criteria. The crucial difference at this point is that Pustejovsky (*op. cit.*) demonstrates how the syntactic and semantic behaviour shown by members of these classes can be derived from the semantic information encoded in adjective qualia structures. Thus, although this author does not thoroughly propose representation strategies for accounting for all adjective classes, he provides us with the tools to model adjectives in the lexicon so that their linguistic behaviour can be predicted. Naturally, that is one of the objectives of this dissertation.

In order to achieve this goal, first of all, we have to concentrate on the semantic nature of adjectives and determine what kind of semantic objects they are. In the introductory chapter of this dissertation we mentioned that adjectives are not a universal class, as there are languages which do not have an independent adjective class. But all languages have the linguistic resources to express the kind of semantic content conveyed by adjectives. Looking into the history of English, Parsons (1990) notes that an important part of English adjectives is derived from Old English verbs. These are not random verbs, but a natural class of Old English verbs which hardly exist in Modern English today: intransitive stative verbs. It is true that stative verbs still exist in English, but these are usually transitive ones, like *love* or *fear* for instance. Given this, we can

say that intransitive stative verbs tend to be reexpressed as adjectives in Modern English.

With regard to research developed within the GL framework, let us consider Bouillon (1998). Along the lines of Parsons (*op. cit.*) and Pustejovsky (1995), this author also defends that the most typical adjectives denote states. However, she claims that there are some exceptions: adjectives like *fast* do not denote states, but events. In section 5.2.1 we present this author claims in more detail and discuss the shortcomings of her proposal. Here we just point out the inexistence of relevant contrasts between adjectives like *fast* and the most typical ones, and, thus, the lack of data which might indicate differences with regard to these adjectives semantic nature. In the course of his argumentation in favour of considering adjectives to contribute with a state to the semantic structure of sentences in which they occur, Parsons (1990:192) presents contexts with adverbial modifiers which isolate the state introduced by the adjective, clearly distinguishing it from the entity introduced by the modified noun. Let us look at (18).

(18) She found her friend hiding behind a tightly closed door.
(adapted from Parsons (1990:192))

In contexts like these, it is awkward to attribute the modifier directly to the individual introduced by the modified noun. We cannot consider that *tightly* applies to *door*. Instead we have to acknowledge that this adverb modifies the underlying state of **being closed** introduced by adjective *closed*. This observation is confirmed by the entailment patterns evidenced by this sentence. Let us look again at (18) in (19)a, as well as at (19)b and (19)c.

(19) a. She found her friend hiding behind a tightly closed door.
b. The door was tight.
c. The door was closed.

As predicted, although (19)a entails (19)c, it does not entail (19)b, where the state of **being tight** is directly applied to *door*. In (20) we take an equivalent example with adjective *fast* modified by an adverb, which behaves exactly like *closed*: (20)a entails (20)c, but not (20)b.

(20) a. He is an extremely fast driver.
b. The driver is extreme.
c. The driver is fast.

We come back to Bouillon's (1998) analysis and modelling of adjectives like *fast* in the following section, where we use stativity tests to clarify the semantic nature of this kind of adjectives. For the time being, and given the data presented above we follow Parsons (*op. cit.*) and Pustejovsky (*op. cit.*) in considering that all adjectives are state-denoting words.

In chapter 3 we identified property ascribing adjectives as the most representative and numerous class of adjectives. We then split this class into two subclasses: descriptive and relational adjectives. Descriptive adjectives corresponding to the most "typical" elements of the adjective class, they have been more often discussed and represented in the literature. Being so, we will start our discussion on adjective modelling in GL with this class of adjectives.

5.2.1. DESCRIPTIVE ADJECTIVES

We have seen that one of the most typical adjective characteristics concerns sense change depending on linguistic context, i.e. adjective meaning is dynamic and often derived by semantic composition from its combination with the lexical material it co-occurs with. In previous chapters we have mentioned the fact that most adjectives do not modify nouns as a whole, but rather take a single aspect of noun meaning and modify it. Let us look at the lexical entry of *round*.

$$\begin{bmatrix} \textbf{round} \\ \text{EVENTSTR} = \left[\text{E}_1 = \textbf{e}_1 \textbf{ : state}\right] \\ \text{ARGSTR} = \begin{bmatrix} \text{ARG}_1 = \begin{bmatrix} \textbf{...} \\ \text{QUALIA} = \left[\text{FORMAL} = \textbf{x : physical entity}\right] \\ \textbf{...} \end{bmatrix} \end{bmatrix} \\ \text{QUALIA} = \left[\text{FORMAL} = \textbf{round\_shape}(\textbf{e}_1, \textbf{x})\right] \end{bmatrix}$$

Let us go through the AVM above. As stated by Pustejovsky (1995:20) "adjectives are generally taken to denote states", a state that is attributed to the modified noun. *Sad* and *joyful*, for example, represent a **state** of mind, a **state** of *sadness* and *joy*,

respectively. As shown above, this fact is represented in the Event Structure (EVENTSTR) of adjectives lexical entries. The Qualia Structure (QUALIA) is the representation level for characterising the state denoted by the adjective. In our example, *round* sets the value of the shape attribute of the modified noun to **round**. This is encoded in the formal role (FORMAL) of the adjective Qualia Structure. Selection restrictions imposed by the adjective are encoded in the Argument Structure (ARGSTR). In this case, as *round* characterises an entity with regard to its shape, and only physical entities have shape, we state that adjective *round* selects a physical entity as its internal argument.

Also, we described a generative mechanism – Selective Binding – which allows adjectives to 'look into' the semantic content of the modified noun (its qualia structure) and pick out the argument that satisfies their selection restrictions. This way, as long as adjective argument selection is correctly specified, there is no need for multiplying adjective lexical entries[8] in the lexicon.

Another salient aspect of adjective behaviour is underspecification and plasticity. Let us go back to one of the examples we used in section 5.1.2.2, where we presented some examples with adjective *good*, showing how senses of *good* seem to be different in every context we consider (see (15) and (16)). Saint-Dizier (1998) analyses the French adjective *bon* (good) in the GL framework, identifying 5 different senses and representations. As noted by Amaro (2002), his analysis has a few setbacks:

- it fails to explain two simple intuitions:
  - the meaning of *bon* (good) does not show significant changes accross the 5 sense representations proposed;
  - the differences that do exist, distinguishing the 5 sense representations, derive from the semantic content of the modified noun;
- the adjective is associated to the telic role of the modified noun by Selective Binding in all 5 representations.

[8] For a detailed description on adjective sense change in Portuguese, see Amaro (2002). Bouillon (1998) also addresses this phenomenon focusing on a small set of French adjectives, and very particularly on adjective *vieux* (old).

This apparent lack of economy of Saint-Dizier's (*op. cit.*) analysis is discussed in detail by Amaro (2002). This author argues for a semantically underspecified representation of adjectives like *bom* (good) in GL by stating that this adjective selects for the telic role of the modified noun. This way, she is able to cover all 5 meanings identified by Saint-Dizier (*op. cit.*) with a single lexical entry for adjectives like *bom* (good) in Portuguese. Taking advantage of the modelling tools available in GL, Amaro (*op. cit.*) puts forth a parsimonious approach, accounting for all the data covered by Saint-Dizier's (*op. cit.*) analysis. However, both these approaches fail to account for a part of the data.

(21) um carro bom
'a good car'
a. ⇒ a car which rolls well (TELIC)
b. ⇒ a well constructed car (AGENTIVE + CONSTITUTIVE)
c. ⇒ a car built in quality materials (CONSTITUTIVE)

(22) uma madeira boa
'a good wood'
a. ⇒ good quality wood. (FORMAL)

As noted by Saint-Dizier (*op. cit.*) himself, "*bon* can be combined with almost any noun in French, and as Katz (1966) pointed out, *good* would need as many different readings as there are functions for objects" (Saint-Dizier, 1998:1144). The evidence provided above indicates that *good* also has readings which go beyond function modification. And what is crucial about the sense variation observed is that these are "interpretations depending on the noun (...) modified" (Saint-Dizier, 1998:1146). This observation indicates that the semantic representation of adjectives like *good* must therefore be underspecified to reflect their context-dependent sense variation. Naturally, in order to prevent overgeneration, "the scope of the underspecified elements must be bounded and precisely defined" (Saint-Dizier, 1998:1146). Moreover, the modelling tools available in GL allow us to straightforwardly represent this information in the lexical entry of *good*.

The evidence put forth in (21) and (22) makes apparent that adjectives like *good* select for qualia roles[9] in the semantics of the modified noun. As mentioned, Amaro's (*op. cit.*) representation covers all the 5 meanings identified by Saint-Dizier (*op. cit.*)[10]. She restricts the modification domain of *good* to the telic role of the modified noun. Supported by evidence presented above, we claim that this definition is too strict, as it fails to cover a part of the data, particularly readings like (21)b, (21)c and (22)a. Some might argue that function entails a form that enables it, and that it would be possible to derive (21)b by entailment. This would nonetheless involve reasoning mechanisms, always computationally costly. Moreover, some of the data provided above fail to be accounted in this way. Hence, as stated above, we claim that the lexical entry of *good* is more underspecified than has been proposed: this adjective selects for qualia roles in the semantics of the modified noun and we model this claim as follows.

$$\begin{bmatrix} \textbf{good} \\ \text{EVENTSTR} = \left[\text{E1} = \textbf{e1 : state}\right] \\ \text{ARGSTR} = \left[\text{ARG1} = \left[\begin{matrix}\textbf{...} \\ \text{QUALIA} = \boxed{1} \\ \textbf{...}\end{matrix}\right]\right] \\ \text{QUALIA} = \left[\text{FORMAL} = \textbf{positive evaluation(e1,} \boxed{1} \textbf{)}\right] \end{bmatrix}$$

Let us go through this representation of adjective *good*. As shown for *round*, the fact that adjectives denote a state is represented in the Event Structure (EVENTSTR) of the lexical entry. The state denoted by the adjective is then characterised in the Qualia Structure (QUALIA). In our example, *good* expresses a **positive evaluation**[11] of the modified item, more precisely, of specific semantic aspects of the modified noun. This is encoded in the formal role (FORMAL) of the adjective Qualia Structure. Selection restrictions imposed by the adjective are encoded in the Argument Structure (ARGSTR). In this case, we can state that *good* makes a **positive evaluation** of the information in

[9] In chapter 6 we come back to this question to claim that *good* selects for **strong qualia roles** in the semantics of the modified noun, i.e. definitional semantic features generally corresponding to the specific difference of the lexical item at stake. Some semantic contrasts addressed in the next chapter will be presented as evidence for adding this restriction to the underspecified definition of selection restrictions of adjectives like *good*.

[10] For a detailed discussion on these meanings and their representations, see Amaro (2002:119-121).

[11] As noted by Demonte (1999:179-180).

qualia of the modified noun. Using these different representation levels it is possible to express all this information simultaneously, linking aspects of the semantics of the adjective and of the modified noun: in the AVM above, for instance, repeating the variable $\boxed{1}$, representing the information in the qualia of the modified noun, in the second argument of the **positive evaluation** performed by *good*, allows us to state that it is the noun qualia information that is modified by the adjective. So, if we combine adjective *good* with a noun like *knife*, the unification of the telic role in the qualia of the noun with the second argument of the positive evaluation introduced by the adjective becomes apparent. This unification operation also explains the reading of *good knife* as a *knife that cuts well*.

$$\begin{bmatrix} \textbf{knife} \\ \text{ARGSTR} = \left[\text{ARG}_1 = \textbf{x : artifact}\right] \\ \\ \text{QUALIA} = \left[\text{TELIC} = \textbf{cut}(\textbf{e}_2, \textbf{x}, \textbf{y})\right] \end{bmatrix}$$

$$\begin{bmatrix} \textbf{good knife} \\ \text{EVENTSTR} = \left[\text{E}_1 = \textbf{e}_1 \textbf{ : state}\right] \\ \\ \text{ARGSTR} = \left[\begin{bmatrix} \text{ARG}_1 = \left[\begin{bmatrix} \textbf{knife} \\ \text{ARGSTR} = \textbf{x : artifact} \\ \text{QUALIA} = \left[\text{TELIC} = \boxed{1}\ \textbf{cut}(\textbf{e}_2, \textbf{x}, \textbf{y})\right] \end{bmatrix}\right] \end{bmatrix}\right] \\ \text{QUALIA} = \left[\text{FORMAL} = \textbf{positive evaluation}(\textbf{e}_1, \boxed{1})\right] \end{bmatrix}$$

If we take a noun like *car*, represented below, we can see there is more than one role in the qualia available for modification by *good*. This way, if the adjective combines with the telic role, (21)a will be derived. If the agentive role is selected by the adjective, (21)b surfaces. Finally, if the adjective takes the constitutive role, we will have (21)c.

$$\begin{bmatrix} \textbf{car} \\ \text{ARGSTR} = \begin{bmatrix} \text{ARG}_1 = \textbf{x : artifact} \end{bmatrix} \\ \\ \text{QUALIA} = \begin{bmatrix} \text{CONSTITUTIVE} = \textbf{has\_engine}(e_2, \textbf{x}) \wedge \textbf{...} \wedge \textbf{has\_mechanical\_parts}(e_3, \textbf{x}) \\ \text{TELIC} = \textbf{roll}(e_4, \textbf{x}) \\ \text{AGENTIVE} = \textbf{assemble}(e_5, \textbf{y}, \textbf{x}) \end{bmatrix} \end{bmatrix}$$

The identification of the relevant reading from the different possibilities available is determined by the context of enunciation, as illustrated in (23). These examples shows that, when more than one qualia role is made available for modification to adjectives like *bom* (good), the context allows for selecting the relevant qualia role modified: as made apparent in (23), not only *bom* can alternatively modify different qualia roles in the same sentence; but given exactly the same syntactic structure, it can modify different qualia roles if the context changes (cf. the contrast between (23)a and (23)b).

(23) a. Esta é uma boa faca (é de prata), mas não é uma faca boa.
'this is a good knife (in silver), but it is not a knife good'
⇒ a knife in good quality materials (CONSTITUTIVE) but that does not cut well (TELIC)

b. Esta é uma boa faca, mas não é uma faca boa (é de materiais baratos).
'this is a good knife, but it is not a knife good (in cheap materials)'
⇒ a knife that cuts well (TELIC) but made from cheap materials (CONSTITUTIVE)

This way, combining *good* underspecified representation with the Selective Binding mechanism prevents us from dividing what is intuitively linked. As it becomes apparent from our discussion above, this proposal does not invalidate the lexical-conceptual structures identified by Saint-Dizier (*op. cit.*). But it shows that what this author identifies as distinct meanings is in fact the result of combining the semantic content of the adjective with the semantic content of the modified noun[12].

However, adjective selection restrictions are not always associated to qualia roles. Selection restrictions of adjectives can consist on certain semantic types. In chapter 3, for instance, we discussed some examples that showed that there were adjectives that

[12] Saint-Dizier's (1998) sense 2 of *bon* covers phrases like *a good man*. This author considers this phrase to determine a function relation along the lines of what is done for the other senses identified. Saint-Dizier (*op. cit.*) claims that, in this context, adjective modification is restricted to the properties in the telic of the noun related to moral behaviour. We come back to this question in detail in chapter 6, arguing for a different approach to these data.

could only modify entities, while others would only select events. We go back to those examples in (24) and (25).

(24) a. a narrow bag
b. *a narrow invasion

(25) a. *a fast bag
b. a fast invasion

The ill-formation of (24)b shows that adjectives like *narrow* necessarily modify nouns denoting physical entities – this is a very intuitive observation, since *narrow* characterises an entity with regard to its form, and only physical entities have form. (25)b, on the other side, makes apparent that *fast* can only modify events. This kind of selection restrictions can be encoded in adjective lexical entries as shown below.

$$\begin{bmatrix} \textbf{narrow} \\ \text{EVENTSTR} = [\text{E1} = \textbf{e1 : state}] \\ \text{ARGSTR} = [\text{ARG1} = \textbf{x : physical entity}] \\ \text{QUALIA} = [\text{FORMAL} = \textbf{narrow(e1, x)}] \end{bmatrix} \quad \begin{bmatrix} \textbf{fast} \\ \text{EVENTSTR} = [\text{E1} = \textbf{e1 : state}] \\ \text{ARGSTR} = [\text{ARG1} = \textbf{e2}] \\ \text{QUALIA} = [\text{FORMAL} = \textbf{fast(e1, e2)}] \end{bmatrix}$$

Before pursuing our discussion on the modelling of descriptive adjectives in GL, we have to comment on the representation we propose for adjective *fast*, presented above.

In section 5.2, when we addressed the question of the semantic nature of adjectives, we mentioned that, unlike most authors in the literature, Bouillon (1998) considered that not all adjectives denote states. And adjective *fast* was the example given to illustrate such adjectives. According to Bouillon (*op. cit.*) *fast* is an event-modifying adjective. As evidenced by the data in (25), that seems indeed to be the case. What is not clear to us is why this fact – which concerns the adjective selection restrictions – should entail that these adjectives are different semantic objects, denoting an event[13] instead of a state. In section 5.1.1.2 we described states as atomic and homogeneous situations. Apparently, adjectives like *fast* show these properties, but let us test this. Earlier in this

[13] Although no definition of **state** or **event** is presented, Bouillon (1998) clearly opposes these two concepts. Here we assume that this author uses these concepts as complementary sets of 'eventualities' (Bach, 1986): **states** being static and unchanging situations; **events** corresponding to dynamic situations, namely processes, transitions, etc.

chapter we mentioned that durative and resultative constructions with states are blocked. The data in (26) indicates that the same is true of adjectives like *fast*.

(26) a. The car is fast.
b. *The car is being fast[14].
c. *The car is fast unmanned.

Also, considering the data in (20), there seems to be no reason to defend a different semantic nature of adjectives like *fast*, as it shows the same kind of behaviour of 'typical' adjectives. Hence, we maintain the homogeneity in terms of semantic nature among all adjectives, i.e. we claim that adjectives are state-denoting objects.

Given this, let us look at the representation proposed by Bouillon (1998:99-103) for adjectives like *fast*.

$$\begin{bmatrix} \textbf{fast} \\ \text{EVENTSTR} = [\text{E1} = \textbf{e1 : event}] \\ \text{ARGSTR} = [\text{ARG1} = \textbf{e1 : event}] \\ \text{QUALIA} = [\text{FORMAL} = \textbf{fast(e1)}] \end{bmatrix}$$

Besides the event-denoting nature of adjectives like *fast*, which we have thoroughly discussed, this representation poses other problems. In the AVM presented above, Bouillon (*op. cit.*) states that these adjectives modify the same event they denote (cf. the identity of the event in the argument structure (ARGSTR) – representation level for encoding selection restrictions of lexical items – and in the event structure (EVENTSTR) – representation level where the event nature of lexical items is given). Not only is this a completely counter-intuitive representation, as it states the existence of a single event

[14] Most authors agree that adjectives are state-denoting words. However we can find some adjective contexts where the progressive is licensed. As noted by Pustejovsky (1995), among others, this fact is related to the time-stability of the state denoted by the adjective: ruled out in the case of individual-level adjectives (see (iv)), constructions in the progressive are possible for stage-level adjectives (cf. (iii)), as shown below. Naturally, these contrasts do not question the semantic nature of adjectives, as these correspond to "different types of stativity" (Pustejovsky, 1995:20).

(iii) a. He is being kind with his students today.
b. The patient is violent again.
c. Stop being gentle.

(iv) a. *He is being thin today.
b. *The patient is tall again.
c. *Stop being literate.

simultaneously contributed by the adjective and the modified noun, a fact which is, at the very least, contrary to all economy principles, but, moreover, it has no empirical nor theoretical motivation. All these facts lead us to discard Bouillon's representation in favour of our own, presented in page 147.

Although adjectives like *narrow* or *fast* select a single type of semantic object, there are nonetheless adjectives that can both modify entities and events. In chapter 3 we showed how the well known Larson's example of ambiguity between intersective and adverbial readings could be accounted for by considering that the specificity of adjectives showing this kind of ambiguity was that they were able to modify two types of semantic objects[15]. Let us look at that example again.

(27) Olga is a beautiful dancer.
'Olga is beautiful & Olga is a dancer' (intersective reading)
'Olga dances beautifully' (adverbial reading)

When we discussed this example in chapter 3 we argued that what was generally considered a non-intersective reading could be accounted for intersectively if we considered that the contrast between the readings was not due to different operations combining the semantic content of the adjective and the noun, but rather amounted to the fact that the intersection was operated between different sets of objects at a time: while in the first reading we have an intersection between *beautiful* and *dancer*, in the second the intersection is between *beautiful* and *dance*, an event associated to the activity noun *dancer*.

Moreover, the data lead us to conclude that the distribution of intersective and adverbial adjective readings could not be explained neither only by the semantic structure of nouns, nor only by the semantic structure of adjectives, but was a result of the semantic properties of both adjectives and nouns combined. Taking advantage of the several representation levels available in GL, modelling the semantic complexity of the modified noun is quite straightforward: *dancer* denotes an entity and is associated to a **dancing** event in the telic role of its qualia structure. The question here is how to

[15] In chapter 3 we showed how the kind of ambiguity discussed by Larson (1999) is no longer accounted for in terms of an intersectivity/non-intersectivity opposition. That is why, for the sake of accuracy, we designate these two readings, traditionally named as intersective and non-intersective readings, as intersective and adverbial readings instead.

represent adjectives like *beautiful* in the lexicon so that they can alternatively combine with events and with entities.

The different representation levels in the GL framework allow for modeling complex items in the lexicon. Pustejovsky (1995) particularly explores the case of nouns showing regular polysemy. Let us look at one of his most used examples: *book*.

(28) a. He tore the book. (physical object)
b. He memorised the **book**. (information)
c. He tore the **book** that he memorised last week.
(physical object & information)

The data in (28) show that nouns like *book* can denote a **physical object** ((28)a), **information** ((28)b) or a **physical object holding information** ((28)c). A traditional approach for accounting for the readings in (28)a, (28)b and (28)c would involve multiplying lexical entries in the lexicon. However, this is a regular process observed in other nouns denoting complex entities: *newspaper*, *letter*, *novel*, *university*, *hospital*, etc. Being so, Pustejovsky (*op. cit.*) argues that, by exploring the different representation levels in GL, it is possible to have only one lexical entry that accounts for the different readings in (28).

$$\begin{bmatrix} \textbf{book} \\ \\ \text{ARGSTR} = \begin{bmatrix} \text{ARG}_1 = \textbf{x : physical entity} \\ \text{ARG}_2 = \textbf{y : information} \end{bmatrix} \\ \\ \text{QUALIA} = \begin{bmatrix} \textbf{physical object} \bullet \textbf{information} \\ \text{FORMAL} = \textbf{contain(x, y)} \\ \text{TELIC} = \textbf{read}(e_1, \textbf{z, x} \bullet \textbf{y}) \\ \text{AGENT} = \textbf{write}(e_2, \textbf{w, x} \bullet \textbf{y}) \end{bmatrix} \end{bmatrix}$$

The structure and semantic links between the noun *book* and the events that are associated to it are structurally represented in the lexical entry presented above. Bouillon (1998) uses a similar strategy to account for adjectives showing sense change in context. In our discussion of the data in chapter 3 we underlined that only certain adjectives show the kind of alternations discussed by Larson (1999), a fact which seems to indicate that there must be something in the semantics of these adjectives that

accounts for their contrasting behaviour. Bouillon (*op. cit.*) puts forth the following representation for French adjective *vieux* (old).

$$\begin{bmatrix} \textbf{vieux} \\ \text{EVENTSTR} = [\text{E1} = \textbf{e1 : state}] \\ \text{ARGSTR} = [\text{ARG1} = \textbf{x : individual} \bullet \textbf{e2}] \\ \text{QUALIA} = [\text{FORMAL} = \textbf{exist(e1, x)} \wedge \textbf{old(e1)})] \end{bmatrix}$$

(adapted from Bouillon (1998:239)[16])

Although the nouns that allow these sense changes must denote an individual-event pair (cf. Bouillon (1998), Larson (1999), Amaro (2002), among others), it does not seem accurate to consider them to necessarily denote a dotted type, as proposed by Bouillon (*op. cit.*) – according to the representation above, adjectives like *vieux* (old) necessarily select a dotted typing noun denoting an individual and an event (see the value for Argument Structure (ARGSTR) in the adjective lexical entry). As Amaro (2003) underlines, nouns that typically enter these sense change constructions – namely nouns like *maire* (mayor), *alcoolique* (alcoholic), *marin* (sailor) or *violiniste* (violin player), used by Bouillon (*op. cit.*) to illustrate the constructions under analysis – should not be considered dotted types since it is not possible to consider a context where only one of the supposed semantic subtypes is available, a fact that indicates that they are not regularly polysemous[17]. Also, it is possible to represent this particular adjective-noun

[16] There is a crucial problem concerning the representation presented by Bouillon (*op. cit.*). As we do not consider it to be linked to this author's general proposal, we will not discuss it in detail in this chapter. Instead, we decided to adapt the representation and just point out the problem here. The following representation is an exact reproduction of the lexical entry of *vieux* (old) put forth by Bouillon (1998:239):

$$\begin{bmatrix} \textbf{vieux} \\ \text{EVENTSTR} = [\text{E1} = \textbf{e1 : state}] \\ \text{ARGSTR} = [\text{ARG1} = \textbf{x : individual} \bullet \textbf{e1 : state}] \\ \text{QUALIA} = [\text{FORMAL} = \textbf{exist(e1, x)} \wedge \textbf{old(e1)})] \end{bmatrix}$$

Let us go through this representation. According to it, adjective *vieux* (old) denotes a state ($\mathbf{e_1}$, presented in the adjective Event Structure (EVENTSTR), and characterised in its Qualia Structure (QUALIA) as being simultaneously **old** and as being the state of **existence** of an entity ***x***) and selects a dotted type as its argument. One of the facets of this dotted type is an **individual**. Its other facet is a state. But strangely, and once again (cf. discussion on adjective *fast*), it is the state denoted by the adjective itself, $\mathbf{e_1}$. So, according to this representation, adjective *vieux* (old) and the noun it modifies must denote the same state. We do not wish to discuss whether this is a slip of the pen or a crucial problem in the accuracy of the representation. Thus, we adapt Bouillon's (*op. cit.*) representation to focus on the main aspects of her proposal.

[17] See Antunes (2002) for a discussion on regular polysemy and its representation in GL.

binding without considering the modified nouns as dotted types, hence avoiding the problem just mentioned.

Amaro (*op. cit.*) considers nouns showing this kind of syntactic and semantic behaviour to be simple typing nouns that denote, at different levels, an individual and an event. Being so, Amaro (2002:136-141) proposes a different representation for these adjectives. According to this author, sense changes observed proceed from Selective Binding operations linking adjectives to the relevant aspects in the semantics of modified nouns. Unlike Bouillon (*op. cit.*), who focuses on representing the semantic content of adjectives showing sense change in context, Amaro (*op. cit.*) not only discusses the most adequate way to represent these adjectives in the lexicon, but she also describes the mechanism which accounts for the different senses observed. So, the point Amaro (*op. cit.*) is making when she states that sense change does not proceed from the meaning of adjectives, is that adjective basic meaning is stable and it gets narrowed down in context. In fact, conforming to our previously mentioned observation that there must be something in the semantics of these adjectives that accounts for their contrasting behaviour, the representation she puts forth to model them is different from the representation of adjectives not showing this behaviour, as it encodes the ability the former have to predicate over two types of semantic objects: entities and events.

$$\begin{bmatrix} \textbf{beautiful} \\ \text{EVENTSTR} = [\text{E}_1 = \textbf{e}_1 \textbf{ : state}] \\ \text{ARGSTR} = [\text{ARG}_1 = \textbf{x : physical entity} \vee \textbf{e}_2] \\ \text{QUALIA} = [\text{FORMAL} = \textbf{positive aesthetic evaluation}(\textbf{e}_1, (\textbf{x} \vee \textbf{e}_2))] \end{bmatrix}$$

Attentively looking at the representation above, we realise that, unlike Bouillon (*op. cit.*), Amaro (*op. cit.*) does not use the semantic operator •, introduced by Pustejovsky (1995) to model complex types. She uses the disjunction operator instead. Following Amaro (2003), we have already underlined that, unlike *book* in (28)a and in (28)b, there are no contexts in which only one of the supposed semantic subtypes of the nouns that typically enter sense change constructions is available. Also, once again unlike *book*, this time in (28)c, which denotes a physical entity and the information contained in it at the same time, adjectives like *vieux* (old) or *beautiful* cannot simultaneously modify two different semantic types. The disjunction in the adjective argument structure and in its

formal role blocks the possibility of having the adjective simultaneously predicating over two distinct arguments, a fact that conforms to the data. Ambiguous sentences like (27), for instance, either mean that *Olga is physically beautiful and is a dancer* or that *Olga is a girl that dances beautifully*, but never that *Olga is physically beautiful and dances beautifully*. This disjunction between the two possible readings becomes apparent in sentences like (29).

(29) A Olga é uma bela bailarina, mas não é uma bailarina bela.
'Olga is a beautiful dancer but she is not a dancer beautiful'
Olga is a beautiful dancer, but she is not beautiful.

In languages like Portuguese, adjectives such as *bela* (beautiful) only display ambiguity in prenominal position. The possibility of negating one of the possible readings, not only resolves this ambiguity, but most of all shows that it is possible to negate one of the available readings of the main – and ambiguous – sentence without introducing any contradiction, a fact that provides further evidence in favour of the disjunction hypothesis presented above, supporting our modelling option. So, in each context, adjectives can only predicate over one of the two semantic types at a time. The disjunction operation is therefore more accurate than the dotted object to express the ability these adjectives have to alternatively predicate over two different types of semantic objects.

Given this, Amaro's analysis mirrors what the data indicated: on the one hand, adjective basic meaning is stable and does not change; on the other hand, the ambiguity or alternation between two possible adjective readings depends, not only on the complexity of the modified noun, but also on adjective properties.

In chapter 3, the description of the data showed that available readings depended not only on the adjective and modified noun, but also on their relative position in the NP. This issue has been object of many analyses and research work. We come back to it and to the evaluation of the role played by adjective relative position in the NP in chapter 6. What is crucial for the time being is that the relevant information be encoded in adjective lexical entries as shown, so that their interpretation in context can be derived by the generative mechanisms available.

In previous chapters we have argued that, in general, adjectives contribute to the construction of NP denotation by set intersection. However that is not always the case. In chapter 3, section 3.2, we discussed some data showing that the relation established between adjectives and the noun they modify is not always that straightforward. Let us look again at some of that data.

(30) a. Este animal é um elefante pequeno.
'this animal is a small elephant'

b. Este animal é pequeno para um elefante.
'this animal is small for an elephant'

c. Este animal, que não é pequeno, é um elefante pequeno.
'this animal, that is not small, is a small elephant'

The data in (30) show that, sometimes, the denotation of the NP depends, not only on the combination of the denotation of the modified noun and of the property introduced by the adjective, but also on a comparison class. In her analysis of adjective readings, Demonte (1999, forth.) distinguishes absolute and relative readings characterising them as follows: in absolute readings there is no relation between the property denoted by the adjective and the class of objects that show that property (the modified noun); contrastively, in relative readings the property denoted by the adjective can only be interpreted in relation to the class of objects to which the modified noun belongs. Demonte (forth.) further explores these main ideas, particularly in what concerns the impact the distinction between absolute and relative adjectives has on entailment patterns, as well as on the distribution of adverbial end-point oriented modifiers such as *almost* and *completely*[18].

[18] As discussed in detail in previous chapters, gradability is a prototypical feature of adjectives, although not all adjective classes are gradable. Bartsch & Vennemann (1972, 1973) and Kennedy (1999, 2007) analyse gradable adjectives as measure functions from a domain of individuals to some positive or negative degree of a dimension ordered in a scale – scales being sets of degrees ordered with respect to some dimension. Demonte (forth.) is particularly concerned with the way absolute and relative adjectives build the relevant scale, exploring many different approaches in the literature and discussing related phenomena in detail (see Demonte, forth., section 4). Assuming Kennedy & McNally's (2005) typology of scales, Demonte (forth.) provides additional empirical evidence making apparent the dependency between the internal structure of scales and the linguistic behaviour of adjectives, particularly with regard to their co-occurrence with end-point oriented modifiers. This detailed discussion on scales and degrees is clearly outside the scope of this dissertation. We refer the reader to Demonte (forth.). The crucial aspect we retain from her approach being the acknowledgement of a context dependent standard of comparison in relative readings, which we aim at formally representing in the lexicon.

Kamp & Partee (1995) formalise these contrasts in a set theory framework: determining the extension of NPs in which absolute adjectives (like *green*, for instance) occur amounts to operating an intersection between the extension of the noun and the extension of the adjective, as shown in (31)a; with regard to the extension of NPs in which relative adjectives (like *small*, for instance) occur, it is determined by the identification of a subset of the entities that conform to the set of properties introduced by the noun – the subset made up of the entities that can be adequately described by the property introduced by the adjective, as shown in (31)b. Thus, in the case of absolute adjectives, NP denotation is calculated by set intersection, while in the case of relative adjectives it is done by subsetting.

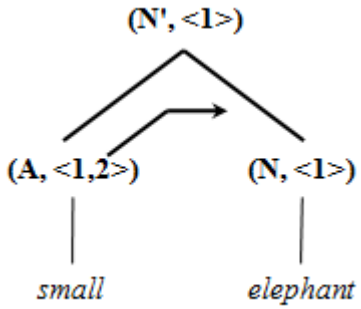
(31) a. [green elephant] = [green] ∩ [elephant]
b. [small elephant] = [small elephant] ⊂ [elephant]

But how should this difference in adjective semantics be represented in the lexicon? Comparison class relativity was first treated as an extra argument in adjective semantics by Wheeler (1972). However, in the literature, relativity to a comparison class has sometimes been mixed with other phenomena. Just to mention an example illustrating this fact, as pointed out by Larson (1999), comparison class relativity – illustrated in (30) – and adverbial readings – see (27) –, have been confused in analyses by Wheeler (1972) and Platts (1979). Although these two phenomena are not the same, these authors use the same mechanism to account for both of them: the existence of a second argument in adjective semantics. As noted by Larson (*op. cit.*), although this mechanism seems correct for accounting for comparison class determination, which was the purpose for which it was first introduced by Wheeler (1972), with regard to the apparent non-intersectivity of adverbial readings, however, it fails to explain, for instance, the relation between these readings and their adverbial counterpart (*Olga is a beautiful dancer – Olga dances beautifully*), a relation that is generally recognised by speakers' intuition.

Previously in this dissertation we have shown how to account for adverbial readings intersectively, by modelling adjective and noun semantic complexity in the lexicon and by using generative operations such as Selective Binding, hence overcoming the problem mentioned above. So let us focus now on subsective adjectives, i.e. adjectives

whose readings can only be interpreted relatively to a comparison class, and see how we can account for this comparison class.

Higginbotham (1985) also identifies the contrast between the two modification patterns mentioned above. His analysis accounts for the observed contrasts in terms of the number of arguments selected by each adjective and of different modes of thematic discharge. Like for other authors, according to Higginbotham (*op. cit.*) there is also a second argument in the thematic grill of subsective adjectives[19]. This second argument expresses the relative character of the property introduced by the adjective, an argument which is saturated by the intension of the modified noun.



Amaro (2002:122-128) puts forth a proposal to model comparison class relativity in GL, introducing this information, which in Wheeler (1972) and Higginbotham (1985) was formalised in terms of a second argument in the adjective semantic representation, in the constitutive role (CONST) of the adjective qualia structure.

[19] Higginbotham (1985:559-560) underlines that there is a strict correlation between predicates, which assign thematic roles, and arguments, which bear them. Being so, the assignment of thematic roles to arguments is understood as the filling of *places* in predicates. However, not all *places* in a predicate semantic structure have to be filled in by an argument. Following Williams (1983), Higginbotham (*op. cit.*) presents the example of nouns which do not take arguments when they form NPs, but that combine with a specifier instead, which acts as a binder of the head noun. Higginbotham (*op. cit.*) will state that this is a different mode of discharging a thematic role, which is associated to different types of argument in the semantic structure of a predicate. Thus, when he analyses subsective adjectives as adjectives with a second argument in their semantic structure, this does not mean that these adjectives will necessarily show a second argument at syntax.

$$\begin{bmatrix} \textbf{subsective adjective} \\ \text{EVENTSTR} = [\text{E1} = \textbf{e1 : state}] \\ \text{ARGSTR} = \boxed{1}[\text{ARG1} = \textbf{x}] \\ \text{QUALIA} = \begin{bmatrix} \text{CONST} = \textbf{relative to a class}(\textbf{e1}, \boxed{1}) \\ \text{FORMAL} = \textbf{adjective content}(\textbf{e1}, \textbf{x}, \boxed{1}) \end{bmatrix} \end{bmatrix}$$

As it introduces information relative to class comparison in adjective qualia structure, this modelling strategy not only encodes relativity to a comparison class as an adjective characterising feature – since it is one of the 'components' of adjective semantics –, but it also establishes a link between the modified noun (the adjective internal argument) and the determination of the relevant comparison class in each context, along the same lines of Higginbotham's (1985) proposal in a configurational framework. Saturated by the intension of the modified noun in Higginbotham's (*op. cit.*) analysis, this mutual dependence between the comparison class and the semantic type of the adjective internal argument is expressed in GL by the unification of their values, represented by $\boxed{1}$ in the AVM above. This way, the comparison class is always determined by the semantic type of the argument modified by the adjective, whether it corresponds to the semantic type of the modified noun or to the semantic type of one of its 'meaning components' represented in its qualia structure[20]. Let us go back to our example in (30) and look at the representation of adjective *pequeno* (small) in GL.

[20] Sentences like (v) constitute a challenge to this perspective: the noun modified by the adjective is underspecified, hence not establishing a class of objects that might function as a comparison class. And yet (v) is perfectly interpretable.

(v) I saw something I was unable to identify, but I saw it was small.

Data such as these show that when a comparison class is not retrievable from the linguistic context, there is some other strategy for satisfying the adjective selection restrictions, since, as illustrated above, no ill-formation nor difficulty in interpreting (v) results from this fact. Let us go through the sentence in (v). Any speaker confronted with this sentence interprets *small* as determining that the size of the unidentified thing that was perceived is below the average size of objects we relate to, which thus are used as the comparison class in this case. However, if we consider a less neutral situation – a conversation taking place on a space centre, where scientists are observing celestial bodies, or on a lab around an electron microscope, for instance – the small thing that was perceived might be considerably larger (the size of an asteroid, for example) or smaller (the size of a virus, for instance) than in a neutral context. This shows that, when no comparison class is made available by the linguistic material in the sentence, the empty argument in the adjective structure is filled in by relevant information in the situational context, particularly by speakers' expectations in that context.

$$\begin{bmatrix} \textbf{pequeno} \\ \text{EVENTSTR} = [\text{E}_1 = \textbf{e}_1 : \textbf{state}] \\ \text{ARGSTR} = \boxed{1}[\text{ARG}_1 = \textbf{x} : \textbf{physical entity}] \\ \text{QUALIA} = \begin{bmatrix} \text{CONST} = \textbf{relative to a class}(\textbf{e}_1, \boxed{1}) \\ \text{FORMAL} = \textbf{reduced dimension}(\textbf{e}_1, \textbf{x}, \boxed{1}) \end{bmatrix} \end{bmatrix}$$

As the comparison class is always determined by the semantic type of the argument modified by the adjective, in this case, if the adjective argument is instantiated by the noun *elefante* (elephant), as in (30)a, the comparison class will also be set to that same class of objects. So *elefante pequeno* (small elephant) will denote the set of elephants that have a reduced dimension for an elephant.

5.2.2. RELATIONAL ADJECTIVES

In the previous section, our main concerns with regard to descriptive adjectives consisted on modeling these adjectives distinguishing characteristics and encoding them in the lexicon, namely their ability to modify a single aspect of noun meaning rather than modifying nouns as a whole. By doing so, using a generative mechanism – Selective Binding – which allows adjectives to 'look into' the semantic content of the modified noun and pick out the argument that satisfies their selection restrictions, we showed that there is no need for multiplying adjective lexical entries in order to account for adjective sense change in context. Descriptive adjectives being property ascribing adjectives, we consider them to denote a state that is attributed to the modified noun. This state corresponds to a single property – more precisely, to a value of an attribute – that consists on the basic meaning of the adjective and is represented in the adjective lexical entry: its semantic type (a state) is established in the Event Structure (EVENTSTR) of the lexical entry; the state denoted by the adjective is characterised in the formal role (FORMAL) of its Qualia Structure (QUALIA).

But although relational adjectives are also property ascribing adjectives, they do not ascribe single properties, but rather sets of properties. Like nouns, relational adjectives denote more complex qualities and usually entail more complex and diversified semantic relations between the set of properties they introduce and the modified noun. Moreover, we have seen that each of these set of properties roughly corresponds to the

properties characterising another noun. Given these aspects, it is crucial to encode both of them in relational adjective lexical entries.

Moreover, as pointed out by Bouillon (1998:87) one of the weak points of Pustejovsky (1995) is that he does not consider relational adjectives in his discussion of adjectives in GL. The residual nature of relational adjectives in English is surely not independent from this fact. Actually, English tends to use a different strategy to express this kind of content: noun-noun modification. In French, however, like in Portuguese and all Romance languages, relational adjectives are very common. And thus, Bouillon (*op. cit.*), after pointing out the shortcoming in Pustejovsky's work, does not address the question either.

So let us resume our observations on relational adjectives presented in previous chapters. Concerning the nature of the semantic relations established between the adjective and the modified noun, we claim that relational adjectives make a very underspecified semantic contribution with regard to this aspect. In fact, relational adjectives establish a link between the modified noun and a domain that is exterior to it. In chapter 4, section 4.3.1.3, we claimed that all we could state in the lexicon to describe the semantic contribution of relational adjectives is that they establish a relation between the modified noun and a set of properties, that generally correspond to the denotation of another noun. We mirrored this in relational lexica by encoding a semantic link between relational adjectives and nouns lexicalising the set of properties they introduce. Before pursuing our discussion of the strategy for representing relational adjectives in GL we would like to stress that GL is a system of attribute-value matrixes (AVM), in which the value of any attribute can be another AVM. This means that values in the Qualia Structure, for instance, can be complex values, as it will be the case with relational adjectives. We propose the following representation for relational adjectives in GL.

$$\begin{bmatrix} \textbf{relational adjective} \\ \text{EVENTSTR} = \left[\text{E}_1 = \textbf{e}_1 : \textbf{state}\right] \\ \\ \text{ARGSTR} = \left[\text{ARG}_1 = \textbf{x}\right] \\ \\ \text{QUALIA} = \begin{bmatrix} \text{FORMAL} = \textbf{relates to}(\textbf{e}_1, \textbf{x}, \begin{bmatrix} \textbf{noun} \\ \\ \text{ARGSTR} = \left[\text{ARG}_1 = \textbf{y}\right] \\ \text{QUALIA} = \begin{bmatrix} \text{CONST} = (\textbf{has\_part}(\textbf{y},\textbf{k}); \ldots) \\ \text{TELIC} = \textbf{event}_1(\textbf{e}_2, \textbf{m}, \textbf{y}) \\ \text{AGENT} = \textbf{event}_2(\textbf{e}_3, \textbf{n}, \textbf{y}) \end{bmatrix} \end{bmatrix}) \end{bmatrix} \end{bmatrix}$$

Let us go through the representation above in detail. As we have repeatedly stated, adjectives denote a state that is attributed to the modified noun. As was the case with the adjective classes previously analysed, this fact is represented in the Event Structure (EVENTSTR) of the lexical entry. This state is then characterised in the Qualia Structure (QUALIA). In the case of relational adjectives, this is a very underspecified characterisation we express by stating that these adjectives denote a **relation** between the modified noun and a set of properties. More precisely, relational adjectives **relate** two independent nouns: the noun lexicalising the set of properties these adjectives introduce and the modified noun. This is encoded in the formal role (FORMAL) of the adjective Qualia Structure, the set of properties introduced by the adjective being encoded as the third argument of this relation. Below we present the representation of adjective *livresco* (related to book), where this semantic link between the adjective and the noun *book* becomes apparent.

$$\begin{bmatrix} \textbf{livresco} \\ \text{EVENTSTR} = \left[\text{E}_1 = \textbf{e}_1 : \textbf{state}\right] \\ \text{ARGSTR} = \left[\text{ARG}_1 = \textbf{x}\right] \\ \text{QUALIA} = \begin{bmatrix} \text{FORMAL} = \textbf{relates to}(\textbf{e}_1, \textbf{x}, \begin{bmatrix} \textbf{book} \\ \text{ARGSTR} = \begin{bmatrix} \text{ARG}_1 = \textbf{y} : \textbf{physical entity} \\ \text{ARG}_2 = \textbf{z} : \textbf{information} \end{bmatrix} \\ \text{QUALIA} = \begin{bmatrix} \text{CONST} = (\textbf{has\_part}(\textbf{y}, \textbf{page}); \textbf{has\_part}(\textbf{z}, \textbf{sentences})) \\ \text{TELIC} = \textbf{read}(\textbf{e}_2, \textbf{w}, (\textbf{y} \bullet \textbf{z})) \\ \text{AGENT} = \textbf{write}(\textbf{e}_3, \textbf{v}, (\textbf{y} \bullet \textbf{z})) \end{bmatrix} \end{bmatrix}) \end{bmatrix} \end{bmatrix}$$

So, we have conceived an economic and empirically motivated strategy for modelling relational adjectives in GL. But we cannot conclude this section without addressing some exceptional cases, already presented and thoroughly discussed in section 3.2.1. In chapter 3 we identified a group of relational adjectives, illustrated by adjective *marinho* (of the sea). Such adjectives, instead of determining an underspecified relation between the modified noun and a domain exterior to it, denote an inclusion relation somewhere along the lines of a meronymy relation between the modified noun and a given domain – the **sea** in the case of *marinho*. So, if for the general case we argue that there are generative mechanisms available in language which allow us to derive different relations between domains from underspecified lexical entries (see the AVMs presented above), hence avoiding an approach involving a multiplicity of lexical entries, in the case of the adjectives like *marinho* we argue something along the opposite direction: this adjective denotes a meronymy relation between the modified noun and the sea, instead of an underspecified link, and this has to be encoded in the lexicon[21]. Given that the relation denoted by this small set of adjectives corresponds to a subtype of the general case, we are able to straightforwardly represent these adjectives in GL, without introducing any significant changes. As illustrated in the AVM below, simply by specifying the relation denoted by the adjective as a meronymy relation – hence specifying the underspecified relation used in the general case, illustrated by *livresco* – we can account for this small group of relational adjectives. By doing so we are simply extending the strategy put forth in this section for modelling relational adjectives, hence providing a unified treatment for relational adjectives, including this small set of exceptional examples.

$$\left[\begin{array}{l} \textbf{marinho} \\ \text{EVENTSTR} = \left[\text{E1} = \textbf{e1 : state}\right] \\ \text{ARGSTR} = \left[\text{ARG1} = \textbf{x}\right] \\ \text{QUALIA} = \left[\begin{array}{l} \text{FORMAL} = \textbf{is part of}(\textbf{e1, x,} \left[\begin{array}{l} \textbf{sea} \\ \text{ARGSTR} = \left[\text{ARG1} = \textbf{y : physical entity}\right] \\ \text{QUALIA} = \left[\text{CONST} = (\textbf{has\_part(y, water); has\_part(y, salt)})\right] \end{array}\right)\end{array}\right] \end{array}\right]$$

[21] For a detailed discussion of the data at stake and how these provide solid evidence supporting our approach, see section 3.2.1.

Moreover, since these are in fact exceptional data – as mentioned earlier, there are few lexicalised forms for expressing this meronymy relation –, arguing for representing these adjectives as separate lexical entries is far from being significantly costly. In fact, the most common strategy in languages like Portuguese for expressing that a noun belongs to a given domain is its modification by a PP introduced by the preposition *de* (of), lexicalisations such as *marinho* being rather rare forms.

5.2.3. NON-RESTRICTING ADJECTIVES

In sections 5.2.1 and 5.2.2 we delineated strategies for a linguistically motivated modelling of property ascribing adjectives. We focused on the distinguishing characteristics of these adjectives, namely their ability to contribute to the delineation of NP denotation by adding extra restrictions to it. Being commonly represented in the literature as one-place predicates (see, for instance, Kamp (1975) for a detailed discussion on the representation of adjective meaning), we consider them to denote a state that is attributed to the modified noun. This state corresponds to the basic meaning of the adjective and is represented in the adjective lexical entry: its semantic type (a state) is established in the Event Structure (EVENTSTR) of the lexical entry; the state denoted by the adjective is characterised in the formal role (FORMAL) of its Qualia Structure (QUALIA).

But, as thoroughly discussed in chapter 3, section 3.3, non-restricting adjectives are a considerably differently adjective class. The semantic nature of lexical items belonging to this class is so distinct from the nature of adjectives from the larger class of property ascribing adjectives that Kamp (1975) leaves them out of his "theory" of adjective meaning. Property ascribing adjectives are usually identified with properties, but non-restricting adjectives do not denote properties: as shown in our description of the data in chapter 3, non-restricting adjectives behave like semantic operators. Hence, semantically interpreting them as functions that map the extension of the modified noun onto a new extension that does not have to be related to the original one in terms of set inclusion – by operating at noun intension level, in order to indicate "the way a concept or intension of a term applies to a certain referent" (Demonte, 1990:139) – is surely a more accurate approach to this question. Also, we have seen above that the semantic contribution of non-restricting adjectives can be expressed in terms of modality values,

such as *possibility* or *necessity* of a certain state of affairs, or *exclusivity* or *exhaustivity* of a reference.

In order to mirror these main features in the lexicon, we propose a strategy along the lines of Pustejovsky's (1995:222) representation of co-composition phenomena in causative verbs. According to his description and analysis of the data, in some causative verb constructions certain aspects of the semantic description of the complement are shared with the main predicate in a modally subordinate way. To represent this, Pustejovsky (*op. cit.*) embeds the relevant semantic aspects into a modal context within the FORMAL role of the main predicate, hence deriving the appropriate reading.

Given our description of non-restricting adjectives and their main features, we propose that non-restricting adjectives embed the modified noun, more precisely some aspects of its meaning, into a modal context. Being so, the semantic contribution of non-restricting adjectives has to be formulated so as to modally embed the relevant expression from the semantics of the modified noun. With these concerns in mind, we propose the following representation for adjectives such as *alegado* (alleged), for instance.

$$\left[\begin{array}{l} \textbf{alegado} \\ \text{ARGSTR} = \left[\text{ARG}_1 = \left[\text{FORMAL} = \boxed{1}\right]\right] \\ \text{QUALIA} = \left[\text{FORMAL} = f_1(\boxed{1}) = \neg(\Box\boxed{1}) \wedge \Diamond\boxed{1}\right] \end{array}\right]$$

Before going through this representation, and in order to make our proposal clear, let us also consider the AVM presented below, representing the NP *o alegado assassino* (the alleged murderer).

$$\left[\begin{array}{l} \textbf{o alegado assassino} \\ \text{ARGSTR} = \left[\text{ARG}_1 = \left[\begin{array}{l} \text{ARGSTR} = \left[\text{ARG}_1 = \textbf{x : human}\right] \\ \text{QUALIA} = \left[\text{FORMAL} = \boxed{1}\,\textbf{murderer(x)}\right] \end{array}\right]\right] \\ \text{QUALIA} = \left[\text{FORMAL} = f_1(\boxed{1}) = \neg(\Box\boxed{1}) \wedge \Diamond\boxed{1}\right] \end{array}\right]$$

These representations make apparent the distinct semantic nature of non-restricting adjectives. We stated above that these adjectives are functions which operate at noun

intension level, indicating the way it applies to the referent. This is expressed in our representation, and encoded in the formal role (FORMAL) of the adjective Qualia Structure, as follows: in the example above, *alegado* (alleged) determines a function which embeds into a modal context the part of the semantic structure of the modified noun that distinguishes it within a larger domain (encoded in the formal role (FORMAL) of the qualia structure of the noun), stating that it is not necessary that the referent denoted by the NP *o alegado assassino* belongs to the set of murderers, although it is possible that it does.

Assuming this representation for non-restricting adjectives allows us to model the following crucial characteristics of this adjective class:

- the semantic nature of these lexical items is different from that of the adjective classes considered until this moment: non-restricting adjectives are semantic operators and, thus, are associated to a function rather than to a property (cf. formal role (FORMAL) of the adjective Qualia Structure);
- non-restricting adjectives operate at intension level, taking as operands part of the semantic structure of the modified noun (the value of the formal role (FORMAL) of the modified noun, in our example) – i.e. they access the set of conditions that must be satisfied by candidate objects to making up the reference of the modified noun;
- the semantic contribution of non-restricting adjectives is formulated in terms of the modal embedding of the relevant expression from the semantics of the modified noun, in our example, *alegado* places the value of the formal role (FORMAL) of the modified noun under the scope of *possibility* ($\Diamond$), *necessity* ($\Box$) and *negation* ($\neg$) operators.

Having made these crucial aspects clear, we propose the following general representation for non-restricting adjectives in GL.

$$\begin{bmatrix} \textbf{intension modifying adjective} \\ \text{ARGSTR} = \left[\text{ARG}_1 = \left[\text{FORMAL} = \boxed{1}\right]\right] \\ \text{QUALIA} = \left[\text{FORMAL} = f_1\left(\boxed{1}\right) = \textbf{semantic\_operator}\ \boxed{1}\right] \end{bmatrix}$$

These modelling strategies allow us to account for all adjective classes in GL, mirroring adjective distinguishing features in the lexicon and conforming to the contrasts displayed by the data. Assuming our proposal, we only have to define the modal contribution of the remaining non-restricting adjectives[22] in order to model and represent them in the lexicon. In the table below we formalise the contributions of a set of the most common non-restricting adjectives in Portuguese.

non-restricting adjectives	*modality*	*notation*
possível (possible)	possibility	$\Diamond$
alegado (alleged) presumível (so-called) suposto (supposed)	contingency	$\neg \Box \wedge \Diamond$
falso (false)	negation	$\neg$
verdadeiro (true)	affirmation	$\neg \neg$
mesmo (same)	identity	=

Having laid out our proposal for modelling non-restricting adjectives in GL, we do not want to conclude this section without making some remarks with regard to some of the adjectives included in the table presented above, particularly adjectives *falso* (false) and *verdadeiro* (true). We have repeatedly chosen *falso* (false) to illustrate the linguistic behaviour of non-restricting adjectives. However, we cannot pursue without underlining some aspects concerning this adjective which allow us to make crucial distinctions that justify the options made in our proposal. Let us consider the following examples.

(32) a. A polícia apreendeu o diamante falso.
'the police seized the diamond false'

b. A polícia apreendeu o falso diamante.
'the police seized the false diamond'

[22] The value that, in the lexical entry of each non-restricting adjective, will specify the particular semantic contribution it makes, by replacing **semantic_operator** in the general representation proposed for non-restricting adjectives in GL with a more specific value.

(33) a. O juiz identificou as afirmações falsas.
'the judge identified the statements false'

b. O juiz identificou as falsas afirmações.
'the judge identified the false statements'

(34) a. Ela tem muito cuidado nas conversas que tem com pessoas falsas.
'she is very careful in the discussions she has with persons false'

b. *Ela tem muito cuidado nas conversas que tem com falsas pessoas[23].
'she is very careful in the discussions she has with false persons'

These contexts illustrate three different readings of *falso* (false). In (32) we find the reading we have discussed up until now, and to which we will come back further below, as we want to make some comments on the value associated both to it and to its antonym, *verdadeiro* (true). (33) illustrates another reading, in which *falso* (false) selects a noun associated to a propositional content, and sets its truth value to **false**. Given that *falso* in (32) and (33) clearly has, not only different semantic contents, but also different selection restrictions – the latter form only combines with nouns denoting propositions, i.e. nouns which can be associated to a truth value, whereas the former can select physical entities like diamonds, for instance –, we will consider these to be two distinct homonym forms, corresponding to two independent entries in the lexicon. Another argument in favour of separating these readings in the lexicon is offered by English correspondences: the adjective *fake*, in English, designates counterfeit or forged entities, and is a synonym of *false*. But not across all contexts: these adjectives are interchangeable in contexts like (32) without entailing any changes in meaning, but not in examples such as (33). Moreover, *falso* in (32) and in (33) belong to different adjective classes: (32) is an non-restricting adjective, whose linguistic behaviour has just been described here, and (33) is a property ascribing adjective, which sets the value of the attribute **truth value** of the modified noun to **false**. We can make this claim even stronger by considering the data in (35).

(35) a. O juiz identificou as afirmações falsas.
'the judge identified the false statements'

b. O juiz identificou afirmações.
'the judge identified statements'

[23] This is not a possible context for *falso* (false), in the reading it has in (34)a.

c. O juiz identificou coisas falsas.
'the judge identified false things'

d. O juiz identificou coisas que pareciam afirmações, mas não eram.
'the judge identified things that seemed like statements but were not'

In chapter 3 we pointed out the entailment patterns displayed by non-restricting adjectives as one of their distinguishing features. If the truth value modifying *falso* were to be a non-restricting adjective, (35)a should not entail (35)b nor (35)c, but would entail (35)d. However, that is not the case. Like property ascribing adjectives, (35)a entails both (35)b and (35)c, but not (35)d. All these observations are equally valid with regard to *verdadeiro* (true), antonym of *falso* (false). Like *falso*, *verdadeiro* also displays two different readings, equivalent to those displayed in (32) and (33), showing similar properties and restrictions. This way, and for the same reasons presented above, we consider *verdadeiro* to have two independent lexical entries.

With regard to (34), it illustrates yet another reading of *falso*: that cannot be trusted. This seems to be a use derived from the core meaning in (32) by inference – things that are not authentic cannot be trusted. However, once again, we claim that, despite its semantic relation with the core meaning of *falso*, (34) is more than just a reading acquired in context and should have an independent entry in the lexicon. An argument in favour of this separation is the fact that this derived use has acquired enough independence for the original and the derived meanings to belong to different adjective classes. Once again, unlike the non-restricting form in (32), *falso*, in (34), is a property ascribing adjective: it gives no indication of the way the concept associated to the modified noun applies to a certain referent, but it rather introduces an extra restriction to those introduced by the modified noun – it sets the value of the **reliance** attribute of the modified noun to a very low value –, contributing to the delineation of NP denotation. Also, the occurrence of the *unreliable* meaning of *falso* in prenominal position is blocked, as shown in (34)b. In chapter 6 we argue that prenominal position is the standard position for non-restricting adjectives. This fact could explain why (34)b is ruled out: given these two concurrent forms, only the non-restricting reading is available in prenominal position, the property ascribing meaning being blocked.

This description and comments on these data are crucial for justifying our options in terms of the forms included in the table of non-restricting adjectives presented above.

We have identified several different semantic contributions made by adjective *false*. We distinguished between them, showing that these are more than adjective readings. Displaying crucial contrasts in terms of linguistic behaviour, we argue that they should have independent entries in the lexicon, and thus be considered homonym forms. Moreover, we have shown that these homonym forms belong to different adjective classes, only the (non-)authenticity *falso* being a non-restricting adjective. This way, only this one is represented in our table – both for *falso* and *verdadeiro*. Having made this point clear, we still want to make some comments on the semantic contribution made by these two adjectives.

In previous chapters, we have discussed the semantic contribution of *falso*, stating that its combination with the modified noun does not amount to set intersection: the resulting NP does not denote any subset of the set denoted by the modified noun, instead it denotes a set that does not share a single element with it, although its elements share some of the properties of the modified noun. This kind of informal gloss of the semantic contribution of *falso* makes its complexity apparent. *Falso* determines the negation of the denotation of the modified noun, but there is more to it: in order for something to be *falso* it has to share some of the characteristic properties of the modified noun. Let us illustrate this with an example: a *false diamond* is more than a *non-diamond*. Everyone would agree, for instance, that a *pen* is a *non-diamond*. However, no one would describe it as a *false diamond*, as they do not have enough properties in common. This complexity distinguishes *falso* from the most prototypical non-restricting adjectives: it introduces a semantic operator indicating the way the intension of the modified noun applies to the referent, a typical behaviour of non-restricting adjectives; but it does more, it introduces restrictions contributing to the delineation of NP denotation. In previous chapters we have seen that often there are lexical items that constitute a problem in terms of classification – considering a traditional concept of class as a very rigid set of necessary and sufficient conditions –, sharing characteristics of more than one word class. As previously argued for in this dissertation, instead of assuming the traditional notion of class as a discrete and rigid category, we follow Rosch (1975) in considering categories not to be "logical, bounded entities, membership in which is defined by features, in which all instances (…) have a full and equal degree of membership" (Rosch, *op. cit.*:544). Understanding classes this

way, some of the apparently problematic data just become natural. Moreover, borderline expressions such as *falso* can be very helpful as they often make apparent the thin border between classes: *falso* displays the core properties of non-restricting adjectives – reason why we classify it in this adjective class –, simultaneously sharing some features with property ascribing adjectives. We argue that this fact will have some impact on its linguistic behaviour, namely in terms of distribution in adnominal position, as we will see in detail in chapter 6.

As we discussed the semantics of *falso* (false), distinguishing between different senses which we argue to be separate meanings corresponding to independent entries in the lexicon, we stated that its antonym *verdadeiro* (true) also showed the same kind of linguistic behaviour. Although they are in fact similar in many aspects, *verdadeiro* has nonetheless specific traits that we will now address. Similarity amounts to truth value *versus* (non-)authenticity readings: like for *falso*, there are two homonym forms for *verdadeiro*, carrying this independent semantic content. We will not go into these as everything that was discussed and concluded about *falso* holds for *verdadeiro*. There are, however, other aspects that are specific of *verdadeiro*. Let us start by commenting on the semantic value we consider to be associated to it.

The double negation associated to *verdadeiro* – which in terms of truth conditions is equivalent to having no semantic operator with scope over the modified noun – may seem a little surprising. We base our proposal on the fact that the authenticity reading of *verdadeiro* only occurs in opposition to *falso*, i.e. we only say that something is authentic or genuine when there are acknowledged forged objects created to stand for the authentic ones. Actually, *falso* and *verdadeiro* very commonly occur with nouns denoting precious, rare or very valuable objects such as diamonds, pearls, money or fur coats. Conversely, they hardly combine with everyday objects such as tables, shirts or furniture, as they are somehow not worth faking[24]. Assuming both that the semantic contribution of *falso* consists in denying the denotation of the modified noun, and that *verdadeiro* denies that the denotation of the modified noun be false, the semantic contribution of *verdadeiro* seems to correspond to the negation of the negation introduced by adjectives like *falso*, i.e. to a double negation as proposed in the table

[24] Naturally, the proper context – any circumstances which make forging an object worthwhile – can license most combinations between *verdadeiro* (true) or *falso* (false), and any noun.

above. But *verdadeiro* occurs in some contexts that have no parallel with those we have presented and discussed for *falso*.

(36) a. Ele comprou jóias verdadeiras.
'he bought jewels true'

b. Ele comprou verdadeiras jóias.
'he bought true jewels'

(37) a. Ela tem uma mini-saia grande.
'she has a miniskirt big'

b. Ela tem uma grande mini-saia.
'she has a big miniskirt'

(38) a. Ele preparou uma salada bela.
'he prepared a salad beautiful'

b. Ele preparou uma bela salada.
'he prepared a beautiful salad'

Unlike *falso* in (32)a and (32)b, the meaning of *verdadeiras* in (36)a and in (36)b is not the same: in (36)a we have the authenticity meaning of *verdadeiras*; in (36)b the adjective indicates the exhaustivity of the reference of the modified noun, the authenticity meaning of *verdadeiras* not being a possible reading. More precisely, like *grande* (big) in (37)b and *bela* (beautiful) in (38)b, the semantic contribution of *verdadeiras* (true) in (36)b consists in stating that the intension of the modified noun fully applies to the referent, with all its consequences and with no margin for doubt[25] (Demonte, 1999:207). These data are a natural introduction to the discussion on a second set of non-restricting adjectives. These are associated to more complex values – or at least apparently more complex[26] – than the semantic operators displayed in the table presented in this section. Acknowledging this does not imply considerable adjustments on what was previously stated with regard to non-restricting adjectives. We only need to enlarge the set of values comprising the semantic contribution of non-restricting adjectives to more complex formulas (or less standard ones), which embed

[25] "[...] la interpretación hacia la exhaustividad de la referencia [invita] a que la acepción correspondiente se aplique al referente con todas sus consecuencias, sin ningún género de duda."

[26] Rather than more complex, this second set of values is above all less standard. In fact, the semantic operators associated to adjectives like *falso* (false) or *alegado* (alleged) only seem simpler because they have been well and repeatedly described in the literature and, thus, we use conventionally established notations to represent them. If this was not the case and we would have to use their formal definition, these would display a complexity similar to that of the semantic values we are now discussing.

the modified noun as proposed for the semantic operators associated to non-restricting adjectives listed in the first table presented in this section. We will not go into detail with regard to the formal definition of these semantic values, as this is clearly outside the scope of this dissertation, being object of work in formal logic. We will nonetheless put forth informal definitions for the kind of semantic contributions we are considering here. We already mentioned exhaustivity of reference, but there are more values of similar nature that can be identified as being associated to non-restricting adjectives, as presented in the table below.

non-restricting adjectives	*semantic contribution*	*informal definition*
único (only)	exclusivity	the intension of the modified noun exclusively applies to the referred entity, excluding any other entities and preventing them from even being candidates to satisfying the conditions that make up the reference of the modified noun
verdadeiro (real) belo (beautiful) grande (great)	exhaustivity of reference	the intension of the modified noun fully applies to the referent, with all its consequences and with no margin for doubt
mero (mere)	ordinariness of reference	the intension of the modified noun applies to the referent only to the extent of its sufficient conditions
antigo (old) ex- (former) actual (present) futuro (future)	time dependence of reference	the application of the intension of the modified noun to the referent is limited to a given period in time (either past, present or future)

5.3. CONCLUSIONS

In this chapter we have established modelling strategies for representing different adjective classes in GL. Motivated by the fact that not all empirical aspects discussed in chapter 3 were accounted for by the modelling strategies put in place in chapter 4, we set ourselves to delineating a finer grained strategy to model adjective representation in the lexicon. Although adjective representation in computational relational lexica allowed for mirroring adjective main definitional features, some syntactic contrasts remained unaccounted for. Also, due to their semantic nature, in particular their kinship with semantic operators, non-restricting adjectives remained unaccounted for in the modelling strategies presented in chapter 4. In this chapter we argued that, in order to

enable a principled account of the different ways the meaning of compound expressions is built, wordnets should include information on event and argument structures. Given this, our goal is to enrich wordnets with a lexical semantics framework, thus allowing for better descriptions of the nature of lexical meaning.

In order to achieve this objective, we have adopted the Generative Lexicon framework, as this model of the lexicon links the different modules of Grammar in a very intuitive way, allowing for a simultaneously thorough and economic modelling of the data. In section 5.1, we presented the main lines of the model, particularly focusing on representation levels (see section 5.1.1) and on generative mechanisms (cf. section 5.1.2).

With our modelling 'tools' well established, we put the main adjective representations put forth in the literature in parallel with the description of the data achieved in chapter 3, discussed them and showed how some adjective classes, particularly those showing a less 'typical' adjective behaviour – relational and non-restricting adjectives – call for alternative representation strategies. Designing such alternative modelling strategies resulted in the unified treatment of all adjective classes presented in this chapter.

Here, we put forth a homogeneous and economic approach for representing all adjective classes in the lexicon, while simultaneouly accounting for crucial empirical data, particularly contrasts observed in terms of linguistic behaviour. We started off with descriptive adjectives, which constitute the most representative adjective class and, thus, have been the most explored in the literature.

Our main contribution with regard to this wide adjective class amounts to an integrated approach to descriptive adjectives, resulting from the thorough discussion of several existing – often partial – analyses regarding this adjective class, which gained in strength as additional supporting data were provided. This integrated approach to descriptive adjectives allowed us to put forth a homogeneous modelling of this adjective class in GL:

- all descriptive adjectives were shown to be state-denoting lexical items, thus sharing a common semantic nature, made apparent by their homogeneous encoding in lexical models such as GL;
- descriptive adjectives have a stable meaning:

- they have the ability to modify a single aspect of noun meaning rather than modifying nouns as a whole, as illustrated in the AVM below (cf. selection restrictions encoded in the argument structure of *good*);

$$\begin{bmatrix} \textbf{good} \\ \\ \text{ARGSTR} = \left[\text{ARG}_1 = \left[\text{QUALIA} = \boxed{1}\right]\right] \\ \text{QUALIA} = \left[\text{FORMAL} = \textbf{positive evaluation}(e_1, \boxed{1})\right] \end{bmatrix}$$

- sense changes in context result from combining this core meaning with the meaning of the lexical material co-occurring with these adjectives – the modified noun, in particular – according to well-defined generative mechanisms (Selective Binding);

- as not all descriptive adjectives contribute to NP denotation in the same way (cf. intersective *versus* non-intersective readings), representing non-intersective readings in lexical models calls for specific strategies:
  - subsective adjectives are accounted for in terms of relativity to a comparison class, as proposed by Amaro (2002) – the data depicted in this chapter provide additional evidence in favour of this approach which thus gains in strength with our analysis;

$$\text{QUALIA} = \begin{bmatrix} \text{CONST} = \textbf{relative to a class}(e_1, \boxed{1}) \\ \text{FORMAL} = \textbf{adjective content}(e_1, x, \boxed{1})) \end{bmatrix}$$

  - adverbial readings are shown to be only apparently non-intersective and are accounted for intersectively.

Pursuing our work on property ascribing adjectives, we went on to designing modelling strategies for representing relational adjectives in GL. In fact, this adjective class is not considered in Pustejovsky's (1995) discussion of adjectives in GL. Relational adjectives being far from residual in Romance languages like Portuguese, we propose a modelling strategy for representing these adjectives in the lexicon. We base our approach on the distinguishing properties of the members of this adjective class, namely on them being characterised by introducing complex qualities and entailing

complex and diversified semantic relations, rather than ascribing single properties. Being so, we claim that these adjectives make an underspecified semantic contribution:

- they establish a link between the modified noun and a domain that is exterior to it;
- we represent this in GL by stating that members of this adjective class denote a relation between the modified noun and a set of properties roughly corresponding to the denotation of another noun, and encode this in the adjective formal role as follows:

$$\text{FORMAL} = \textbf{relates to } (\mathbf{e_1}\textbf{, modified\_noun, domain\_AVM}).$$

Finally, we focused on the acknowledgedly different class of non-restricting adjectives, which do not denote properties, behaving more like semantic operators. This fact has led many authors to leave them out of their analyses and theories, and authors working in the GL framework are no exception. So, as done for relational adjectives, we also designed modelling strategies for representing non-restricting adjectives in the lexicon from scratch.

We treat non-restricting adjectives as functions that map the extension of the modified noun onto a new extension, which does not have to be related to the original one in terms of set inclusion, this way conforming to these adjectives semantic nature, as described in chapter 3. Concerning these adjectives modelling in GL:

- we express the semantic contribution of non-restricting adjectives in terms of modality values;
- our proposal consists in considering that non-restricting adjectives embed some aspects of the meaning of the modified noun into a modal context as follows:

$$\text{FORMAL} = f_1(\boxed{1}) = \textbf{semantic\_operator}\,\boxed{1};$$

- assuming this analysis, we only have to define the modal contribution made by each non-restricting adjective in order to accurately represent them in the lexicon, which we do for a relevant set of members of this adjective class.

Moreover, we make apparent that putting a small set of economic generative mechanisms to work – unification, underspecification and information sharing between structures – allows us to account for complex linguistic phenomena such as the following:

- relativity to a comparison class;
- selection restrictions, in particular when a single adjective can alternatively select arguments with different semantic types;
- construction of meaning in context;
- sense change.

This way, as clearly shown in this section, our approach accounts for the most characteristic and general syntactic and semantic aspects of adjective behaviour.

However, in previous chapters, we have seen that there is an important role played by adjective relative position in the NP with regard to the definition of the meaning of adjective-noun groups, namely in what concerns adjective sense change, which remains unaccounted for. We focus on this issue in chapter 6, where we provide a detailed discussion and analysis of the data. Also, although the characteristic adjective linguistic behaviour are accounted for by the strategies set up in this chapter, there are some specific phenomena, namely aspects related to event modification by adjectives, that has to be analysed and discussed in more detail. We address this question in chapter 7.

CHAPTER 6

ADJECTIVE POSITION IN ADNOMINAL CONTEXTS

6.0. INTRODUCTION

In chapter 4 and 5 we have delineated a linguistically motivated approach for modelling adjectives in the lexicon. We proposed modelling strategies for encoding adjectives in computational relational lexica such as wordnets and enriched adjective lexical entries with information on event and argument structures. We used the GL framework to put this fine-grained modelling in place.

This way, we were able not only to mirror adjective definitional features, but also to account for the way the meaning of compound expressions is built. Moreover, with our approach we account for the most characteristic and general syntactic and semantic aspects of adjective behaviour.

In previous chapters we have seen that there is an important role played by adjective relative position in the NP with regard to the construction of the meaning of adjective-noun groups, namely in what concerns adjective sense change. In this chapter we discuss this issue in detail. We will consider adjective position in attributive contexts, focusing on adjective distribution and on the impact this distribution has on the construction of NP denotation.

Generally, in Portuguese, adjectives in adnominal contexts can occur both in prenominal position and in postnominal position. But not all: although the majority of adjectives can occur in both these positions, relational adjectives, for instance, can only occur postnominally, while most non-restricting adjectives can only occur prenominally. Moreover, there are some examples, discussed in previous chapters, in which the relative position of the adjective and the noun entails changes in adjective

meaning[1]. However, even if meaning change only occurs in very specific circumstances and with a relatively small number of adjectives, there are contrasts correlated to adjective relative position in the NP that are generally observed. These aspects are the object of this chapter. We aim at explaining the contrasting distribution of descriptive, relational and non-restricting adjectives. Also, we will account for some meaning contrasts that seem to depend on adjective-noun relative position in the NP. In order to do so, in section 6.1 we start by discussing whether adjective position in the NP is associated to certain values, and exactly which values are these. We pursue with a discussion on adjective distribution in adnominal contexts, associating the distribution contrasts observed to adjective classes and providing an explanation for the distribution restrictions displayed by the data. Having accomplished this description and preliminary analysis of the relevant data, in section 6.2 we equate some of the salient analysis in the literature, particularly work by Bouillon (1998) and Amaro (2002) on adjective sense change contexts, as these are closely dependent on adjective position in the NP. In section 6.3, after a detailed discussion and comparison of several analyses in the literature, we put forth our analysis and modelling proposal for representing in GL the impact adjective relative position in the NP has on the construction of NP semantic contribution. We conclude this chapter by representing some illustrative examples, showing how this analysis and modelling strategies conform to the data.

6.1. ADJECTIVE DISTRIBUTION WITHIN THE NP

As noted by Mateus *et al.* (1989:186), in languages like Portuguese, although AdjPs sometimes occur in prehead position, 'usually, they appear on the right handside of the NP head'. In fact, as illustrated in (1)-(3), we can identify three types of behaviour among adjectives with regard to adnominal position:

- adjectives that only occur in prenominal position (see (1));
- adjectives that only occur in postnominal position (see (2));
- adjectives that occur both in prenominal and postnominal positions (see (3)).

[1] For a detailed discussion on the relation between adjective position and changes in adjective meaning, in Portuguese, see Amaro (2002).

(1) a. Encontrei o suposto estudante no corredor.
'I met the alleged student in the hall'

b. *Encontrei o estudante suposto no corredor.
'I met the student alleged in the hall'

(2) a. * Encontrei o universitário estudante no corredor.
'I met the university student in the hall'

b. Encontrei o estudante universitário no corredor.
'I met the student university in the hall'

(3) a. Encontrei o inteligente estudante no corredor.
'I met the bright student in the hall'

b. Encontrei o estudante inteligente no corredor.
'I met the student bright in the hall'

Clearly there is a correlation between this distribution and adjective classes defined in chapter 3: relational adjectives, in (2), can only occur in postnominal position; other property ascribing adjectives, in (3), occur both in prenominal and postnominal position. As to adjectives like *suposto* (alleged), in (1), it belongs to the larger and most representative subgroup of non-restricting adjectives in terms of distribution in the NP. Although *suposto* (alleged) represents the 'typical' behaviour of non-restricting adjectives with regard to their distribution in adnominal contexts, there are, nonetheless, adjectives like *falso* (false), thoroughly discussed in previous chapters, and also a non-restricting adjective, that do not show this kind of distribution, occurring, like most property ascribing adjectives, both in prenominal and postnominal positions in the NP[2]. So, as the examples above indicate, there is a large group of adjectives that can occur both in prenominal and postnominal position.

However, although adjectives like *inteligente* (bright) in (3) can alternatively occur in prenominal and postnominal position, their relative position in the NP is far from being irrelevant from a semantic point of view. As noted by Demonte (2008) there are systematic interpretative differences associated with the relative position of the adjective in the NP. This observation, and although according to Demonte (*op. cit.*) these differences are not easily describable, confirms the conclusion drawn by several authors that syntactic position determines semantic interpretation (Bolinger, 1967; Bouchard, 1998; and Larson, 1998). Besides many other aspects that will be analysed in

[2] In section 3.3 we analyse these distribution contrasts among non-restricting adjectives.

section 6.1.1, it has repeatedly been noted that prenominal and postnominal adjective positions are not equally neutral: in languages like Portuguese, postnominal position is an unmarked syntactic position, whereas adjectives occurring prenominally are marked. This is not true of languages like English, for instance: in English there are no semantic differences emerging from prenominal and postnominal adjective positioning[3] corresponding to the ones we pinpoint further down. With regard to adjective-noun relative position in the NP, French is considerably similar to Portuguese. Bouillon (1998) points out that, prenominal position being a marked position, it is only used when the speaker intends to establish a special semantic relation between the adjective and the noun. Further below we investigate which kind of semantic relations are these. We start by trying to establish if there are specific values associated to adjective position in adnominal contexts, and which conditions determine adjective distribution in these contexts. In order to do so, we will look into adjectives occurring in both adnominal positions, as only these allow us to compare the two positions with a minimal interference of other phenomena[4].

6.1.1. 'CENTRAL' ADJECTIVES

To launch our investigation on the values associated to adjective position in adnominal contexts, we focus on the generally called 'central adjectives'. These form the largest group of adjectives, named 'central' for showing the most typical adjective linguistic behaviour. With regard to the aspects under discussion in this chapter, these are adjectives occurring both in prenominal and postnominal position in the NP.

First let us take a look at what is stated in traditional grammars about adjective position in adnominal contexts. Grammatical tradition, represented for instance by Cunha & Cintra (1996:268-269), ascribes certain values to adjective relative position in the NP: postnominal position is associated to objectivity; prenominal position to subjectivity.

[3] Although the contrasts observed show no parallel with what is at stake in Portuguese and other Romance languages, rather complex lexical and syntactic phenomena seem to be involved in the distribution of adjectives in the NP in languages like English. See Sadler & Arnold (1994) for a detailed description of the data and phenomena involved, and Arnold & Sadler (1994) for an analysis of noun modifying adjectives in English within the HPSG framework.

[4] In sections 6.1.2 and 3.3, respectively, we discuss adjectives showing a different distribution, namely the case of relational adjectives and of non-restricting adjectives like *suposto* (alleged) in (1).

This idea emerging from traditional grammars is explored and deepened by several authors. Hernanz & Brucart (1987:179-180) put forth a generalisation to account for the behaviour of adjectives that can easily appear both in prenominal and postnominal position. Pointing out that there are adjectives whose semantic value implies an evaluation by the speaker and others whose contents correspond to more neutral and objective properties, these authors argue that the latter, when in prenominal position, gain an aspect of subjective evaluation. They also underline that, when adjectives are evaluative by nature, i.e. when their value implies an evaluation by the speaker, the effect of prenominal position is hardly perceptible.

However, as González (1995) remarks, this generalisation is somewhat fragile from an explicative point of view, as the relation between the expressive difference identified and adjective position is not made very clear: no explanation is given for the relation established between these expressive nuances and the impossibility of having relational adjectives in prenominal position; also, the mandatory prenominal positioning of certain non-restricting adjectives fails to be explained. So, even if Hernanz & Brucart's (1987) descriptive generalisation is certainly relevant, it does not provide a solid explicative principle for the data.

Following González (1995) we will now look at some aspects that can contribute to a better understanding of what is at stake in these contexts, i.e. what explains the distribution observed and its impact on the semantics of NPs. The following examples, adapted from González (*op. cit.*:243), provide further evidence that there is more to it than just an expressive aspect.

(4) a. Assisti a uma palestra interessante em Lisboa.
'I attended a lecture interesting in Lisbon'

b. Assisti a uma interessante palestra em Lisboa.
'I attended an interesting lecture in Lisbon'

(5) a. * Assisti à sua[5] palestra interessante em Lisboa[6].
'I attended his lecture interesting in Lisbon'

b. Assisti à sua interessante palestra em Lisboa.
'I attended his interesting lecture in Lisbon'

The grammaticality contrasts between (4) and (5) seem to indicate that adjectives in prenominal position imply a reference to a specific entity. (5)a results strange because the possessive *sua* (his) determines that *a sua palestra* (his lecture) refers to a specific entity. Introducing the adjective *interessante* (interesting) in postnominal position corresponds to introducing an additional restriction in order to delineate and narrow down the reference *a sua palestra* (his lecture). Since the reference of *a sua palestra* (his lecture) is already determined, adding an extra restriction to it has a strange result.

Aiming at confirming whether this approach to the data is leading us in the right direction, let us look at similar contexts with proper nouns.

(6) a. O Al Gore fez uma palestra em Lisboa.
'Al Gore gave a lecture in Lisbon'

b. * O Al Gore persuasivo fez uma palestra em Lisboa.
'Al Gore persuasive gave a lecture in Lisbon'

c. O persuasivo Al Gore fez uma palestra em Lisboa.
'persuasive Al Gore gave a lecture in Lisbon'

By definition, proper nouns are rigid denotators, they always denote a specific and individual entity, i.e. proper nouns are lexical items whose reference is always

[5] This is a possible structure if we consider a deictic reading of *sua* (your), as made apparent in (i), where we use the deictic informal form.

(i) Assisti à tua palestra interessante em Lisboa.
'I attended your lecture interesting in Lisbon'

[6] This context can be acceptable with the implication that the NP *a sua palestra* (his lecture) does not conform only to a specific entity, but to a set of units. To illustrate this point, let us imagine the following situation: there is a project that is being presented among research communities around the world with the goal of finding new partners for its future stages. There is a member of the project team who is responsible for giving lectures presenting the project. In order to accommodate to different kinds of public, this researcher has prepared two different lectures: one that is more interesting and catchy, another one that is denser and more technically detailed. Given this context, we can imagine another member of the team, well familiar with these two lectures, stating that at a given event he attended the interesting lecture, and not the other one. In a situation such as this one the adjective *interessante* (interesting) can help to restrain the extension of the set denoted by *a sua palestra* (his lecture) – which in the context described above would accommodate to the description of two different entities –, in a similar way to what happens in (4)a. Thus, (5)a would no longer be ruled out.

determined, no matter the context in which they occur. Interestingly, in (6) we find the same kind of linguistic behaviour we observed in (5): both (5)a and (6)b, where adjectives occur postnominally, are ruled out. This additional evidence backs up the explanation presented above for the ungrammaticality of (5)a: when the entity designated by the noun is already fully determined, the adjective can no longer be used to identify an object and distinguish it from a larger set. However, examples like (6)c show that adjectives can co-occur with nominal items previously identified in discourse, such as proper nouns. Thus, co-occurrence of nominal items previously identified in discourse with adjectives is only ruled out when the latter are used to identify and distinguish an entity from a larger set. Being so, it is important to determine what happens in prenominal position, but not in postnominal position, so that (5)b and (6)c are licensed whereas (5)a and (6)b are not, and what is the role of adjectives in these contexts. It has been pointed out by several authors (e.g. Demonte (1999)) that rather than distinguishing an object from a larger set, thus contributing to the delineation of NP reference, in structures like (5)b or (6)c, the adjective underlines the most relevant property of an entity according to the speaker. More accurately, prenominal adjectives stress the information that the speaker considers most relevant to communicate in a given context. Following Pullum & Huddleston (2002), Demonte (2008) provides additional evidence supporting the first part of the claims presented above. As illustrated in (7), only postnominal adjectives can be used to answer "What kind of an N is X" questions, and only these adjectives can co-occur with set making verbs as well, because only postnominal adjectives are restrictive, i.e. distinguish an object from a larger set, prenominal adjectives making a considerably different semantic contribution which rules them out in contexts such as the ones presented below.

(7) a.Q: Que tipo de bebida pediu a Maria? A: A Maria pediu uma bebida fresca.
'Q: what kind of drink did Maria order? A: Maria ordered a drink fresh'

a'.Q: Que tipo de bebida pediu a Maria? A: *A Maria pediu uma fresca bebida.
'Q: what kind of drink did Maria order? A: Maria ordered a fresh drink'

b. A Maria separou os livros interessantes dos livros aborrecidos.
'Maria separated the books interesting from the books boring'

b'.*A Maria separou os interessantes livros dos aborrecidos livros[7].
'Maria separated the interesting books from the boring books'

Sadler & Arnold (1993) and Bouchard (1995) state something similar to this. According to these authors, the distribution restrictions described above are due to the establishment of different semantic relations between the noun and the adjective in the NP. And the surfacing of these different semantic relations depends on the existence of two structurally different constructions. But before discussing these and other analyses, let us go back to work by Higginbotham (1985).

Although not focusing on semantic contrasts related to adjective relative position in adnominal contexts, Higginbotham (*op. cit.*) was one of the first to distinguish between different types of modification structures. This author notices that in Montague's theory (Montague, 1970) all modifications are alike[8], although the data show that there are important differences that should be accounted for. From this observation, Higginbotham (1985) developed pioneering work in distinguishing between different types of modification structures. This author states that "each mode of combination has its characteristic semantics" (Higginbotham, 1985:568), and formalises this idea in terms of special arguments in the semantic grid of lexical items and specific modes of thematic discharge. We will not go into detail with regard to the technicalities of these

[7] There are some exceptions to Demonte's (2008) generalisation on the distribution of prenominal adjectives, as evidenced by (ii)b and (ii)d.

(ii) a. Q: Que tipo de bebida pediu a Maria? A: A Maria pediu uma bebida boa.
'Q: what kind of drink did Maria order? A: Maria ordered a drink good'
b. Q: Que tipo de bebida pediu a Maria? A: A Maria pediu uma boa bebida.
'Q: what kind of drink did Maria order? A: Maria ordered a good drink'

c. A Maria separou os livros bons dos livros maus.
'Maria separated the books good from the books bad'
d. A Maria separou os bons livros dos maus livros.
'Maria separated the good books from the bad books'

The contrast between the behaviour evidenced by the adjectives in (ii) and those in (7) is nonetheless limited to a small set of adjectives with very underspecified selection restrictions, like *bom* (good) and *mau* (bad), as argued in the previous chapter, section 5.2.1. Given this semantic underspecification, the semantic contribution they make in context is even more dependent on the modified noun than what is generally the case with other adjectives. We will, thus, consider them to be 'light' adjectives, and argue that it is this 'semantic lightness' that licenses sentences like (ii)b and (ii)d.

[8] Treating all modification structures in the same way resulted in the need for a series of postulates for allowing the theory to conform to the data.

modes of thematic discharge. However, the general idea behind them can be considerably relevant in the context of our discussion here.

One of the crucial observations under the scope of this work is that although modification is a unified linguistic phenomenon, it does not correspond to any single operation to be found, for instance, in quantification theory, sometimes being taken to express a conjunction of predicates, but not always. Some adjectives, for instance, grade things along dimensions that are in part contextually filled in, and partly controlled by the syntactic environment in which they occur. That is the case of adjectives which grade things with respect to an attribute given by the noun, for example[9]. In order to account for these non-intersective adjective readings, Higginbotham (*op. cit.*) states that, besides the commonly acknowledged arguments (corresponding to thematic roles), and their corresponding modes of thematic discharge, there are other types of open positions in the semantic grid of certain predicates, particularly adjectives[10]. This author discusses the contrast between intersective and subsective adjectives, and, in order to account for the way these adjectives combine with the modified noun, he postulates the existence of two extra types of arguments, besides thematic ones: referential arguments and intensional arguments.

Thus, it is a difference in the semantic grid of adjectives that accounts for differences in adjective-noun combination: on the one hand, all lexical items are associated to a referential argument, which has to be saturated in a maximal projection; on the other hand, some have an intensional argument in their semantic grid which also has to be saturated in a well-formed projection, thus giving rise to the establishment of different types of semantic relations between adjectives and nouns. In chapters 3 and 5 we thoroughly discussed these adjective classes, as well as Higginbotham's proposal on different modification patterns, which has been very important to support our work in the delineation of the modelling strategies we adopt for representing adjectives in the lexicon. These acknowledge the existence of an extra argument in subsective adjectives,

[9] For a detailed discussion on the role of scales in the semantics of adjectives see Demonte (forth.).

[10] Higginbotham (1985) uses the θ-criterion and takes it a step further to account for these phenomena. The θ-criterion suggests a strict correlation between predicates, which assign thematic roles, and arguments, which bear them. These assignments being understood as the filling of places in the predicate, there is a close correlation between them and the adicity of a predicate. However, Higginbotham (*op. cit.*) notices that, although most head nouns do not take arguments, they must have an open position in order for them to form NPs, a position which is accessible to the determiner so that it can bind the noun reference and, thus, give place to a well-formed NP. Assuming the existence of such non-thematic positions will be crucial for a better understanding of adjective-noun semantic combination.

accounting for the determination of the relevant comparison class by being saturated by the intension of the modified noun. So, in previous chapters, we have seen how Higginbotham's (*op. cit.*) proposal conforms to the data and how the crucial points it makes are transposable to non-derivational frameworks, such as GL (see section 5.2.1).

In this chapter we have a different goal: understanding the role played by adjective relative position in adnominal contexts in the construction of NP denotation. And Higginbotham's (*op. cit.*) central ideas are also relevant for understanding the phenomena discussed here.

As previously mentioned, Sadler & Arnold (1993) and Bouchard (1995) account for the different semantic relations established between the noun and the adjective in the NP by postulating the existence of structurally different constructions. Demonte (2008) also stresses the role played by syntactic position arguing that "adjectives have a lexical meaning which 'helps' to produce a logical meaning, but the latter meaning is obtained configurationally" (Demonte, 2008:75). Although we do not intend to go into a detailed discussion on the configurational aspects of their analyses, addressing the kind of semantic relations these authors identify as being established between the noun and the adjective can, nonetheless, be insightful for the development of our work[11]. According to these analyses, when it occurs after the noun, the adjective determines an intersection relation between its own denotation and the denotation of the modified noun. In prenominal position, however, there is an inclusion relation, and the noun and the adjective determine a single property (Waugh, 1977; Arnold, 1989).

In order to support the idea that postnominal adjectives determine an intersection relation between its own denotation and that of modified noun, whereas prenominal adjectives determine an inclusion relation, noun and adjective specifying a single property, Bouchard (1995) appeals to noun semantics and, following Milner (1989), uses two operative notions – noun virtual reference and noun actual reference – which are defined as follows: the virtual reference of a given noun consists on a set of conditions that must be satisfied by any object in the world in order for it to constitute the actual reference of that noun; the actual reference of a noun corresponds to the

[11] As previously stated, Sadler & Arnold (1993) work on English data, and these data display contrasts with regard to adjective position in the NP that have no parallel with what is at stake in languages like Portuguese (see footnote 3). Being so, although we consider the general assumptions put forth by these authors, we will not discuss their analysis in detail and, henceforth, we focus on Bouchard's (1995) and Demonte's (2008) analysis.

objects in the world which satisfy the set of conditions that make up the virtual reference of that noun[12]. These two notions obviously correspond to the logical notions of intension (a set of conditions that must be satisfied by objects in the world so that speakers are able to associate them to a given lexical sign) and extension (a set of objects in the world which satisfy the set of conditions in the intension of the noun) of any linguistic object. According to Bouchard (*op. cit.*), noun and adjective relative position in the NP determines the aspect of noun semantics to which the adjective applies: in postnominal position, the adjective would modify the entire set of features in the intension of the noun, i.e. the entity denoted by the noun as a whole; in prenominal position, the adjective would be able to modify any single feature in the semantics of the noun, as it "becomes part of a complex nominal head, hence part of its virtual reference" (Bouchard, 1995:327). However, Bouchard (*op. cit.*) does not provide a representation for either nominal or adjectival lexical entries, nor does he formalise the way their semantics interact. Demonte (2008) also addresses this question stating that postnominal adjectives select for the category they modify, whereas prenominal adjectives have scope over spatio-temporal event arguments or over denotational variables[13].

In previous chapters, we have addressed the question of adjective and noun lexical entries, putting forth formal representations for these lexical items. So we have overcome the first shortcoming of Bouchard's (*op. cit.*) analysis. With regard to the question of representing the way the information encoded in noun and adjective lexical entries interact to build NP denotation in a way that conforms to the data described here, we come back to it in sections 6.2 and 6.3, after discussing other salient analyses in the literature which contribute to a better understanding of the phenomena discussed in this chapter.

The data and analyses presented up until now make apparent that, in languages like Portuguese, the crucial difference between prenominal and postnominal adjectives regards the way these modifiers contribute to the construction of NP denotation.

[12] Note that the use these authors make of the expression *reference* does not correspond to the concept of **reference** as generally defined and used in Semantics.

[13] Demonte (2008) states that the concept of 'denotational variables' is left deliberately vague in order to cover all the different aspects in the intension of the noun. According to this author, this concept corresponds to the R[eferential] argument claimed to be bound by determiners when dealing with referential expressions (Longobardi, 1994).

Demonte (1999) describes the differences introduced by adjective position as follows: postnominal adjectives, on the one hand, are expressions that combine with set extensions (the modified nouns) to create new set extensions (the noun-adjective group); prenominal adjectives, on the other hand, are specific functions over noun references[14], which do not affect the extension of the modified noun, but stress one of the salient characteristics of the modified noun[15]. This way, in the latter case, the extension of the modified noun remains unchanged by the presence of the adjective. These observations conform to the data in (4)-(6) and are not very different from Bouchard's (1995) analysis. Demonte (2008) formalises these descriptive generalisations arguing that prenominal adjectives and postnominal adjectives differ as to their denotation: the former denote a function from adjective denotations to adjective denotations whereas the latter denote a function from individuals to truth values (or a property of individuals)[16].

Translating this into a set theory formalisation makes the contrasts between the two constructions apparent. Let us use some of the examples previously presented to illustrate this. In the NP *uma palestra interessante* (an interesting lecture), in (4)a, the adjective occurs in postnominal position. In chapter 3, we have seen that when adjectives such as *interessante* (interesting) occur in postnominal position they determine a set intersection operation:

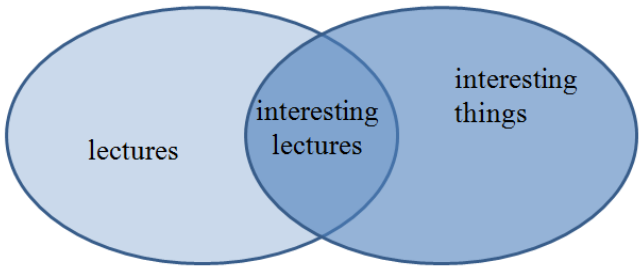
[14] It is generally accepted that reference setting takes place when a given nominal expression combines with a determiner. This poses a technical problem to this analysis. However, we will not discuss this issue here, as it is clearly outside the scope of this dissertation. For the sake of our argument we consider that the crucial aspect with regard to prenominal adjectives consists in having the entity designated by the modified noun previously identified in discourse.

[15] "Caracterizamos a los adjetivos posnominales (…) como expresiones que se unen a extensiones (nombres comunes) para configurar nuevas extensiones (nuevos nombres comunes); los adjetivos prenominales, en cambio, son funciones que actúan sobre la referencia o intensión sin que su aplicación afecte a la extensión del término modificado" (Demonte, 1999:192).

[16] Assuming that prenominal and postnominal adjectives differ with regard to their denotation poses an important problem to any analysis: these different denotations must be encoded in adjectives lexical entries. In the case of 'central adjectives', which can occur in both positions in the NP, this amounts either to arguing that these adjectives have two different lexical entries in the lexicon, or that there are mechanisms which transform one denotation in the other. Adopting this latter hypothesis entails the additional question of identifying basic and derived adjective denotations.
The primary question consists in whether there are aspects of the meaning of adjective-noun groups which come from structural factors. Demonte (2008) identifies this same question, claiming that adjective readings are probably a combination of adjective intrinsic meaning with the syntax of the expression in which they occur. We come back to this question further below in this chapter, arguing that adjective position plays a crucial role in the construction of NP meaning, namely in the case of adjectives which can occur in both adnominal positions.

[XY] being the set of entities denoted by the NP,
[X] being the set of entities denoted by the N,
and [Y] being the set of entities denoted by the ADJ,
[XY] = [X] ∩ [Y].

In (4)a, [interesting lectures] = [interesting things] ∩ [lectures], i.e. given the set of **lectures** and the set of **interesting things**, *palestra interessante* (interesting lecture) denotes the set of entities that belong to both sets, i.e. the set of entities that are in the intersection of the two sets considered, as shown in the diagram below.



Being so, when in postnominal position, the adjective "works" with the extension of the modified noun to form the NP extension: the adjective narrows down the set of objects which satisfy the conditions introduced by the noun (its extension) by adding an extra restriction to it.

Still following Demonte (1999, 2008), things are nonetheless a bit different with regard to adjectives in prenominal position: prenominal adjectives do not affect the extension of the modified noun, since, as indicated by the data in (6), in these contexts the entity mentioned is already identified in discourse. Being so, prenominal adjectives have no impact on the construction of NP denotation. These adjectives rather stress one of the salient characteristics of the modified noun. This being the case, prenominal adjectives must access the intension of the modified noun, i.e. the set of conditions determining its denotation, and adjective-noun combination cannot be interpreted intersectively, as in the example above.

Considering that **lectures** are a kind of **speech** which is **done for instruction**, let us illustrate this with our example in (4)b: the **lecture** that is mentioned in (4)b shares the

properties shared by all lectures and, besides this, it has other individual properties that characterise it, among which, is **being interesting**.

So, in the case of prenominal adjectives, adjective-noun semantic combination does not involve the sets of entities denoted by the noun and the adjective, i.e. noun and adjective extensions, but their intensions, i.e. the sets of conditions that have to be satisfied by entities in the world in order for them to be identified with a given lexical item. Also, as previously stated, in this case we are dealing with nominal items which are already identified in discourse, i.e. topics, whose characteristic properties are thus known. We can translate this in a first order logic framework as follows:

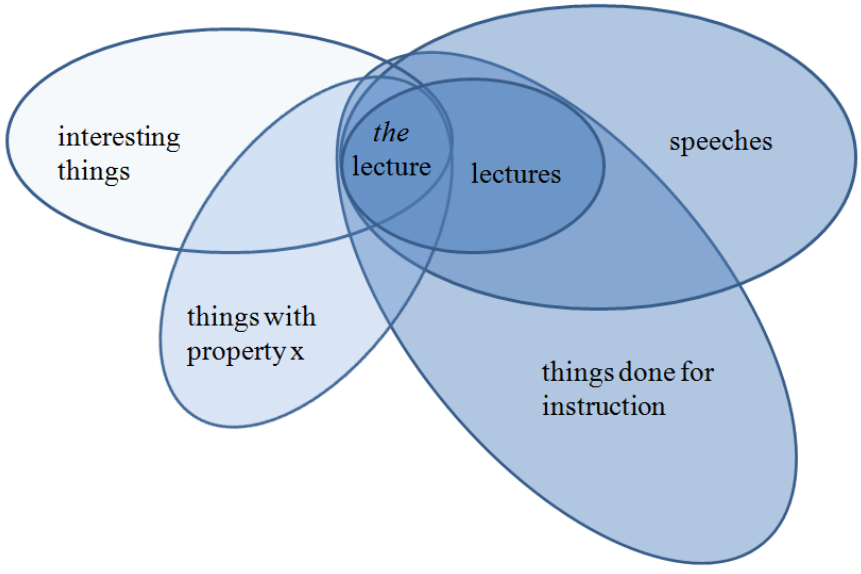
x being the object in the world which constitutes the reference of the NP,

Pn being a property that must be satisfied by x,

and f(N') being a function that maps the set of properties associated to N with an object in the world that satisfies them,

$P_5(x) \subset \exists \mathbf{x} [N'(x) \wedge P_5(x) \wedge \ldots \wedge P_m(x) \wedge f(N') = x] \subset N' = [P_1(x) \wedge P_2(x) \wedge \ldots \wedge P_n(x)]$

In our example, [the interesting lecture] $\subset$ [lectures].



The Venn diagrams presented above make apparent the contrast existing between adjective-noun relations established when the adjective occurs in postnominal position and when it appears in prenominal position. The reason behind these contrasts, however, i.e. explaining why adjective-noun relative position has such an impact on the

construction of NP denotation remains unaccounted for. In section 6.2 we focus on this question. But before doing so, we will also dedicate two sections to the description of the linguistic behaviour of adjectives displaying specific distribution restrictions in the contexts discussed for central adjectives, particularly relational (section 6.1.2) and non-restricting adjectives (section 3.3).

6.1.2. RELATIONAL ADJECTIVES

In the previous section we presented a solid description of data involving central adjectives in adnominal contexts. Moreover, we put forth a motivated analysis for how adjective relative position in the NP determines the construction of NP denotation. We have pointed out the different relations established between the noun and the adjective depending on their relative position. However, we have not yet explained how these contrasts relate to the differences in terms of distribution between adjective classes, namely why relational adjectives can never occur in prenominal position.

The crucial question being whether the entity denoted by the modified noun has already been identified in discourse, it was to be expected that, given the relevant and proper context, all adjectives would occur in both adnominal positions. But that is not the case. Not even for all property ascribing adjectives.

Above, we stated that prenominal adjectives stress **one** of the salient properties of the modified noun, the property they ascribe[17]. But relational adjectives do not ascribe a single property. They denote more complex qualities.

In chapter 3 we discussed work by Jespersen (1924) on the semantics of nouns and adjectives. Let us go back to it. This author argues that these two POS differ in terms of semantic complexity, and these differences explain why nouns cannot be graded and hardly occur in predicative contexts: due to the complexity of their denotation, nouns cannot be graded – since they introduce sets of properties, it would be almost impossible to know which of them was being graded. Likewise, in chapter 3, we have seen that relational adjectives cannot co-occur with degree adverbs nor participate in comparative structures for similar reasons. Pursuing this line of reasoning, this fact can

[17] The general case regarding prenominal adjective position in the NP amounts to stressing one of the properties of the modified noun. However, in particular circumstances, adjective prenominal position determines sense change. These exceptional data have been studied in detail in the literature (see Bouillon (1998) and Amaro (2002), among others). We come back to these pehnomena at the end of this chapter, showing how our approach allows for a unified treatment of all the data, including the particular case of sense change adjectives.

also explain why relational adjectives do not occur in prenominal position: given that prenominal adjectives single out **one** property of the modified noun, and since relational adjectives denote complex qualities, establishing a link between the modified noun and a domain exterior to it, instead of one simple single property, it would not be possible to know which property of the modified noun was being singled out. Thus, the occurrence of relational adjectives in prenominal position is straightforwardly ruled out for the same reasons explaining these adjectives resistance to gradation and comparison operations.

6.1.3. NON-RESTRICTING ADJECTIVES

In previous chapters, we described the linguistic behaviour of non-restricting adjectives. We made a contrastive description of property ascribing adjectives and non-restricting adjectives (see chapter 3) showing that the latter display very specific properties which allowed us to establish a kinship between this closed and relatively small adjective class and semantic operators.

Considering the analysis regarding property ascribing adjectives in sections 6.1.1 and 6.1.2, particularly the establishment of the impact differences in semantic content have in adjective distribution, we expect such a particular semantic nature to be crucial for understanding the distribution of non-restricting adjectives in adnominal position.

In order to do so, let us quickly go back to the most salient aspects characterising non-restricting adjectives. Along with Demonte (1999), we argue that, unlike property ascribing adjectives, which introduce additional properties to those carried by the modified noun, non-restricting adjectives are used "to indicate the way a concept or intension of a term applies to a certain referent"[18]. Also, this adjective class displays a special behaviour with regard to its distribution in adnominal contexts – almost all adjectives in this class exclusively occur in prenominal position. The data used in chapter 3 for identifying and analysing non-restricting adjectives distinctive features indicated this. However, we chose not to introduce this aspect to discussion there.

Although that is not the case of *falso* (false), which was thoroughly discussed in previous chapters, a great number of non-restricting adjectives seem to only occur in

[18] "Algunos adjetivos, en efecto, sólo sirven para indicar la manera como el concepto o intensión de un término se aplica a un determinado referente." (Demonte, 1999:139)

prenominal position. In fact, according to Demonte (1999), this class has an even more regular distribution in Spanish: in adnominal contexts, these adjectives can only occur in prenominal position[19]. Let us look at (32)-(15), which display occurrences of some of the most common non-restricting adjectives: *falso* (false), *verdadeiro* (true), *suposto* (supposed), *presumível* (so-called), *alegado* (alleged), *mero* (mere), *mesmo* (same) and *único* (single).

(8) a. A polícia apreendeu o diamante falso.
'the police seized the diamond false'

b. A polícia apreendeu o falso diamante.
'the police seized the false diamond'

(9) a. O empresário comprou as jóias verdadeiras.
'the businessman bought the jewels true'

b. O empresário comprou as verdadeiras jóias.
'the businessman bought the true jewels'

(10) a. *A polícia identificou o ladrão suposto.
'the police identified the thief supposed'

b. A polícia identificou o suposto ladrão.
'the police identified the supposed thief'

(11) a. *As autoridades capturaram o traficante presumível.
'authorities captured the drug dealer so-called'

b. As autoridades capturaram o presumível traficante.
'authorities captured the so-called drug dealer'

(12) a. *O juiz interrogou o assassino alegado.
'the judge questioned the murderer alleged'

b. O juiz interrogou o alegado assassino.
'the judge questioned the alleged murderer'

(13) a. *A investigação seguiu o palpite mero de um dos inspectores.
'the investigation followed the hunch mere of one of the inspectors'

b. A investigação seguiu o mero palpite de um dos inspectores.
'the investigation followed the mere hunch of one of the inspectors'

[19] Demonte (1999:207) presents some examples in which adjectives such as these apparently can occur in postnominal position. However, according to this author the non-restricting reading is only present in prenominal position, postnominal contexts corresponding to occurrences of homophonous property ascribing adjectives. In chapter 5, we pointed out the existence of homonym forms for adjectives like *falso* (false) in Portuguese. Hence, the variability of Portuguese data can also be partly accounted for in terms of homonym forms that are not non-restricting adjectives, but not all.

(14) a. *O estudante chumbou às cadeiras mesmas do semestre passado.
'the student failed the courses same as last semester'

b. O estudante chumbou às mesmas cadeiras do semestre passado.
'the student failed the same courses as last semester'

(15) a. *O inspector interrogou a testemunha única do acidente[20].
'the inspector questioned the witness only of the accident'

b. O inspector interrogou a única testemunha do acidente.
'the inspector questioned the only witness of the accident'

(32)-(15) show that, except for adjectives *falso* (false) and *verdadeiro* (true)[21], which occur both in prenominal and postnominal positions, postnominal position is ruled out for all the other examples. Leaving out these two exceptions for the time being, it seems clear that, conversely to relational adjectives, non-restricting adjectives occur only in prenominal position. If we consider both the semantic nature of this adjective class and the role played by adjective position in the construction of NP denotation, this distribution restriction appears as a natural consequence.

We have assumed with Demonte (1999, 2008) that prenominal adjectives are specific functions over nouns designating entities already identified in discourse. Given that non-restricting adjectives indicate the way the intension of a term applies to its referent, i.e. that they operate at the level at which identification in discourse is established, it is only natural that their occurrence be restricted to prenominal position.

[20] Some speakers accept contexts like (iii), in which *único* (only) occurs postnominally. However, they recognise a clear parallel between the sentence in (iii) and the structure in (iv), where the adjective is replaced by an adverb. Moreover, these speakers recognise an acceptability contrast between (iii) and (v), where agreement with a feminine noun takes place. These aspects indicate that *único* (only) in (iii) has an adverbial status.

(iii) O sucesso da proposta depende de um factor único.
'the success of the proposal depends on a factor only'
(iv) O sucesso da proposta depende de um factor apenas.
'the success of the proposal depends on just a factor'
(v) ?? O sucesso da proposta depende de uma razão única.
'the success of the proposal depends on a reason only'

This way, and given the apparent adverbial status of *único* in (iii), this structure does not constitute a counter example to our description of the data, namely to our claim that non-restricting adjectives only occur in prenominal position.

[21] In chapter 5 (section 5.2.3), in our first discussion on the distribution of non-restricting adjectives in adnominal position, we focused on these two adjectives showing that there are complex phenomena determining the specificities observed in their distribution. We identified the existence of homonym forms introducing some 'noise' in the data. However, the contrasts observed in distribution in adnominal contexts between these two adjectives and other non-restricting adjectives are not fully accounted for by this 'noise'. We come back to this question further below in this section.

Being so, the problematic data concern adjectives *falso* (false) and *verdadeiro* (true). As observed in previous chapters, (32) and (9) show that, unlike all other non-restricting adjectives in (10)–(15), these two adjectives can occur both in prenominal and postnominal positions. Having identified homonym forms of these two adjectives belonging to other adjective classes and distinguishing between them (see chapter 5, section 5.2.3), here we only consider the distribution of non-restricting forms of *falso* (false) and *verdadeiro* (true).

We thoroughly discussed the semantic contribution of *falso* in chapter 5, arguing that the NP resulting from the combination of this adjective and any given noun denotes a set that does not share a single element with the denotation of the modified noun, although their elements necessarily share some properties. This kind of informal gloss of the semantic contribution of *falso* makes its complexity apparent: *falso* determines the negation of the modified noun, simultaneously ascribing some of its characteristic properties to the referent. Thus, *falso* introduces a semantic operator indicating the way the intension of the modified noun applies to the referent – a typical behaviour of non-restricting adjectives –, but it also introduces restrictions contributing to the delineation of NP denotation, like property ascribing adjectives. Previously in this dissertation we assumed that natural classes, and linguistic ones in particular, rather than discrete and rigid categories, should be perceived as organised groups delimiting a continuum of realities. This way, specific entities do not have a full and equal degree of membership to these natural classes (Rosch, 1975). The complexity of *falso* leads us to consider it a borderline element, sharing features of both property ascribing and non-restricting adjectives, among which its distribution, typical of the former class: *falso* can occur both in prenominal and postnominal positions in adnominal contexts.

Passing on to *verdadeiro*, there are important differences to be discussed. *Verdadeiro* occurs in contexts that have no parallel with those of *falso*. Unlike *falso* in (32)a and (32)b, the meaning of *verdadeiras* in (9)a and (9)b is not the same: in (9)a we have the authenticity meaning of *verdadeiras*, antonym of *falso* in both (32)a and (32)b; whereas in (9)b *verdadeiras* indicates the exaustivity of the reference of the modified noun, being synonym of the non-restricting forms of adjectives like *belo* and *grande* (cf. section 5.2.3, page 169). The semantic contribution of *verdadeiras* in prenominal position consists in stating that the intension of the modified noun fully applies to the

referent, with all its consequences and with no margin for doubt[22] (Demonte, 1999:207). Moreover, in prenominal position, the authenticity meaning of *verdadeiras* is not a possible reading. In fact, although we have identified several homonym forms both for *falso* and *verdadeiro*, there is an important difference to be acknowledged: only one of the forms of *falso* is a non-restricting adjective; whereas there are two for *verdadeiro* – one determining the authenticity of the referent, the other the exhaustivity of the reference. Probably, it is this convergence in form that explains their distribution: each of these adjectives is restricted to occurring in one of the adnominal positions. Being antonym of *falso*, and therefore closer to property ascribing adjectives, it is expected – and confirmed by the data – that the authenticity form of *verdadeiro* be restricted to postnominal position, its occurrence in prenominal position being blocked by the existence of the prototypical non-restricting adjective *verdadeiro*, determining exhaustivity of the reference.

6.2. SOME SALIENT ANALYSES IN THE LITERATURE

In section 6.1.1 we thoroughly described the contrasts between postnominal and prenominal adjectives. We focused on descriptive aspects and did not yet delineate explicative principles for the data. Thus, explaining why adjective-noun relative position in the NP has such an impact on the construction of NP denotation remains an open question. This is the object and the goal of this section.

As shown previously in this dissertation, authors like Sadler & Arnold (1993), Bouchard (1995) and Demonte (2008) consider that there are two configurationally different syntactic constructions in which adjectives can participate[23] and which would account to some extent for the contrasts between prenominal and postnominal adjectives. This way, as they participate in different syntactic structures, adjectives can establish distinct syntactic and semantic relations with the noun they modify. Bouchard (1995) examines this question in detail, identifying a link between the syntactic relation

[22] "[...] la interpretación hacia la exhaustividad de la referencia [invita] a que la acepción correspondiente se aplique al referente con todas sus consecuencias, sin ningún género de duda."

[23] According to Sadler & Arnold (1993) and Bouchard (1995), syntactically, postnominal adjectives form normal syntactic categories with the noun. Contrastingly, prenominal adjectives form a weak lexical category (an endocentric head to head construction) around an X° projection. Given this, prenominal adjectives are in between lexical and syntactic structures, sharing properties with both of them. According to these authors, this explains their hybrid linguistic behaviour, observable in facts such as the following: prenominal adjectives can participate in coordination structures, but they cannot co-occur with complements.

established with the noun and the different aspects of nominal semantics to which the adjective applies: in postnominal position the adjective modifies all the features denoted by the noun, i.e. the entity it denotes as a whole; in prenominal position it can apply to any single aspect of noun semantics as it "becomes part of a complex head, hence part of its virtual reference" (its intension) (Bouchard, 1995:327). Like Bouchard (1995), Bouillon (1998) considers that adjective relative position in the NP determines which types in the qualia of the noun can be modified by the adjective: in postnominal position the adjective only has access to the noun head type; in prenominal position, the adjective can apply to any type simultaneously present in the noun qualia structure and selected by the adjective itself. This way, in order for an adjective to be able to modify other type than the noun head type, it must occur in prenominal position. In short, following Wilmet (1986)[24], Bouillon (1998) considers that, in languages like French, postnominal position is the neutral adjective position, prenominal position being used for establishing special semantic relations.

Being so, adjective occurrence in prenominal position has to be explained by certain factors that we should be able to identify and characterise. Focusing on meaning change, Bouillon (1998) only addresses those cases in which adjective prenominal position determines that adjectives apply to any type in the qualia structure of the modified noun other than its head type.

However, these analyses fail to account for the distribution contrasts in (1)-(3), described in detail in sections 6.1.1, 6.1.2 and 3.3. In fact, although they account for the meaning contrasts related to adjective relative position in the NP, no unified explanation for adjective distribution restrictions is given. If the meaning contrasts are due to the existence of two possible syntactic constructions for adjectives, why is the participation of some elements of this POS sometimes blocked in one of these constructions? Also accounting for these data in terms of configurationally different syntactic structures, González (1995) states that adjective relative position in the NP is dependent on the organisation of the mechanisms of thematic discharge. Assuming Higginbotham's (1985) analysis on the thematic complexity of different adjective classes, González (*op.*

[24] Wilmet (*op. cit.*:158) states that, being a neutral position, postnominal position does not need to be justified. Prenominal position, on the other hand, necessarily has one of the following effects: determining an inclusion relation, instead of the general intersection relation; selecting a metaphoric semantic interpretation; or introducing a naïve impression to world knowledge, given that postnominal position does not comprise subjectivity.

cit.) reinterprets this thematic complexity in terms of the lexical structure projected by different adjectives. Although we do not intend to go into the technical details of the configurational structures postulated by this author, it is important to underline some of the general aspects of his proposal.

González (*op. cit.*) postulates that these mechanisms of thematic discharge operate by phases, involving two steps. Adjectives in the NP integrate a kind of Larsonian projection: there are two maximal projections in each of which an operation takes place – the relevant mechanism of thematic discharge that saturates (or identifies) the arguments in the adjective lexical entry, resulting in well-formed structures. For these operations to be successfully accomplished in the theoretical framework adopted by González (*op. cit.*) movement is in order, more precisely, a succession of movements[25]. And it is the various movements involved in the operations taking place at the different structural configurations that result in several possible adjective relative positions in the NP. Thus, adjective-noun relative position is determined by the lexical nature of the former, i.e. by the arguments in its lexical structure, as they will determine not only the kind of structure that is projected at syntax, but also the operations that will have to take place in order for well-formed structures to surface. With regard to alternations displayed by adjectives which can occur both in prenominal and postnominal positions, these are accounted for by the movements that are needed to establish NP reference, and this is why, as discussed in section 6.1.1 (see (4)-(6)), adjective position is not independent from restrictions regarding whether the noun is already identified in discourse. Also according to this author, these two steps, and the movements which determine the final syntactic structure, set two types of configurations, one resulting in predication relations and another in evaluation relations. In general lines, this approach goes along similar lines of Demonte's (2008)[26]. Being so, along the main claims of proposals by Sadler & Arnold (1993) and Bouchard (1995), González (*op. cit.*) and Demonte (*op. cit.*) assume that contrasts regarding adjective prenominal and postnominal position amount to the syntactic structure in which adjectives occur. However, and this is González's (*op. cit.*) and Demonte's (*op. cit.*) crucial contribution,

[25] González (1995) adopts Chomsky's Principles and Parameters model (Chomsky, 1981) to delineate his analysis. As these movements are internally motivated by theoretical restrictions, we will not go into their nature and motivation, as they are not a crucial point for our discussion, which is framed by non-derivational lexical models of the grammar.

[26] See footnote 16.

these different configurational structures are determined by adjectives themselves, more precisely, by their lexical entries, as it is the thematic complexity of lexical items, and of adjectives in particular, that determines the kind of lexical structure that is projected at syntax[27].

6.3. REPRESENTING PRENOMINAL AND POSTNOMINAL ADJECTIVES IN LEXICAL MODELS

In this dissertation, we place ourselves in a lexical approach to the grammar, representing adjectives in the lexicon being one of the main goals of our work. Naturally, our analysis has to deal with some aspects of adjective syntactic behaviour whose motivation is linked to the information present in adjective lexical entries. This way, we managed to achieve our goal, putting forth strongly motivated adjective lexical representations, which are able to account for a number of phenomena related to adjective syntactic and semantic behaviour. We did so by establishing a tight connection between these phenomena and the intrinsic properties of adjectives. For various reasons, presented and discussed where appropriate, we chose to model adjectives and their properties within relational models of the lexicon – focusing on wordnets –, and in the GL framework. In chapters 3 and 5 we described and modelled the internal structure of adjectives belonging to different adjective classes. Analysing the data, we identified syntactic and semantic contrasts which allowed us, not only to establish adjective classes, but also to determine and put forth a proposal for representing them and their distinguishing features in the lexicon. Although wordnets and GL are both models of the lexicon, GL, in particular, provides us with the tools for combining lexical items and calculating their joint semantic contribution. This way, and although the devices at our disposal are not specifically designed for modelling phenomena such as adjective syntactic position in the NP, they allow us to model the semantic contribution of complex expressions. This way, and although representing syntactically motivated

[27] The exception is adjectives occurring in both positions and not displaying sense change. These are accounted for by independent factors by González (1993): movements required for establishing NP reference.
Demonte's (2008) approach to these cases is considerably different. Analysing the implication adjective position has on this group of adjectives, Demonte (*op. cit.*) claims that a strategy of focalisation is co-substantial with the marked meaning of certain prenominal adjectives, whose position is derived by movement to a focus position. Our claims go along similar lines, although our analysis is not developed in a derivational framework, as presented in detail in section 6.3.

phenomena is outside the scope of this dissertation, in this section we discuss some aspects of NP semantics, providing modelling strategies for calculating and representing it in GL.

However, following Higginbotham (1985), we assume that differences in the internal structure of adjectives can determine contrasts in terms of adjective-noun combination. Such contrasts can range from differences in adjective semantic contribution to the construction of NP denotation, to asymmetries in distribution. Hence, in section 6.1 we established a link between the semantic nature of adjectives, their contribution to the construction of NP meaning, and the syntactic restrictions observed with regard to their distribution in adnominal contexts. In this section we aim at making this link explicit, by modelling full NP structures – both with prenominal and postnominal adjectives. This will underline the contrasts previously identified and make them apparent.

Previously in this dissertation we mentioned work developed by Bouillon (1998) and Amaro (2002). Both these authors aim at analysing and representing adjective sense change. As this very specific adjective semantic behaviour is directly related to adjective position in adnominal contexts, they have to address this question in detail. Although we aim at arriving at a general proposal accounting for the distribution of all adjective classes in adnominal contexts, we will start by casting a glance at their work on this small and very restricted group of apparently exceptional adjectives. But before doing so, let us exemplify the phenomena considered by Bouillon (*op. cit.*) and Amaro (*op. cit.*).

(16) a. Ele encontrou um amigo velho.
'he met a friend old'
He met an aged person who is also a friend of his.

b. Ele encontrou um velho amigo. (ambiguous)
'he met an old friend'
Reading 1: He met a person who has been a friend of his for a long time.
Reading 2: He met an aged person who is also a friend of his.

Assuming what is commonly acknowledged in grammatical tradition, Bouillon (1998) starts by underlining that adjective prenominal position is a marked syntactic position, contrasting with the more canonical and neutral postnominal adjective

position. Moreover, Bouillon (*op. cit.*) states that prenominal adjective position is only used when the speaker intends to establish a special semantic relation between the adjective and the noun. By "special semantic relation" Bouillon (*op. cit.*) means adjective sense change contexts, i.e. those contexts in which, rather than determining a subset of the denotation of the modified noun, the adjective establishes a link with a specific feature in the semantic structure of the noun.

In order to be able to represent this phenomenon, Bouillon (*op. cit.*) needs a model which allows her to "look inside the semantic structure of a linguistic unit, and (...) [make] possible a principled account of the way in which the meaning of a composite unit emerges through the integration of the meanings of its parts" (Taylor, 1992:9). As thoroughly shown in chapter 5, GL provides us with the mechanisms to do so.

$$\begin{bmatrix} \textbf{amigo} \\ \text{ARGSTR} = \begin{bmatrix} \text{ARG}_1 = \textbf{x} : \textbf{human} \\ \text{D\_ARG}_1 = \textbf{y} : \textbf{human} \end{bmatrix} \\ \text{QUALIA} = \left[\text{FORMAL} = \textbf{friendship}(\textbf{e}_1, \textbf{x}, \textbf{y})\right] \end{bmatrix}$$

$$\begin{bmatrix} \textbf{velho} \\ \text{EVENTSTR} = \left[\text{E}_1 = \textbf{e}_1 : \textbf{state}\right] \\ \text{ARGSTR} = \left[\boxed{1}\ \text{ARG}_1 = \textbf{w}\right] \\ \text{QUALIA} = \begin{bmatrix} \text{FORMAL} = \textbf{exist\_for\_a\_long\_time}(\textbf{e}_1, \textbf{w}, \boxed{1}) \\ \text{CONST} = \textbf{relative\_to\_a\_class}(\textbf{e}_1, \boxed{1}) \end{bmatrix} \end{bmatrix}$$

Considering that the representations presented above model the lexical entries of the noun and adjective in (16)[28] – *amigo* and *velho*, respectively –, Bouillon (1998) analysis

[28] The AVMs presented above are adapted from Bouillon (1998), as we consider the original proposal to have some problems. According to Bouillon (1996; 1999) nouns like *amigo*, discussed above, are dotted typing lexical items, as implied by the AVM below, representing adjective *vieux* (old) (cf. the ARGSTR of *vieux*). This assumption allows her to account for adjective argument selection depending on its position.

$$\begin{bmatrix} \textbf{vieux} \\ \text{EVENTSTR} = \left[\text{E}_1 = \textbf{e}_1 : \textbf{state}\right] \\ \text{ARGSTR} = \left[\text{ARG}_1 = \textbf{x} : \textbf{individu} \bullet \textbf{e}_1 : \textbf{state}\right] \\ \text{QUALIA} = \left[\text{FORMAL} = \textbf{exist}(\textbf{e}_1, \textbf{x}) \wedge \textbf{old}(\textbf{e}_1)\right] \end{bmatrix}$$

However, as discussed in detail by Amaro (2003), the nouns occurring in these contexts cannot be dotted typing nouns, as they are not regularly polysemous (cf. Antunes (2002)): there are no contexts in which only one of their subsemantic types is available. Moreover, as shown by Amaro (2002, 2003), it is possible to represent these adjective alternations without having to assume that modified nouns must be dotted typing nouns. We agree with Amaro (*op. cit.*) and follow her in considering the nouns participating

consists in considering that adjective position determines which aspects of nominal semantics can be modified by the adjective. Given this, she presents different GL representations for each type of NP: when in postnominal position the adjective only has access to the entity denoted by the modified noun as a whole (**x**, in the AVM for *amigo* (friend) presented above); in prenominal position, the adjective can apply to any feature in the qualia structure of the modified noun that is compatible with its selection restrictions. This analysis correctly predicts that only (16)b be ambiguous, i.e. that the adjective must precede the noun in order to be able to modify any feature in the qualia structure of the modified noun – the **friendship** event in the formal role (FORMAL) of the qualia structure of *amigo*, for instance. However, Bouillon (*op. cit.*) does not provide an explanation for this. Thus, her work on adjective position in the NP stays at a descriptive level: Bouillon (*op. cit.*) does not identify the role played by adjective position in the construction of NP meaning, hence not providing an explicative principle for the data. Moreover, (17) apparently makes up a counter-example to what has just been stated above, as (17)a, in which the adjective *bom* (good) occurs in postnominal position has two available readings: one in which the adjective modifies a **playing event**; and another in which it modifies a person[29]. We come back to this example further down, after discussing the approach put forth by Amaro (2002).

(17) a. Ele encontrou um guitarrista bom.
'he met a guitar-player good'
available readings: *He met a person who plays the guitar well.* (preferred reading)
He met a good person who plays the guitar.

b. Ele encontrou um bom guitarrista.
'he met a good guitar-player'
available reading: *He met a person who plays the guitar well.*

in these particular adjective-noun constructions not to be regularly polysemous, hence the adaptations in the representation we adopt for the nouns occurring in adjective alternations, visible in the AVMs presented in the main text of this chapter.
Also, as mentioned in chapter 5, footnote 16, there is another problem concerning the representation put forth by Bouillon (*op. cit.*) to model adjectives like *velho* (old): according to the AVM presented above, the event denoted by the adjective, $\mathbf{e_1}$, is the same event that constitutes its argument, i.e. the event denoted/or associated to the modified noun, also $\mathbf{e_1}$. Independently of it being a slip of the pen or a real technical problem, it is clearly an incorrect representation, as the state of being **old** (state denoted by adjective *velho* (old)) cannot be the same of **being friends with** (state denoted by a noun like *amizade* (friendship), or associated to a noun like *amigo* (friend)), for instance.

[29] The event modifying reading of (17)a is this sentence preferred reading. We come back to this question further down in this chapter, the crucial fact for now being the possibility of, given a proper context, either of the readings associated to *bom* being available when the adjective occurs in postnominal position.

Also focusing on adjective sense change, Amaro (2002) takes this question a step further. Assuming with Pustejovsky (1995) that alternations derive from the semantic information in lexical entries[30], Amaro (*op. cit.*) establishes a parallel between adjective sense change and verbal alternations. As demonstrated by Pustejovsky & Busa (1995), the polysemy of verbs participating in causative/inchoative alternations is due to a simultaneously complex and underspecified event structure: it is the combination of the headless nature of these verbs event structure and the fact that they are transitions, i.e. **complex events** made up of a process subevent plus a final state, that explains their ability to either surface as a causative or as an inchoative. According to these authors, given the presence of more than one qualia role in the semantic structure of a lexical item, individual qualia compete for projection and the mechanism of headedness acts as a filter to constrain the set of projectable arguments. Understanding verbal alternations this way allows us to draw near this phenomenon and adjective sense change, as they seem to share crucial features: adjective sense change only surfaces when the modified noun makes several facets available for modification by the adjective, i.e. it is the complexity of the head noun, combined with the underspecification of the adjective, in particular of its selection restrictions, that determines whether 'adjective alternations' surface or not. The following table sums up these ideas, making apparent that Amaro (*op. cit.*) proposal is on the right track when it approaches adjective sense change as an alternation, proposing a unified analysis for verbal and adjective alternations.

	verbal alternations	*adjective sense change*
underspecification	the event structure denoted by verbs showing causative/inchoative alternations is headless	adjectives displaying sense change select for more than one type of argument
complexity	verbs showing causative/inchoative alternations are complex events, denoting a **process** subevent plus a final **state**	nouns modified by adjectives displaying sense change are complex entities, showing several facets in their qualia structures

[30] One of the basic assumptions of Pustejovsky's (1995) analysis of causative/inchoative alternations is that generative rules "operate over underspecified lexical representations, such that the behaviour of a predicate can be predicted from the configurational properties of different parameters in the semantic representation" (Pustejovsky, *op. cit.*:188).

Another important contribution of Amaro's work consists on the way this author summons the typology of alternations proposed by Fernández et al. (1999) to explain the role played by adjective position in the construction of NP denotation. Among the alternations considered in this typology, *change of focus*[31] is particularly interesting to us. As underlined by Amaro (*op. cit*), this type of alternation and adjective sense change phenomena have several aspects in common: they determine a change of focus on the components of a single semantically complex argument. This alternation results in a contrast between a structure which presents an entity as whole and a structure in which one of the parts making up an entity is emphasised. The similarity between these verbal alternations and adjective sense change is striking: the semantic contrasts shown by the latter amount to whether these combine with the entity denoted by the modified noun as a whole (the noun head type) or with one of its facets (one of the qualia roles in its qualia structure). Moreover, these contrasts are linked to the syntactic position in which adjectives occur: prenominal position allows the adjective to combine with any feature in the qualia structure of the modified noun; in postnominal position only the noun head type is available for modification. This is entirely compatible with what is commonly stated about prenominal adjectives in grammatical tradition, often described as a result of emphasis given by the speaker. Authors like Demonte (2008) also argue for this approach to the prenominal position of adjectives claiming that the marked meaning of certain prenominal adjectives is a result of a strategy of focalisation. In fact, according to Demonte's (*op. cit.*) analysis prenominal position is derived by displacing the adjective to a *focus* position, from the position in which it is originally generated. Clearly, our approach is theoretically different, but we maintain this association between *stress* and prenominal adjectives showing the kind of value described above[32].

The AVMs presented below, adapted from Amaro (2003), model this analysis, making these crucial properties apparent. But before going through them in detail, we want to discuss a very specific aspect of Amaro's (*op. cit.*) proposal, essentially a

[31] This alternation type does not correspond to the *topic* versus *focus* opposition between old and new information, but rather to the evidencing of some expression.

[32] This way, introducing an adjective in prenominal position corresponds to underlining the information given by it. This is sometimes accompanied by prosodic stress, but not necessarily, and we do not wish to make any claim regarding prosody when we mention the stressing function of prenominal adjective position in the NP.

technical detail, from which we propose some adjustments to her representations, contributing to making them more empirically motivated.

Amaro's (2002, 2003) analysis consists in interpreting adjective sense change as an alternation. Being so, she applies to adjectives the strategy used by Pustejovsky (1995) to represent verbal alternations in GL. In Pustejovsky (*op. cit.*), verbal alternations are represented in the event structure of the verb: for verbal alternations to surface, it is necessary that the verb at stake be simultaneously complex and underspecified, as causative/inchoative alternations depend on part of the event denoted by the verb being focused to constitute the head of the event structure. However, adjectives are state predicates and, as so, they are associated to atomic event structures. This way, they do not denote complex event structures from which it is possible to select a subevent that might be its head. In order to maintain the strategy to model verbal alternations delineated by Pustejovsky & Busa (*op. cit.*), Amaro (*op. cit.*) proposes that, when adjectives occur in prenominal position, the adjective event structure allows for a contextual event head definition, and for the event denoted by the modified noun to be focused: the event in the qualia structure of the modified noun is included in the event structure (EVENTSTR) of the NP and marked as its head.

$$\left[\begin{array}{l}\textbf{velho amigo}\\ \text{EVENTSTR} = \left[\begin{array}{l}\text{E1} = \mathbf{e}_1 : \textbf{state}\\ \text{HEAD} = \mathbf{e}_2 *\end{array}\right]\\ \text{ARGSTR} = \left[\begin{array}{l}\text{ARG1} = \left[\begin{array}{l}\textbf{human}\\ \text{ARGSTR} = \left[\begin{array}{l}\text{ARG1} = \boxed{1}\ \mathbf{x} : \textbf{human}\\ \text{D\_ARG1} = \boxed{2}\ \mathbf{y} : \textbf{human}\end{array}\right]\\ \text{QUALIA} = \left[\begin{array}{l}\text{FORMAL} = \left[\begin{array}{l}\boxed{3}\ \textbf{state}\\ \text{EVENTSTR} = \left[\text{E2} = \boxed{4}\ \mathbf{e}_2 : \textbf{state}\right]\\ \text{ARGSTR} = \left[\begin{array}{l}\text{ARG1} = \boxed{1}\\ \text{ARG2} = \boxed{2}\end{array}\right]\\ \text{QUALIA} = \left[\text{FORMAL} = \textbf{friendship}(\mathbf{e}_2, \boxed{1}, \boxed{2})\right]\end{array}\right]\end{array}\right]\end{array}\right]\\ \text{QUALIA} = \left[\begin{array}{l}\text{FORMAL} = \textbf{exist\_for\_a\_long\_time}(\mathbf{e}_1, \boxed{4}, \boxed{3})\\ \text{CONST} = \textbf{relative\_to\_a\_class}(\mathbf{e}_1, \boxed{3})\end{array}\right]\end{array}\right]$$

To represent our example, *velho amigo*, Amaro (*op. cit.*) puts forth the structure presented above[33]. Although we generally agree with Amaro's (*op. cit.*) proposal, namely with regard to the association of prenominal position to stress and to treating adjective sense change as an alternation, having the event associated to the modified noun promoted to, not only integrating, but being head of the event structure of the whole NP seems counter-intuitive to us. In fact, according to the information in the AVM presented above, the **friendship** event in the formal role (FORMAL) in the qualia structure of *amigo* should be the most salient event associated to the NP *o velho amigo*, a fact which is not mirrored in the representation above. This makes apparent the need for a revision of some technical aspects of the modelling strategies proposed by Amaro's (*op. cit.*) analysis. Concerning these technical aspects, we question the promotion of the event in the noun qualia structure to the NP event structure, as there is no apparent empirical motivation for it. Its motivation seems to be keeping the parallel between the representation of adjective and verbal alternations. However, we consider the 'event promotion' to be this parallel analysis being taken a step too far.

We argue that there is no need for this 'event promotion', the crucial aspect with regard to prenominal adjective position being access to the internal structure of the modified noun: for adjectives like *velho* to display sense change they have to occur in prenominal position because only in that position can they modify any facet in the internal structure of the modified noun (the noun qualia structure, in GL); when in postnominal position, the adjective is bound to modify the noun head type, as it cannot 'look into' the qualia structure of the modified noun. Assuming this allows us to put forth an economical proposal that, not only conforms to the data without introducing language specific devices nor radically different lexical entries to account for adjective alternations, but also provides a linguistically motivated explicative principle for the phenomena discussed in this chapter.

Having clearly made this point, let us go through the AVM we adopt to model NPs with postnominal adjectives, such as *o amigo velho* (friend old). The variable $\boxed{2}$,

[33] These representations, as well as many others further below in this and the following chapter, no longer correspond to lexical entries, but rather to semantic representations of complex constituents. Lexical models of the grammar, like GL, not only constitute a framework to model lexical entries, but also provide us with the tools for calculating and representing the meaning of complex structures, such as *velho amigo* (old friend).

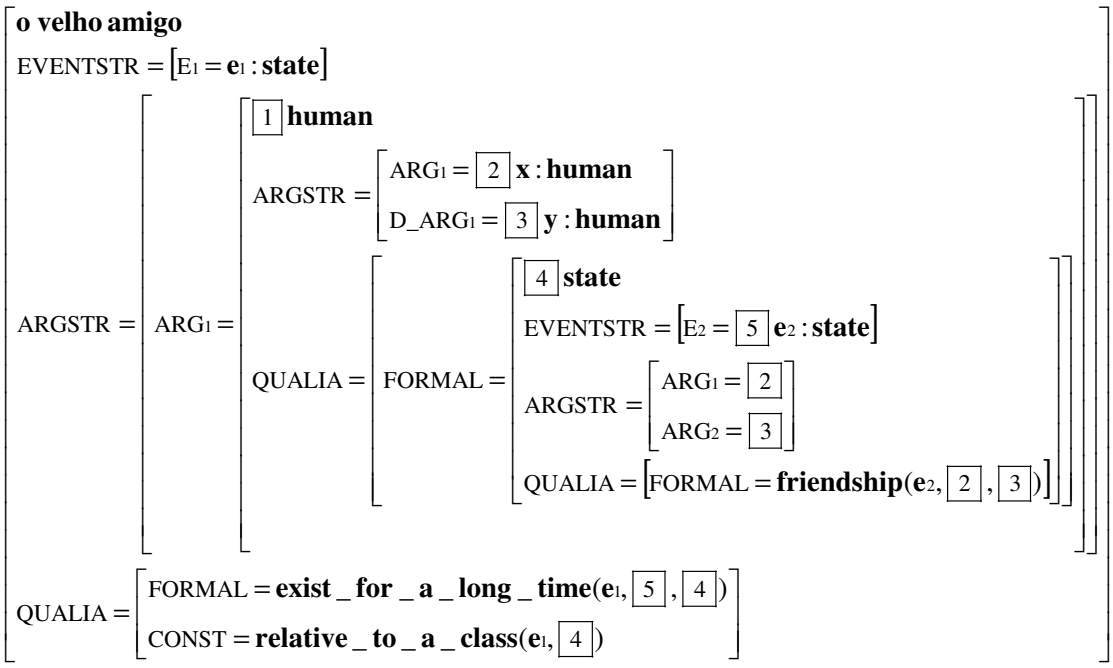
which is unified with the head type of the modified noun, is the argument taken by the predicate in the formal role (FORMAL) in the qualia structure of *velho* (**exist_for_a_long_time(e_1,x,y)**[34]).

$$\left[\begin{array}{l}\textbf{o amigo velho}\\ \text{EVENTSTR} = \left[\text{E1} = \mathbf{e}_1 : \textbf{state}\right]\\ \text{ARGSTR} = \left[\text{ARG1} = \left[\begin{array}{l}\boxed{1}\,\textbf{human}\\ \text{ARGSTR} = \left[\begin{array}{l}\text{ARG1} = \boxed{2}\,\mathbf{x} : \textbf{human}\\ \text{D\_ARG1} = \mathbf{y} : \textbf{human}\end{array}\right]\\ \text{QUALIA} = \left[\text{FORMAL} = \textbf{friendship}(\mathbf{e}_2, \boxed{2}, \mathbf{y})\right]\end{array}\right]\right]\\ \text{QUALIA} = \left[\begin{array}{l}\text{FORMAL} = \textbf{exist\_for\_a\_long\_time}(\mathbf{e}_1, \boxed{2}, \boxed{1})\\ \text{CONST} = \textbf{relative\_to\_a\_class}(\mathbf{e}_1, \boxed{1})\end{array}\right]\end{array}\right]$$

As to *velho amigo*[35] (old friend), below, the same predicate (**exist_for_a_long_time(e_1,x,y)**) in the formal role (FORMAL) of *velho* takes $\boxed{5}$ as its argument. This variable is unified with the **friendship** state in the formal role (FORMAL) of the modified noun, i.e. the adjective has access to the internal structure of the modified noun.

[34] This predicate should be understood as follows: there is a state event **e_1 existing for a long time**, so that for a **y**, **x exists for a long time**. This **y** variable determines the applicable comparison class. As relativity to a comparison class is not relevant for the phenomena discussed in this chapter, we refer the reader to chapter 3, section 3.2.3, and chapter 5, section 5.2.1, for a detailed discussion on this aspect.

[35] As shown in (16), NPs like *um velho amigo* (an old friend) are ambiguous between a reading in which the adjective modifies the entity denoted by the modified noun, and a reading in which it is an event (in the qualia structure of the modified noun) that is taken by the adjective as its argument. As the first reading matches the reading of *um amigo velho* (a friend old), in which the adjective occurs postnominally and for which we have already proposed a representation, we will now only discuss the second reading.



Having made apparent how this analysis correctly accounts for adjectives like *velho*, represented above, let us go back to the example in (17), which seems to constitute a problem to this proposal, as *bom* displays ambiguity when it occurs postnominally. However, only apparently do these data make up a problem to our analysis. In chapter 5, sections 5.1.2.2 and 5.2.1, we stated that there was no need for postulating different lexical entries for the apparently different senses of *bom*, as these could be accounted for by a single entry, if we considered that this adjective selected for the information in the qualia structure of the nouns it combines with. Also, using the modelling tools available in GL, we straightforwardly represented this information in the lexicon, by combining an underspecified representation for *bom* – assuming that its semantic contribution consists in a **positive evaluation** of the **qualia roles** specified for the modified noun – with the Selective Binding mechanism (see section 5.1.2.2). But how can we explain the ambiguity observed in (17)a but not in (17)b? The only possibility consists in considering that a noun like *guitarrista* (guitar player) makes more than one feature available to *bom* (good).

In order to account for data involving sense change adjectives that modify human entities, Amaro (2002:134 ff.) argues that *homem* (man) is associated to an event in its qualia structure, as shown in the AVM below.

$$\begin{bmatrix} \textbf{homem} \\ \text{QUALIA} = \begin{bmatrix} \text{FORMAL} = \textbf{x : human} \\ \text{TELIC} = \textbf{rational\_behaviour}(\textbf{e}_1, \textbf{x}) \end{bmatrix} \end{bmatrix}$$

Although this representation allows Amaro (*op. cit.*) to account for some adjective sense change contexts with this noun, her proposal seems a little *ad hoc*. Moreover, it fails to account for the extension of the modification performed by an adjective like *bom*, reducing the **positive evaluation** it introduces to a part of human behaviour – **rational behaviour** –, when a phrase like *o homem bom* (the good man) has a considerably wider meaning, involving most aspects of **human nature**. This observation, in combination with the redefinition in the selection restrictions of adjectives like *bom* we proposed[36], lead us to argue that we are able to account for the meaning of expressions like *o homem bom* without postulating a telic role for **human entities**. We claim that, in this NP, *bom* modifies the formal role of *homem*, the appropriate meaning of *o homem bom* being thus derived, as represented in the AVM below: it refers a **man** whose **human nature** is **positive evaluated**.

$$\begin{bmatrix} \textbf{o homem bom} \\ \text{EVENTSTR} = \left[\text{E}_1 = \textbf{e}_1 \textbf{ : state}\right] \\ \text{ARGSTR} = \begin{bmatrix} \text{ARG}_1 = \begin{bmatrix} \textbf{homem} \\ \text{ARG}_1 = \textbf{x} \\ \text{QUALIA} = \left[\text{FORMAL} = \boxed{1}\ \textbf{x : human}\right] \end{bmatrix} \end{bmatrix} \\ \text{QUALIA} = \left[\text{FORMAL} = \textbf{positive evaluation}(\textbf{e}_1, \boxed{1})\right] \end{bmatrix}$$

Following Pustejovsky (1995), in section 5.1.1.4, we stated that for a lexical item to obtain its semantic representation, it has to have access to a semantic type in a network of types so that it can inherit the relevant information from its mother. *Guitarrista* (guitar player) being a type of **man**, it carries the semantic information inherited from its mother plus its own specific difference, which consists in its function: **playing the guitar**. Being so, as shown in the AVM below, activity nouns like *guitarrista* (guitar player) carry their specific semantic contribution in the telic role (TELIC). As to the

[36] We claim that adjectives like *bom* select for the qualia information in the semantic structure of the modified noun, and not necessarily for a telic role (cf. chapter 5, section 5.2.1).

information inherited from its mother, we claim that it is also present in the qualia structure, but that it is somehow weaker, as it constitutes the information shared with other structures – namely with its hyperonym and co-hyponyms –, in contrast with the information making up its specific difference, which is naturally more salient.

$$\begin{bmatrix} \textbf{guitarrista} \\ \text{QUALIA} = \begin{bmatrix} \text{FORMAL} = \textbf{x : human} \\ \text{TELIC} = \textbf{play \_ guitar}(\textbf{e}_2, \textbf{x}) \end{bmatrix} \end{bmatrix}$$

Having made these points clear, let us go back to our example in (17). Given our assumptions regarding adjective *bom* and nouns like *homem*, the two possible readings in (17)a can be straightforwardly derived. This semantic complexity of *guitarrista*, in combination with the selection restrictions of *bom*, which, as mentioned above, call for special linking mechanisms to guarantee well-formed structures: Selective Binding consists in a linking mechanism which allows for selecting the argument expected by a lexical item from the set of objects in the semantic content of another lexical item. Thus, unlike typical adjectives, whose selection restrictions are satisfied simply by accessing the head type of the modified noun, *bom* has to be linked to the argument it expects, the information in the qualia of the noun it modifies. This way, through the activation of the Selective Binding generative mechanism, this adjective always has access to the qualia structure of the modified noun, independently of the position in which it occurs. This explains the ambiguity observed in (17)a and prevents it from being a counter-example to our claims in this chapter.

But the contrast in terms of preferred readings still remains unaccounted for. Moreover, unlike what was argued for other adjectives, it was to be expected that no particular syntactic position would determine the argument selection performed by *bom*, as its linking with the relevant argument is determined by Selective Binding. And, yet, only in postnominal position are there two possible readings. Furthermore, they display clear contrasts in terms of preference. As made apparent by (18), when the modified noun does not show the semantic complexity argued for above, being characterised by a single role in its qualia structure, there is no ambiguity either in postnominal, or prenominal positions.

(18) a. Ele encontrou um homem bom.
'he met a man good'
Reading: He met a kind and righteous person.

b. Ele encontrou um bom homem.
'he met a good man'
Reading: He met a kind and righteous person.

However, when that is not the case, contrasts both in terms of available and preferred readings may surface, as made apparent in (17). This is a specific case, which we argue to be accountable by the different status of the qualia roles made available for modification by *bom*. As mentioned above, activity nouns like *guitarrista* are characterised by a **strong** telic **role**, which corresponds to its specific difference, and a **weaker** inherited formal **role**. We argue that preferred readings are determined by this difference in the status of qualia roles, underspecified adjectives like *bom* selecting strong qualia roles by default, only modifying other available features when context points towards other readings. Also, given the stress value associated to prenominal position, we argue that, in this position, underspecified adjectives like *bom* only combine with strong qualia roles.

But let us recall that the main goal of this chapter was making explicit the link between adjective position in the NP and meaning contrasts displayed by the data. Given the amount of work in the literature, we started off by addressing sense change adjectives, which lead us to the discussion of some data involving underspecified adjectives like *bom*. But adjective sense change is just one of the contrasts related to adjective relative position in the NP, only displayed by a very restricted group of adjectives. And yet, less important, although determinant, contrasts related to adjective-noun relative position in the NP have been identified and discussed for most adjectives. In order to take our discussion to this second, and larger, group of adjectives, let us look at (19) and (20). *Velho* (old), extensively discussed above, occurs in both these examples, although it does not display the 'typical' sense change identified in (16), as the nouns modified in (19) and (20) only make one semantic feature available for modification by the adjective.

(19) a. Ele encontrou o seu professor velho.
'he met his professor old'
Reading: He met one of his professors, the one who is old.

b. Ele encontrou o seu velho professor.
'he met his old professor'
Reading: He met his professor, who is old.

(20) a. *Ele encontrou o seu pai velho.
'he met his father old'

b. Ele encontrou o seu velho pai.
'he met his old father'
Reading: He met his father, who is old.

Nonetheless, although no sense change is to be reported in these examples, there are semantic contrasts determined by adjective position in the NP, as made apparent by the readings associated to each of the examples presented above. Moreover, the ill-formation of (20)a, contrasting with the well-formed (20)b, support the observation made in section 6.1.1 with regard to the relation between adjective relative position in adnominal contexts and the construction of NP denotation. As *pai* (father) somehow functions like a rigid designator – in most families there is only one father –, it is not possible to restrict its denotation. Hence, modifying *pai* (father) with a postnominal adjective results in the ill-formation of the structure. Conversely, combining it with the same adjective, but placing it in prenominal position, results in a well-formed sentence, such as (20)b. In fact, in this sentence, just as in (19)b, the adjective is not restricting the denotation of *pai* (father), but rather underlining one of the salient features of the entity it mentions, precisely its **elderness**. These data allow us to make the bridge between the analysis of sense change adjectives and our observations in section 6.1.1, regarding the relation between adjective position, entity identification and the construction of NP meaning. Hence, we will now pursue our discussion on this issue, aiming at providing a unified analysis for the role played by adjective position in adnominal contexts, in the construction of NP meaning.

We consider that widening Amaro's (*op. cit.*) analysis to all adjectives should give interesting results. As evidenced by sentences like (19)b or (20)b, we have seen that adjective prenominal position is generally associated to emphasis. When we discussed central adjectives, this idea appeared very clearly as we stated that adjectives occurring

in prenominal position stress one of the salient characteristics of the entity referred by the NP. So, assuming that the alternation between prenominal and postnominal position corresponds to a *change of focus*, also conforms to data not involving sense change. What seems to be crucial, both for adjectives displaying sense change and for those not displaying it, is access to the internal structure of the modified noun. We have seen that for adjectives like *velho* to display sense change they have to occur in prenominal position because only in that position can they modify any facet in the internal structure of the modified noun (the noun qualia structure, in GL), being bound to modify the noun head type when in postnominal position. As to adjectives not displaying sense change, and in order for them to stress **one** of the salient characteristics of the entity mentioned by the noun, they also must access the set of conditions determining nominal reference, i.e. the internal structure of the head noun (its qualia structure).

Let us go through the AVMs below, which model our proposal to widen Amaro's (*op. cit.*) analysis of sense change adjectives to all lexical items belonging to this POS. In order to do so, we go back to the example we used at the beginning of this chapter (see (4) and (5), section 6.1.1): *a palestra interessante* ('the lecture interesting') versus *a interessante palestra* (the interesting lecture). Considering that the crucial information about **palestra** (lecture) is that it is a kind of **speech** which is **done for instruction**, we have to represent this in its lexical entry.

$$\left[\begin{array}{l} \textbf{palestra} \\ \\ \text{ARGSTR} = \left[\begin{array}{l} \text{ARG}_1 = \mathbf{e}_2 \textbf{ : process} \\ \text{D\_ARG}_1 = \mathbf{x} \textbf{ : human} \\ \text{D\_ARG}_2 = \mathbf{y} \textbf{ : human} \end{array}\right] \\ \text{QUALIA} = \left[\begin{array}{l} \text{FORMAL} = \textbf{speech}(\mathbf{e}_2, \mathbf{x}, \mathbf{y}) \\ \text{CONST} = \textbf{has\_introduction}(\mathbf{e}_3, \mathbf{e}_2) \wedge \textbf{has\_conclusion}(\mathbf{e}_4, \mathbf{e}_2) \\ \text{TELIC} = \textbf{instruct}(\mathbf{e}_5, \mathbf{x}, \mathbf{y}) \end{array}\right] \end{array}\right]$$

As qualia structure is the level of representation in GL that establishes the set of semantic restrictions introduced by a word, the qualia structure associated to a noun like *palestra* in the AVM above should state this crucial information: in the formal role (FORMAL) we define the kind of object a **lecture** is – a **speech**; the telic role (TELIC)

allows us to express the purpose of **lectures** – they are **done for instruction**; in the constitutive role (CONST) we are able to express the constituent parts making up any **lecture** in the world. NPs like *a palestra interessante* ('the lecture interesting'), where the adjective occurs in postnominal position, are the general case in adjective-noun modification structures. Before looking at the representation we propose for the full NP, let us consider the lexical entry of *interessante* (interesting).

$$\begin{bmatrix} \textbf{interessante} \\ \text{EVENTSTR} = [\text{E1} = \textbf{e1 : state}] \\ \text{ARGSTR} = [\text{ARG1} = \textbf{x}] \\ \text{QUALIA} = [\text{FORMAL} = \textbf{interesting(e1, x)}] \end{bmatrix}$$

As mentioned in previous chapters in this dissertation, modelling NPs with postnominal adjectives simply consists in putting the entity denoted by the noun *palestra* (the process in its argument structure (ARGSTR)) under the scope of the predicate denoted by the adjective *interessante* (interesting), by unifying the process that constitutes the denotation of the former with the second argument of the latter, as represented in the AVM below, this way restricting the denotation of the modified noun by adding an extra restriction to it.

$$\begin{bmatrix} \textbf{a palestra interessante} \\ \text{ARGSTR} = \begin{bmatrix} \text{ARG1} = \boxed{1} \begin{bmatrix} \textbf{process} \\ \text{ARGSTR} = \begin{bmatrix} \text{ARG1} = \textbf{e2 : process} \\ \text{D\_ARG1} = \textbf{x : human} \\ \text{D\_ARG2} = \textbf{y : human} \end{bmatrix} \\ \text{QUALIA} = \begin{bmatrix} \text{FORMAL} = \textbf{speech(e 2, x, y)} \\ \text{CONST} = \textbf{has\_introduction(e 3, e 2)} \wedge \textbf{has\_conclusion(e 4, e 2)} \\ \text{TELIC} = \textbf{instruct(e 5, x, y)} \end{bmatrix} \end{bmatrix} \end{bmatrix} \\ \text{QUALIA} = [\text{FORMAL} = \textbf{interesting(e 1,} \boxed{1}\textbf{)}] \end{bmatrix}$$

As to NPs where the adjective occurs in prenominal position, like *a interessante palestra* (the interesting lecture), these structures have been shown to make a considerably different contribution to the construction of NP semantics.

As mentioned in section 6.1.1, Demonte (1999, 2008) points out that rather than distinguishing an object from a larger set, thus contributing to the delineation of NP reference, as it is the case of *a palestra interessante*, when the adjective occurs in prenominal position it underlines the most relevant property of an entity. Thus, according to this author, unlike postnominal adjectives, which are expressions that combine with set extensions (the modified nouns) to create new set extensions (the noun-adjective group), prenominal adjectives are specific functions over nouns, which do not affect the extension of the modified noun, but stress one of the salient characteristics of a given expression. Being so, in *a interessante palestra* the adjective is not combining with the set of **lectures**, but rather with ***a*** specific **lecture**, which has already been identified in discourse. Being so, it shares the properties all lectures have in common, as well as other individual properties that characterise the **lecture** referred to in particular, among which, is **being interesting** (see the constitutive role (CONST) in the qualia structure of *a palestra* (the lecture), represented in the AVM below).

$$\left[\begin{array}{l} \textbf{a palestra} \\ \\ \text{ARGSTR} = \left[\begin{array}{l} \text{ARG1} = \textbf{e}_2 : \textbf{process} \\ \text{D\_ARG1} = \textbf{x} : \textbf{human} \\ \text{D\_ARG2} = \textbf{y} : \textbf{human} \end{array}\right] \\ \text{QUALIA} = \left[\begin{array}{l} \text{FORMAL} = \textbf{speech}(\textbf{e}_2, \textbf{x}, \textbf{y}) \\ \text{CONST} = \textbf{has\_introduction}(\textbf{e}_3, \textbf{e}_2) \wedge \ldots \wedge \textbf{long}(\textbf{e}_4, \textbf{e}_2) \wedge \textbf{interesting}(\textbf{e}_1, \textbf{e}_2) \\ \text{TELIC} = \textbf{instruct}(\textbf{e}_5, \textbf{x}, \textbf{y}) \end{array}\right] \end{array}\right]$$

In the lines of what has been proposed by Demonte (2008), we assume that the semantic contribution of adjectives in prenominal position consists in underlining the most relevant property of an entity according to the speaker. More accurately, prenominal adjectives stress the information that the speaker considers most relevant to communicate in a given context. Being so, we model this idea as exemplified below in the AVM representing *a interessante palestra* (the interesting lecture).

$$\left[\begin{array}{l}\textbf{a interessante palestra}\\ \text{ARGSTR} = \left[\begin{array}{l}\text{ARG}_1 = \left[\begin{array}{l}\textbf{process}\\ \text{ARGSTR} = \left[\begin{array}{l}\text{ARG}_1 = \mathbf{e_2}\textbf{ : process}\\ \text{D\_ARG}_1 = \mathbf{x}\textbf{ : human}\\ \text{D\_ARG}_2 = \mathbf{y}\textbf{ : human}\end{array}\right]\\ \text{QUALIA} = \left[\begin{array}{l}\text{FORMAL} = \textbf{speech}(\mathbf{e_2},\mathbf{x},\mathbf{y})\\ \text{CONST} = \textbf{has\_introduction}(\mathbf{e_3},\mathbf{e_2}) \wedge \textbf{...} \wedge \textbf{long}(\mathbf{e_4},\mathbf{e_2}) \wedge \boxed{1}\,\textbf{interesting}(\mathbf{e_1},\mathbf{e_2})\\ \text{TELIC} = \textbf{instruct}(\mathbf{e_5},\mathbf{x},\mathbf{y})\end{array}\right]\end{array}\right]\end{array}\right]\\ \text{QUALIA} = \left[\text{FORMAL} = \textbf{stress}(\boxed{1})\right]\end{array}\right]$$

This way, we put forth an economical and wide-ranging proposal, which accounts for the data without introducing language specific devices, and simultaneously provides linguistically motivated explicative principles for phenomena related to adjective position. Moreover, we provide a uniform treatment for all adjectives, including adjectives displaying sense change. Being so, sense change adjectives are accounted for as a particular case of adjectives occurring in prenominal position, accurately modelled without the need for radically different lexical entries. The crucial aspect, valid for any adjective in prenominal position, is access to the internal structure of the modified noun, in the GL framework where we place ourselves, its qualia structure. In the example above, for the correct reading of *a interessante palestra* (the interesting lecture) to be derived, just like in adjective sense change contexts, the prenominal adjective must have access to one of the characterising features in the constitutive role (CONST) of the *palestra* (the lecture) – the fact that it is **interesting** – in order to stress it[37]. The difference between this general case and adjective sense change contexts, a difference to which amount the semantic contrasts between these two types of adjective-noun constructions, consists in the absence of adjective underspecification with regard to selection restrictions and of semantic complexity of the modified noun. Previously in this section we have stated that these were the crucial aspects determining the surfacing of adjective sense change examples. In fact, if any of the previous conditions is not met, sense change is not displayed by prenominal adjectives, although the emphasis, typical of the general case, is. The following example illustrates this. We have taken an

[37] Very similar to Demonte's (2008) analysis in its general lines, our approach to the data and our modeling proposal accounts for the phenomena at stake in this chapter in a non-derivational way and without resorting to movement. Moreover, it provides a unified analysis of all prenominal adjectives.

adjective displaying sense change in prenominal position – *velho* (old) – and combined it with the noun *tio* (uncle).

(21) a. Ele encontrou o tio velho.
'he met the uncle old'
He met an aged person who is also his uncle.

b. Ele encontrou o velho tio.
'he met the old uncle'
He met an aged person who is also his uncle.

Unlike (16)b, (21)b is not ambiguous. Even if the adjective is the same in both sentences – *velho* –, while *amigo* is semantically complex, making more than one type of semantic object available for modification by the adjective, *tio* (uncle) does not. Hence, as one of the necessary conditions for adjective sense change to emerge is not met, only one reading is available for (21)b. Nonetheless, although both in (21)a and (21)b, it is the entity denoted by *tio* that is **old**, this characteristic is stressed in (21)b, and not in (21)a, as shown in the AVMs below.

$$\begin{bmatrix} \textbf{o tio velho} \\ \text{ARGSTR} = \begin{bmatrix} \text{ARG1} = \begin{bmatrix} \textbf{human} \\ \text{ARGSTR} = \begin{bmatrix} \text{ARG1} = \boxed{1}\,\textbf{x : human} \\ \text{D\_ARG1} = \textbf{y : human} \end{bmatrix} \\ \text{QUALIA} = \left[\text{FORMAL} = \textbf{uncle}(\boxed{1}, \textbf{y})\right] \end{bmatrix} \end{bmatrix} \\ \text{QUALIA} = \left[\text{FORMAL} = \textbf{exist\_for\_a\_long\_time}(\textbf{e}_1, \boxed{1})\right] \end{bmatrix}$$

$$\begin{bmatrix} \textbf{o velho tio} \\ \text{ARGSTR} = \begin{bmatrix} \text{ARG1} = \begin{bmatrix} \textbf{human} \\ \text{ARGSTR} = \begin{bmatrix} \text{ARG1} = \boxed{2}\,\textbf{x : human} \\ \text{D\_ARG1} = \textbf{y : human} \end{bmatrix} \\ \text{QUALIA} = \begin{bmatrix} \text{FORMAL} = \textbf{uncle}(\boxed{2}, \textbf{y}) \\ \text{CONST} = \boxed{1}\,\textbf{exist\_for\_a\_long\_time}(\textbf{e}_1, \boxed{2}) \end{bmatrix} \end{bmatrix} \end{bmatrix} \\ \text{QUALIA} = \left[\text{FORMAL} = \textbf{stress}(\boxed{1})\right] \end{bmatrix}$$

6.4. CONCLUSIONS

In this chapter we analysed the distribution displayed by different adjective classes in adnominal contexts. In section 6.1, we provided a thorough description of the data under analysis, putting forth an explicative principle for the distribution restrictions evinced by each adjective class. Along with most authors in the literature, we assumed the markedness of prenominal position. Also, we underlined its emphatic role and the contrast between prenominal and postnominal adjectives in terms of the relation they establish with the modified noun. Following González (1995) and Demonte (2008), we identified a dependence between nominal items previously identified in discourse and prenominal adjectives.

This led us to research on the role played by adjective position in the construction of NP denotation. As the impact of adjective position in the NP has been essentially discussed under the scope of work on adjectives displaying sense change in context, and although we aimed at providing a general analysis for all adjectives, in sections 6.2 and 6.3 we started off by analysing this work, particularly research developed by Bouillon (1998) and Amaro (2002). Although these analyses – mostly Amaro's (*op. cit.*) – have provided us with important clues to pursue our work on adjective position in the NP, our goal consisted in arriving at a more general solution, valid for all adjectives occurring in prenominal position.

With Amaro (*op. cit.*) we analyse sense change adjectives as alternations, along the same lines of what Pustejovsky & Busa (1995) propose for causative/inchoative verbal alternations. An analysis such as this one not only conforms to the data without introducing language specific devices or radically different lexical entries to account for adjective alternations, but also provides a linguistically motivated explicative principle for the phenomena.

Moreover, we extend this proposal to all adjectives, hence providing a unified analysis for all adjectives occurring in prenominal position. Hence, we arrived at a very economical and wide-ranging proposal, as it provides a unified analysis of both verbal and adjective alternations and of all adjectives occurring in prenominal position. In order to make our crucial assumptions apparent, in section 6.3 we model this analysis in GL. By representing full NPs, both with prenominal and postnominal adjectives, we are able to straightforwardly make adjective semantic contribution self-evident, in a

linguistically motivated way and without having to introduce any important changes to what was proposed in chapter 5 regarding adjective lexical entries. Moreover, with the evidence and analysis put forth in this chapter, we highlight aspects of the interface between syntax and semantics.

This way, we account for the role played by adjective relative position in the NP, determining their contribution to the definition of the meaning of adjective-noun groups. Still, there are some specific phenomena, such as aspects related to event modification by adjectives, which remain unaccounted for. They will be the object of chapter 7.

CHAPTER 7

EVENT MODIFYING ADJECTIVES IN PORTUGUESE

7.0. INTRODUCTION

In chapters 4, 5 and 6 we put forth a linguistically motivated modelling strategy for representing adjectives in the lexicon. Our proposal allowed us to encode adjectives in computational relational lexica, such as wordnets. Also, using the GL framework for defining enriched lexical entries for adjectives with fine-grained information on event and argument structures allowed us to develop an analysis on the construction of NP meaning. This way, not only did we mirror adjective definitional features, but we also accounted for the way the meaning of compound expressions is built.

In chapter 5, we began by addressing the general case in adjective-noun combination, which involves descriptive adjectives, and is characterised by NP meaning resulting from the intersection of the sets denoted by the adjective and the noun. NPs involving relational and non-restricting adjectives were also discussed, and adjective semantic contribution to NP meaning in these cases was also made apparent: instead of determining an intersection operation, we argue that relational adjectives determine an underspecified relation between the modified noun and a domain exterior to it (generally corresponding to the denotation of another noun – see section 5.2.2); as to non-restricting adjectives, we claim that these define the way the intension of the modified noun is applied to a given referent (see section 5.2.3).

Having established the semantic contribution of all adjective classes to the meaning of the NP in which they occur, in chapter 6, we focused on the role played by the relative position of adnominal adjectives in the construction of NP meaning. We determined the impact adjective position has on the definition of the meaning of adjective-noun groups, and proposed a very economical and universal analysis, providing a unified analysis of alternations involving verbs and adjectives, which we

modelled in GL. This proposal allowed us to straightforwardly make adjective semantic contribution self-evident, in a linguistically motivated way and without introducing any important changes with regard to adjective lexical entries, as delineated in chapter 5.

Hence, with the approach and modelling strategies described in previous chapters, we account for the most characteristic and general syntactic and semantic aspects of adjective behaviour. There are nonetheless some specific phenomena related to event modification by adjectives that we mentioned in chapter 1 (see section 1.2), and which should be analysed and discussed in more detail. They are the object of the present chapter.

In order to understand what is at stake in these constructions, in section 7.1, we will start by recuperating what was stated in previous chapters with regard to event modifying adjectives. Having done so, we will move on to presenting and illustrating the phenomena we focus on in this chapter. First noted by Bolinger (1967), and later discussed by Larson (1999), the relevant data involve event modifying adjectives occurring inside a nominal phrase that are understood as if they were matrix adverbials, i.e. adjectives displaying adverbial readings whose scope does not seem to be restricted to the NP in which they occur. As these data apparently involve a relationship between adjectives and adverbs, in section 7.2 we briefly discuss the semantic nature of adverbs, following Davidson (1967) in considering them as event predicates and, thus, as lexical items which have a clear kinship with adjectives, and particularly with event modifying adjectives such as those we focus on in this chapter. Finally, in section 7.3, we establish the restrictions determining whether a sentence has available adverbial readings and in what circumstances can the scope of the event modifier be extended beyond the borders of the phrase in which it occurs. We delineate our analysis showing the crucial role played by events associated to the lexical material occurring in each sentence.

7.1. EVENT MODIFYING ADJECTIVES

As mentioned in the introductory notes to this chapter, we arrive at this point of our dissertation having addressed and established the typical semantic contribution made by each adjective class. Among these, we discussed a particular group of descriptive adjectives – descriptive adjectives being those whose combination with the modified noun generally amounts to set intersection – that modifies an event associated to the

modified noun (see section 5.2.1). We used the well known Larson's (1999) example of ambiguity between intersective and adverbial readings[1], in (27), to illustrate this kind of contexts, and showed how they could be accounted for by considering that the particularity of these adjectives consisted on their ability to modify two types of semantic objects: entities and events.

(1) Olga is a beautiful dancer.
Reading 1: Olga is beautiful & Olga is a dancer (intersective reading)
Reading 2: Olga dances beautifully (adverbial reading)

We argued that what was generally considered a non-intersective reading (reading 2) could be accounted for intersectively if we considered that the contrast between the available readings was not due to different operations combining the semantic content of the adjective and the noun, but rather amounted to the fact that the intersection was operated between different sets of objects at a time: while in the first reading we have an intersection between *beautiful* and *dancer*, in the second the intersection is between *beautiful* and *dance*, an event associated to the activity noun *dancer*. Taking advantage of the several representation levels available in GL, modelling the semantic complexity of the modified noun in this example is quite straightforward: *dancer* denotes an entity and is associated to a **dancing** event in the telic role (TELIC) of its qualia structure, the question being how to represent adjectives like *beautiful* in the lexicon so that they can alternatively combine with events and with entities. In order to represent the ability adjectives like *beautiful* have to predicate over two types of semantic objects at a time – entities and events –, we assumed that their representation in the lexicon, particularly their argument structure (ARGSTR), i.e. the representation level that models these adjectives selection restrictions, must be different from that of adjectives not showing this behaviour. As adjectives like *beautiful* cannot simultaneously modify two different semantic types, we use a disjunction operator in the adjective argument structure (ARGSTR), as shown in the AVM below, hence blocking the possibility of having the adjective simultaneously predicating over two distinct arguments[2].

[1] In chapter 3 we showed how the kind of ambiguity discussed by Larson (1999) should no longer be accounted for in terms of an intersectivity/non-intersectivity opposition. Thus, for the sake of accuracy, instead of the traditional designations used to identify these readings – intersective and non-intersective readings –, we use the following: intersective and adverbial readings.
[2] See section 5.2.1 for a detailed discussion of these data.

$$\begin{bmatrix} \textbf{beautiful} \\ \text{EVENTSTR} = [\text{E1} = \textbf{e1 : state}] \\ \text{ARGSTR} = [\text{ARG1} = \textbf{x : physical entity} \vee \textbf{e2}] \\ \text{QUALIA} = [\text{FORMAL} = \textbf{positive aesthetic evaluation}(\textbf{e1}, (\textbf{x} \vee \textbf{e2}))] \end{bmatrix}$$

This way, in each specific context, adjectives like *beautiful* can only predicate over one of the two semantic types at a time. This approach mirrors the most characteristic aspects displayed by the data under analysis: on the one hand, adjective basic meaning is stable and does not change; on the other hand, the ambiguity or alternation between two possible adjective readings depends, not only on the complexity of the modified noun, but also on adjective properties. Moreover, what is usually considered exceptional data, is analysed and modelled as a particular instantiation of the general case of adjective-noun combination, which is characterised by NP meaning resulting from the intersection of a set determined by the modified noun and a set determined by the adjective.

In this chapter we focus on data first noted by Bolinger (1967), and later discussed by Larson (1999), involving contexts in which adjectives occurring inside a nominal phrase seem to be understood as if they were a matrix adverbial. Once again, as in (27), we have adjectives displaying adverbial readings. However, apparently their scope is not restricted to the NP in which they occur, but is extended over the whole sentence, a fact that is surprising, at the very least[3].

[3] Pursuing research on adjectives which can be interpreted outside the NP in which they occur, Larson (2000) discusses the semantic behaviour of adjective *possible*, illustrated in (i).

(i) Mary interviewed every possible candidate.
'Mary interviewed everyone that was a possible candidate' (direct modification reading)
'Mary interviewed every candidate that is was possible for her to interview' (implicit relative reading)

However, due to related facts, Larson (2000) claims that sentences like (i) "in its Relative Reading might actually derive from a source (...) where the A originates postnominally and is subsequently fronted, and where the adjective takes an infinitival complement that remains elliptical": Mary interviewed every possible$_i$ candidate [t_i [for her to interview t].
According to this author, well-formed English sentences like (ii) constitute evidence that prenominal adjectives with a *direct modification reading* have a different structural source: Larson (*op. cit.*) claims there are two different positions to be occupied by the adjective.

(ii) Mary interviewed every possible possible candidate.
'Mary interviewed every possible candidate that is was possible for her to interview'

(2) Barbara saw an occasional sailor.
'Barbara saw a person who occasionally sailed' (internal adverbial reading)
'Occasionally, Barbara saw a sailor' (external adverbial reading)

Like *beautiful* in (27), accounting for the semantic behaviour of adjectives like *occasional* in (34) also has to address the question of event modification. However, differently from what has been shown to be the case of *beautiful*, adjectives like *occasional* only have adverbial readings, i.e. these adjectives necessarily modify events. Thus, while the ambiguity in (27) was argued to be due to the possibility adjectives like *beautiful* have to modify two types of semantic objects, the two readings identified in (34) seem to result from contrasts related to the scope of the modifier.

Larson (1999, 2000) and Zimmermann (2003), among others, state that the existence of an external adverbial reading constitutes a puzzle for compositional semantics, the problem consisting on how to account for these adjective external readings which, according to these authors, are limited to 'infrequency adjectives'[4]. Larson (1999) refers a derivational analysis involving movement, in which the external adverbial reading is derived by raising the adjective out of DP at Logical Form (LF), hence allowing it to modify the whole sentence. Larson (2000) and Stump (1981) argue for the incorporation of the adjective to the determiner, thus forming a complex quantifier able to bind the event. Analyses such as these are able to explain some constraints in the availability of the external adverbial reading. Particularly, by assuming that the adjective requires an article as an 'escape-hatch' out of DP and cannot move over an intervening adjective, it accounts for the requirement of having an article present and for why the occurrence of other determiners or of other adjectives in a more oblique position, i.e. having scope

Moreover, as shown by Demonte (2008), in languages where adjectives can appear both in prenominal and postnominal positions in the NP, there is no ambiguity to be acknowledged and there is a clear correlation between position and the available readings (see (iii)a and (iii)b, below).

(iii) a. A Maria entrevistou os possíveis candidatos.
'Mary interviewed everyone that was a possible candidate' (direct modification reading)

b. A Maria entrevistou os candidatos possíveis.
'Mary interviewed every candidate that is was possible for her to interview' (implicit relative reading)

As there are clearly other factors – particularly some syntactic derivation – besides the semantic nature of the adjectives, involved in the data put forth by Larson (2000), we will not discuss this data in detail here.

[4] Further below we argue that, at least in languages like Portuguese, this restriction does not hold, differences in **frequency** *versus* **infrequency** not being relevant for accounting for adjectives 'external readings' (see page 225 ff.).

over the event modifying adjective, block this external adverbial reading[5]. Although it accounts for some constraints on the surfacing of the external adverbial reading, this analysis has some empirical difficulties, namely it is unable to explain some alternations in definiteness, such as the ones illustrated below, which show that an adjective occurring in a **definite** description corresponds to an adverb outside an **indefinite** NP. If the adjective were simply raising out of DP, past the article, we should not have this alternation in definiteness. Further below, in this section, we make a thorough and more fine-grained description of the data which will contribute for understanding the puzzles raised by these data.

(3) **The** occasional customer strolled by.
=*'Occasionally,* ***a*** *customer strolled by'*
≠*'Occasionally,* ***the*** *customer strolled by'*

taken from Larson (1999)

Also, the approach mentioned above has crucial problems in terms of its linguistic motivation: it offers no reason why an element interpreted outside DP is projected within it initially, nor why an adjective projected within a given phrase (the DP, in this case) does not participate in its semantic composition.

Larson (*op. cit.*) comments that, more than simple LF raising, what is at stake in these data is converting a nominal modifier into a verbal modifier, and he states that the behaviour illustrated in (34) is restricted to infrequency adjectives. This is quite an unexpected effect to be put down to a difference in frequency *versus* infrequency. We will not make any claims on English data here, but we show that this is not the crucial aspect determining the semantic behaviour of Portuguese adjectives, as made apparent by (35)–(36).

[5] These constraints are based on data such as the following:

(iv) Two occasional sailors strolled by.
=*'There were two persons strolling by who occasionally sailed*' (internal adverbial reading)
≠*'Occasionally two sailors strolled by'* (external adverbial reading)

(v) Every occasional sailor strolled by.
=*'Every person who strolled by occasionally sailed'* (internal adverbial reading)
≠*'Occasionally every sailor strolled by'* (external adverbial reading)

taken from Larson (1999)

(4) a. Passou um cliente ocasional do bar[6].
'an occasional customer of the pub strolled by'

b. = Passou uma pessoa que ocasionalmente é cliente do bar.
'a person who is occasionally a customer of the pub strolled by'

c. ≠ Ocasionalmente passou um cliente do bar.
'occasionally a customer of the pub strolled by'

(5) a. Ele é um cliente ocasional do bar.
'he is an occasional customer of the pub'

b. = Ocasionalmente ele é cliente do bar.
'occasionally he is a customer of the pub'

Contrastingly to Larson's (*op. cit.*) description of English data, although (35)a, (35)b and (35)c are all possible Portuguese sentences involving infrequency event modifying adjectives, they are not semantically equivalent. (36)a and (36)b, however, show the alternation discussed by Larson (*op. cit.*). Thus, Portuguese data seem to involve different restrictions from those identified by Larson (*op. cit.*). Furthermore, in Portuguese, this alternation is clearly not restricted to infrequency adjectives, as shown in (37) and (7).

(6) a. Passou um cliente habitual do bar.
'a usual customer of the pub strolled by'

b. = Passou uma pessoa que habitualmente é cliente do bar.
'a person who is usually a customer of the pub strolled by'

c. ≠ Habitualmente passou um cliente do bar.
'usually a customer of the pub strolled by'

(7) a.Ele é um cliente habitual do bar.
'he is a usual customer of the pub'

b. = Habitualmente ele é cliente do bar.
'usually he is a customer of the pub'

[6] The available readings are not those presented in (4) if instead of preposition *de* (of), preposition *em* (in) is used, as illustrated in (vi). We will leave the investigation on the motivations for these data for future work, as they seem to depend on the semantics of prepositions, particularly on the internal structure of constituents in which they occur, rather than on the specific properties of adjectives like *ocasional* (occasional).

(vi) Passou um cliente ocasional no bar.
'*an occasional customer of the pub strolled by'*
≠ Passou uma pessoa que ocasionalmente é cliente no bar.
'a person who is occasionally a customer strolled by the pub'
= Ocasionalmente passou um cliente no bar.
≠*'Occasionally a customer strolled by the pub'*

Unlike what is argued by Larson (*op. cit.*), (6) and (7) show exactly the same linguistic behaviour as (35) and (36). In fact, what seems to be at stake in these examples is the number of events available for modification by the adjective, as well as adjective ability to modify them. (38)–(41) provide further evidence in favour of this observation.

(8) *Este objecto é uma garrafa habitual da Maria.
'this object is a usual bottle of Maria'

(9) a. Este rapaz é um colaborador habitual da Maria.
'this boy is a usual collaborator of Maria'

b. = Este rapaz colabora habitualmente com a Maria.
'this boy usually collaborates with Maria'

(10) a. Este objecto é a garrafa habitual da Maria.
'this object is the usual bottle of Maria'

b. = Este objecto é a garrafa que a Maria usa habitualmente.
'this object is the bottle Maria usually uses'

(11) a. Este rapaz é o colaborador habitual da Maria.
'this boy is the usual collaborator of Maria'

b. = Este é o rapaz que colabora habitualmente com a Maria.
'this is the boy that usually collaborates with Maria'

Comparing (38) and (39), we can identify a clear grammaticality contrast between the two sentences. And yet, they have exactly the same syntactic structure, the only difference being the head noun modified by the adjective *habitual* (usual). Let us now consider (40) and (41). These are identical to (38) and (39), except for the determiner introducing the noun phrase modified by *habitual* (usual)[7]. Despite this, (38) is ruled out while (40) is grammatically sound. The acceptability of (40) seems to be explained by the availability of an event to be modified by *habitual* (usual), which has to somehow depend on a difference between the articles *a* (the) and *uma* (a), probably with regard to their definiteness. In fact, (38) is the only ungrammatical sentence due to the absence of an event available for modification. Since *habitual* (usual) selects for an event, given

[7] Both NPs in (40) and (41) being definite descriptions, but not (38) or (39), seems to somehow make an event available for modification by *habitual* (usual), particularly when one is not provided by the modified noun. This has a crucial impact on the sentences in which these NPs occur, as it makes (40) acceptable, by contrast with (38). Thus, there is a clear definiteness effect involved in these constructions. Here we just want to underline that the acceptability of (39), (40) and (41) depends on an event being made available to the adjective for modification, the distinctive properties of definite *versus* indefinite articles being outside the scope of this dissertation.

that the noun *garrafa* (bottle) is not associated to any particular event in its semantic structure, the same not being true of *colaborador* (collaborator) (cf. (39) and (41)), and the adjective not being able to retrieve an event elsewhere in order to satisfy its selection restrictions, (38) is ruled out.

The grammaticality contrasts depending on the availability of an event in the structures considered, makes the alternation between adjectives and adverbs appear as a natural and expected phenomenon: both adjectives and adverbs being modifiers, and adverbs modifying event-denoting items – verbs and sentences, typically –, if we consider that some adjectives also select for events, an alternation between such semantically close lexical items is to be expected. Thus, if we are dealing with event modifying adjectives, associating events to the nouns occurring in these NPs is crucial. As thoroughly detailed in previous chapters, the GL framework allows us to do so straightforwardly. And yet, as mentioned above, not all nouns are associated to events.

The availability of an event for adjective modification only depending on the semantic structure of the head noun, (40) should be ruled out, just like (38) is. But that is not the case. Being so, if there is no event associated to *garrafa* (bottle) – the modified noun both in (38) and (40) –, where does the event making (40) an acceptable Portuguese sentence come from?

The examples below show that this event is context-dependent, i.e. it is not associated to the noun *garrafa* (bottle), being somehow retrieved from context[8]. Comparing (42)–(14) with (15)–(17) allows us to identify a clear contrast between the nouns *colaborador* (collaborator) and *garrafa* (bottle) in what concerns their association to events. Based on the data in (15)–(17), we can formulate a hypothesis in which *colaborador* (collaborator) is always associated to an event, the same not being true for *garrafa* (bottle), a noun which can only be modified by adjectives such as *habitual* (usual) when an event can be retrieved from context. Context-dependency of the event modified by *habitual* (usual) in (40) becomes apparent as we look at (42)–(14). In fact, although they also have a context-dependent adverbial reading available (see (15)c, (16)c and (17)c), all the sentences in which *colaborador* (collaborator) occurs have an

[8] Although we do not wish to make any strong claims with regard to the mechanism in grammar relating definiteness and this link to context, it seems that it is the definite article that allows for this context-dependent event to be made available for modification. Thus, henceforth, as only them display the kind of phenomena analysed in this chapter, we privilege definite NPs to illustrate the aspects at stake.

adverbial reading whose modified event is *colaborar* (to collaborate) (cf. (15)b, (16)b and (17)b). When *garrafa* (bottle) is the noun at stake and when an adverbial reading is possible, for each sentence there is only one possible paraphrase, and the modified event is always context-dependent, varying from sentence to sentence (*trazer* (to bring) in (42), *comprar* (to buy) in (13) and *levar* (to take) in (14))[9].

(12) a. A Maria trouxe a garrafa habitual[10].
'Maria brought the usual bottle'

b. = A Maria trouxe a garrafa que traz habitualmente.
'Maria brought the bottle she usually brings'

[9] It is important to notice that not all nouns discussed in this paper are event denoting, and therefore associated to an event structure and semantically very close to verbs. In fact, most of the examples discussed in this chapter are nouns associated to events in their qualia structure, and not event denoting nouns such as *explosion* or *surgery*. We do not particularly stress the generative mechanisms licensing the adjective-noun combinations discussed in this chapter, since we have already presented them in detail previously in this dissertation. Nonetheless, we have to underline that, in most cases, the readings we are discussing in this chapter are derived by Selective Binding, as described in section 5.1.2.2, since this mechanism allows licensing adjective-noun combinations which otherwise would be ruled out, as it enables the adjective to access the internal structure of the modified noun and combine with any feature found there that satisfies its selection restrictions.
Moreover, as pointed out by Pustejovsky (1991b), the main difference between event descriptions in NPs and those at the sentence level, is that event descriptions at the sentence level are anchored by **tense** within an interval structure (Pustejovsky (*op. cit.*) leaves the door open to also considering **aspect** as an anchoring relation, this being the case in languages like Portuguese, as stated further below in this chapter), tense being viewed as a functional property applying to event descriptions, similar to quantifiers in many ways.

[10] The readings paraphrased in (42)b, (13)b and (14)b, entail the sentences presented in (vii)b, (viii)b and (ix)b, respectively, since if *Maria brought the bottle she usually brings*, then *Maria usually brings a bottle*, and so forth.

(vii)a. A Maria trouxe a garrafa que traz habitualmente.
'Maria brought the bottle she usually brings'

b. ⇒ Habitualmente, a Maria traz uma garrafa.
'usually Maria brings a bottle'

(viii) a. A Maria comprou a garrafa que compra habitualmente.
'Maria bought the bottle she usually buys'

b. ⇒ Habitualmente, a Maria compra uma garrafa.
'usually Maria buys a bottle'

(ix) a. A Maria levou a garrafa que leva habitualmente.
'Maria took the bottle she usually takes'

b. ⇒ Habitualmente, a Maria leva uma garrafa.
'usually Maria takes a bottle'

Going back to (34) and to the readings identified by Bolinger (1967) and Larson (1999) allows us to establish an obvious and perfect correspondence between (vii)b, (viii)b and (ix)b and Larson's *external adverbial reading*.
Here, we wish to make a clear distinction between available readings of the data at stake in this chapter and propositions entailed by these sentences. So, we maintain our observation that (35)a and (35)c are not semantically equivalent. In fact, we want to take a step forward and state that, although not semantically equivalent, they are logically related by an entailment relation. Assuming this, we also argue that there is a fundamental problem with Larson's (*op. cit.*) proposal, as it is based on the identification of a reading that is in fact a proposition entailed by the sentences under analysis.

(13) a. A Maria comprou a garrafa habitual.
'Maria bought the usual bottle'

b. = A Maria comprou a garrafa que compra habitualmente.
'Maria bought the bottle she usually buys'

(14) a. A Maria levou a garrafa habitual.
'Maria took the usual bottle'

b. = A Maria levou a garrafa que leva habitualmente.
'Maria took the bottle she usually takes'

(15) a. A Maria cumprimentou o colaborador habitual.
'Maria greeted the usual collaborator'

b. = A Maria cumprimentou a pessoa que colabora habitualmente com ela. (preferred reading)
'Maria greeted the person that usually collaborates with her'

c. = A Maria cumprimentou o colaborador que habitualmente cumprimenta.
'Maria greeted the collaborator she usually greets'

(16) a. A Maria chamou o colaborador habitual.
'Maria called the usual collaborator'

b. = A Maria chamou a pessoa que colabora habitualmente com ela.
'Maria called the person that usually collaborates with her'

c. = A Maria chamou o colaborador que habitualmente chama.
'Maria called the collaborator she usually calls'

(17) a. A Maria advertiu o colaborador habitual.
'Maria admonished the usual collaborator'

b. = A Maria advertiu a pessoa que colabora habitualmente com ela.
'Maria admonished the person that usually collaborates with her'

c. = A Maria advertiu o colaborador que habitualmente adverte.
'Maria admonished the collaborator she usually admonishes'

Although, for the sake of clarity, in the examples above context-dependency of the modified event was restricted to the domain of the sentence (see (6)–(15)), we want to stress that this does not always have to be the case. Both the discourse and the situational context can make an event available for modification by the adjective, hence licensing adjective-noun groups where event modifying adjectives, like *habitual* (usual), are combined with nouns like *garrafa* (bottle), which are not associated to any event in their qualia structure.

(18) a. A Maria compra uma garrafa todas as sextas-feiras, quando vai à mercearia. **Na semana passada, só quando chegou a casa é que se apercebeu de que se tinha esquecido da garrafa habitual.**
'Maria buys a bottle every Friday, when she goes to the grocery store. Last week, she only realised that she had forgotten her usual bottle when she arrived home'

b. = Quando a Maria chegou a casa apercebeu-se de que se tinha esquecido de comprar a garrafa que compra habitualmente.
'when Maria arrived home she realised she had forgotten to buy the bottle she usually buys'

In (18) the informational content in the first sentence allow us to retrieve the event needed to satisfy the selection restrictions of the adjective *habitual* (usual) in the second sentence, thus preventing it from being ruled out like (38). So, in this case, the event modified by the adjective in the second sentence is once again context-dependent, like in (40), only this time it is not retrieved from sentential context, but from discourse context.

Another possibility consists in being able to retrieve this context-dependent event from the information we hold about the situation. For instance, if we consider the following state-of-affairs: every week, me and my friends have dinner together; each of us brings something to eat and Maria, who owns a wine shop, always brings a bottle of wine. This being common knowledge to me and my interlocutor, if I state (19)a, he will certainly interpret it as the paraphrase in (19)b, retrieving the relevant event from the situational context, hence satisfying the selection restrictions of the adjective *habitual* (usual) and licensing the sentence, thus avoiding ruling it out.

(19) a. Esta semana a Maria esqueceu-se da garrafa habitual.
'this week Maria forgot the usual bottle'

b. = Esta semana a Maria esqueceu-se de trazer a garrafa que traz habitualmente.
'this week Maria forgot to bring the bottle she usually brings'

As stated above, the kind of alternation discussed here being restricted to event modifying adjectives, an alternation between adjectives and adverbs not only is possible, but it is also very natural. But before discussing the kinship between adjectives and adverbs, and having been able to identify the distinguishing properties of the

adjectives involved in the contexts analysed in this chapter, let us illustrate how GL allows us to straightforwardly represent these lexical items in the lexicon.

As we introduced the phenomena under analysis at the beginning of this section, we stated that the data considered involve a particular case of descriptive adjectives. Also, we identified the distinguishing features common to all adjectives involved in the constructions we are investigating, arguing that these are adjectives which select for events. So, at this point we have isolated the crucial aspects characterising the descriptive adjectives participating in these constructions: these are descriptive adjectives whose selection restrictions are limited to events. Having done so, and in order to have an accurate modelling of the phenomena under discussion, we should be able to represent these features in the lexicon.

$$\begin{bmatrix} \textbf{habitual} \\ \text{EVENTSTR} = [\text{E1} = \textbf{e1 : state}] \\ \text{ARGSTR} = [\text{ARG1} = \textbf{e2}] \\ \text{QUALIA} = [\text{FORMAL} = \textbf{usual(e1,e2)}] \end{bmatrix}$$

Going through this AVM, representing the lexical entry of *habitual* (usual), we can see that, like all descriptive adjectives, *habitual* is a one place predicate, denoting the **state** of being **usual** (cf. the adjective event structure (EVENTSTR) and formal role (FORMAL)). Also, it has specific selection restrictions, as stated in its argument structure (ARGSTR), necessarily modifying an event. Moreover, these selection restrictions constitute the specific difference characterising the adjectives involved in the alternations analysed in this chapter, and will be crucial for explaining the semantic behaviour displayed by these lexical items.

Being so, and already having shown how event modifying adjectives can be straightforwardly represented in GL, there are two crucial issues at stake in these sentences that have to be accounted for in our approach: the association of nouns to events; and adjective ability to retrieve and modify an event from context when one is not provided and made available for modification by the modified noun. The first question having already been addressed in the context of this dissertation, when, following Pustejovsky (1995), we showed how events can be straightforwardly

associated to nominals in the GL framework, we will continue to focus on the second one in the following sections.

7.2. ADVERBIAL MODIFICATION

The data discussed in section 7.1 make apparent the event modifying nature of the adjectives involved in the phenomena illustrated by (34). Above we mentioned a close relation between these adjectives and adverbs, as both modify the manner of occurrence of an event over time. In this section we aim at making this relation self-evident.

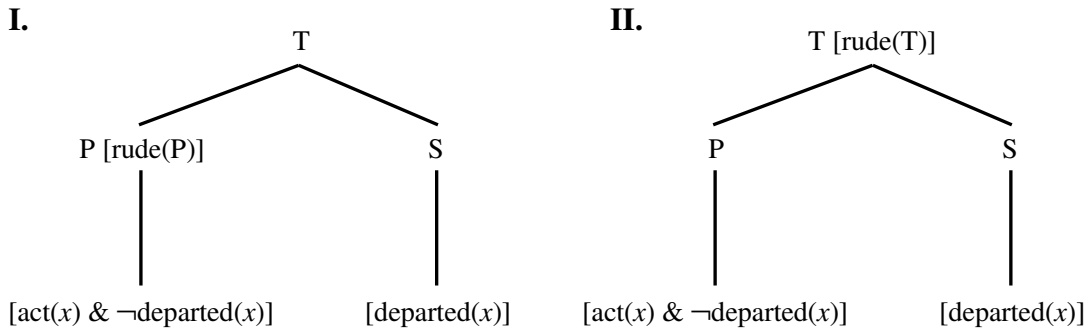
Davidson (1967) analyses adverbs as event predicates and introduces event quantification at VP level, connecting it with adverbial modification, as shown in (20), which reads as follows: 'there was a slipping event such that it was fatal to Mary' (taken from Pustejovsky (1991b:68)).

(20) Mary fatally slipped.
$\exists e[slipped(e,m) \wedge fatal(e,m)]$

Adverbs being event modifiers, the semantic similarity between this POS and event modifying adjectives becomes apparent. The AVM below represents the adverbial reading of the NP *the beautiful dancer*, discussed in previous chapters, in which the adjective *beautiful* modifies an event associated to the activity noun *dancer*: the **dancing** event, $\mathbf{e_2}$ in the AVM. Comparing this representation with the formula in (20), allows us to realise that adverbs and event modifying adjectives make exactly the same kind of semantic contribution: they both modify events. Despite this semantic similarity, these two POS are clearly distinguishable as they display different selection restrictions, particularly with regard to the syntactic categories they combine with: event modifying adjectives, as any item in this POS, can only select for nominals, whereas adverbs can combine with verbs, adjectives, adverbs and sentences.

$$\left[\begin{array}{l}\textbf{the beautiful dancer}\\ \text{ARGSTR} = \left[\begin{array}{l}\text{ARG}_1 = \left[\begin{array}{l}\textbf{human}\\ \text{ARGSTR} = \left[\text{ARG}_1 = \textbf{x : human}\right]\\ \text{QUALIA} = \left[\begin{array}{l}\text{FORMAL} = \textbf{x}\\ \text{TELIC} = \boxed{1}\,\textbf{dance}(\textbf{e}_2,\textbf{x})\end{array}\right]\end{array}\right]\end{array}\right]\\ \text{QUALIA} = \left[\text{FORMAL} = \textbf{positive\_aesthetic\_evaluation}(\textbf{e}_1, \boxed{1}\,\textbf{e}_2)\right]\end{array}\right]$$

Both event modifying adjectives and adverbs being analysed as event predicates, GL provides us with very suitable modelling structures for representing the phenomena discussed here, since "an event structure provides a natural representation for adverbs [, and for any event modifying category,] as event predicates" (Pustejovsky, 1991b:68). In fact, event structures in the GL framework allow for richer structural possibilities for adverbs as event predicates: sentences can have as many interpretations for an adverbial as there are distinct predicates in the event structure. This way, the two usually available readings for adverbs – manner *versus* speaker-oriented – result, in this framework, from the different scopes they can take. The diagrams presented below schematically represent the two possible readings of the English sentence *Lisa rudely departed*.



In the structure in I, the adverb has scope over the process of **departing** ($[_P$ act(x) & ¬departed(x)]), resulting in a manner interpretation (rude(P)). In schema II, the adverb has scope over the entire transition event ($[_T$ $[_P$ act(x) & ¬departed(x)], $[_e$departed(x)]]), thus being interpreted relatively to the speaker and situation (rude(T)).

Thus, the ambiguity of adverbs between available readings, such as those illustrated in the example above, can be derived from scope differences of the same lexical item.

This way, the possibility of having multiple readings depends on the event structure of the modified event[1]. Parallelly, multiple readings with event modifying adjectives depend on the number of events made available for modification by the adjective. We will analyse this question in detail in the following section.

7.3. ANALYSING ADVERBIAL READINGS OF EVENT MODIFYING ADJECTIVES

As presented in detail in section 7.1, Larson (1999) identifies the following restrictions on the availability of adverbial readings of event modifying adjectives: they only surface with infrequency adjectives and when the adjective is under the scope of an article; they are subject to definiteness constraints.

In section 7.1 we showed that the infrequency restriction does not hold for Portuguese, and the following examples make apparent that there are other aspects with regard to which the restrictions pointed out by Larson (*op. cit.*) do not hold for Portuguese data either.

(21) a. Passam clientes habituais desta loja.
'usual customers of this store stroll by'

b. = Passam pessoas que habitualmente compram nesta loja.
'people who usually buy at this store stroll by'

c. ≠ Habitualmente passam clientes desta loja.
i.e. habitualmente passam pessoas que compram nesta loja.
'customers of this store usually stroll by'
i.e. 'people who buy at this store usually stroll by'

(22) a. Este senhor é cliente habitual desta loja.
'this gentleman is a usual customer of this store'

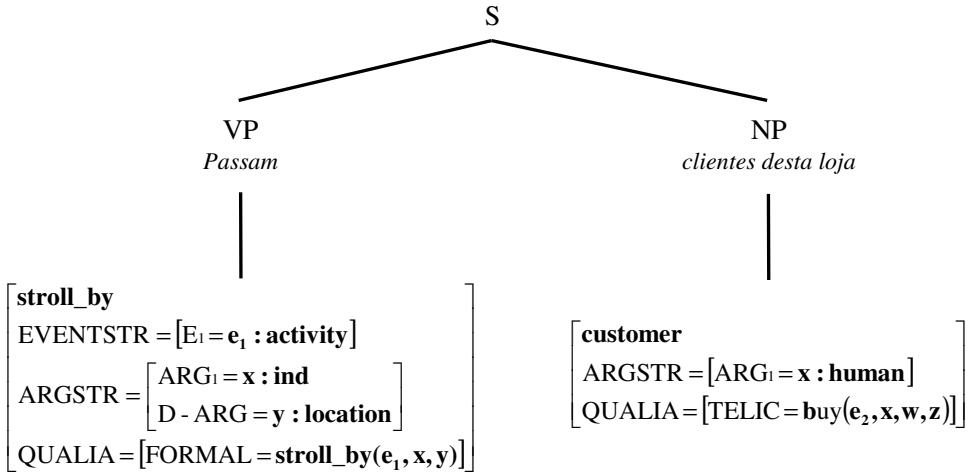
b. = Habitualmente este senhor é cliente desta loja,
i.e. habitualmente este senhor compra nesta loja.
'usually this gentleman is a client of this store'
i.e. 'usually this gentleman buys at this store'

As (35) and (36) in the introductory section of this chapter, (21) and (22) display an important contrast: in (21) the adjective *habituais* (usual) never has scope over the whole sentence (see (21)c), whereas in (22) it can have (cf. (22)b). As most of the

[1] Pustejovsky (1991b) also mentions idiosyncratic aspects of adverbs influencing the possibility of multiple readings. Here, we will not address this issue, which is clearly outside the scope of our dissertation.

lexical material is common to both (21) and (22), exception being made to the main verb, the contrast in the available readings described above is likely to be related to this single difference.

III.



Schema III represents (21)a[2]. As indicated by paraphrases presented in (21)b and (21)c, and made apparent in III, in this sentence there are two distinct events: $\mathbf{e_1}$, associated to the verb *passar* (to stroll), and $\mathbf{e_2}$, associated to the telic role (TELIC) of the noun *cliente* (customer).

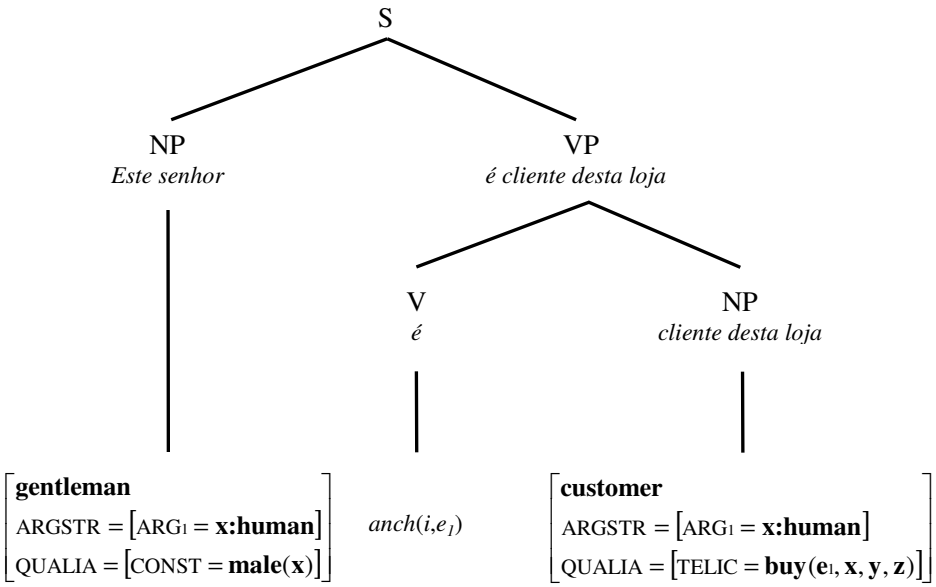
Before moving on to discussing the representation we propose for (22)a, there are some claims to be made with regard to the main verb in this sentence. In (22)a the main verb is the copula verb *ser* (to be). This is a standard copula verb, and thus semantically light. We assume here that it only carries information regarding tense and aspect. Following Pustejovsky (1995), we consider tense to be an anchoring function over event descriptions, as presented in (23) below (Pustejovsky, 1995: section 8.4). The anchoring relation *anch* embeds an event within the structure of an interval.

(23) $[[\ Tns\alpha]] = \lambda\varepsilon\exists i\exists e[\alpha(i,n) \wedge anch(i,e) \wedge \varepsilon(e)]$

[2] In the representations in III and IV, modifiers are not included. We chose to do so for the sake of simplicity, as, at this stage of the discussion, we aim at making apparent the number of events associated to each sentence, without addressing the question of the scope taken by these modifiers for the time being. We believe the presentation of our analysis becomes clearer this way.

In the representation in 0 we associate this relation to *é* (is), making apparent that no full event is denoted by this verb.

IV.



As no full event is denoted by *é* (is)[3], there is only one content event associated to (22)a: the **buying** event in the telic role (TELIC) of the qualia structure of *cliente* (customer). Thus, in (21)a there are two events associated to the sentence *Passam clientes habituais desta loja* (usual customers of this store stroll by), whereas in (22)a only one event can be identified. Despite this, and contrastingly to the semantic behaviour displayed by the NPs in (42)–(17), where the existence of multiple events available for modification resulted in the ambiguity of the NP, having two events associated to a sentence is not a sufficient condition for an event modifying adjective embedded in an NP to be able to have scope over events introduced by the matrix verb, hence implying the surfacing of multiple readings for that sentence (cf. (21)c).

Inability of an embedded event modifying adjective to extend its scope beyond the borders of the phrase in which it occurs – an NP – conforms quite naturally to the speakers' linguistic intuition and expectations, as languages have specific strategies available for modifying events associated to sentences: adverbial modification. So, the

[3] We argue that copula verbs like *ser* ($be_{non\text{-}temp}$) and *estar* (be_{temp}) are light events, carrying only time and aspect information, and thus empty with regard to semantic content properties.

data that are somehow surprising, and thus call for further clarification, consist in contexts such as (22). Since no full event is denoted by the matrix verb *é* (is)[4], the adjective *habitual* (usual) modifies the only event available for modification: the **buying** event introduced by the noun *cliente* (customer), e_1 in the telic role (TELIC) of the qualia structure of this lexical item. Being the sole "content event" associated to this sentence, the **buying** event associated to *cliente* (customer) can be understood as the matrix event (cf. (22)b), hence the apparent scope extension of *habitual* (usual).

Being so, (21) and (22) seem to allow us to conclude that an event modifying adjective can only be understood as having scope over the matrix verb when the whole sentence only denotes a single event. (24) constitutes additional data supporting this idea It is nonetheless a slightly different type of alternation, which therefore calls for further discussion.

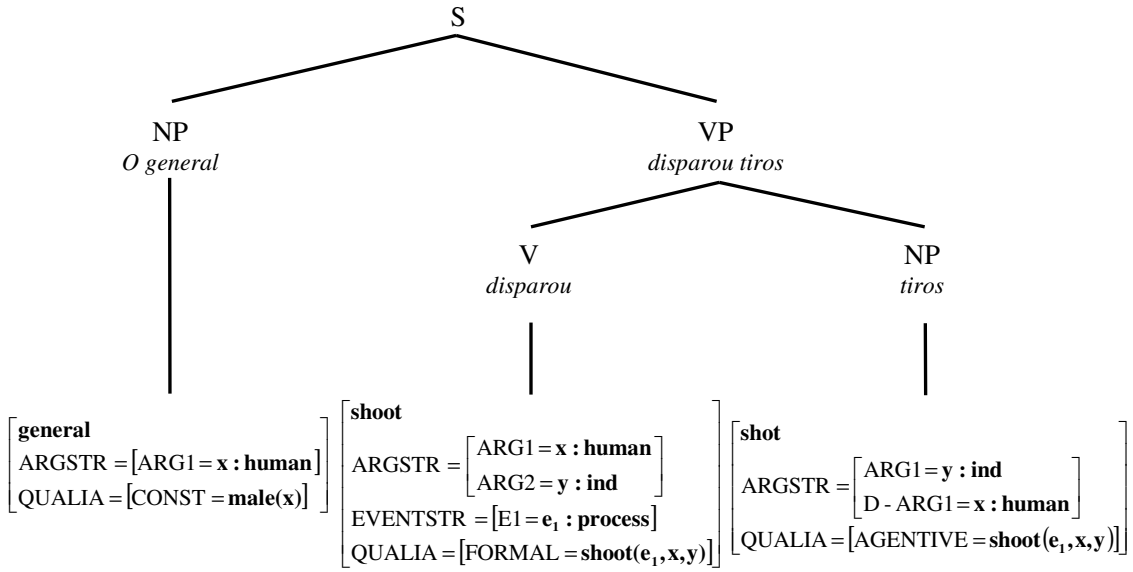
(24) a.O general disparou tiros esporádicos.
'the general shot sporadic shots'

b. = Esporadicamente o general disparou tiros.
'sporadically the general shot shots'

Keeping in mind the restriction identified above, according to which only when there is a single event associated to an entire sentence can the alternation under analysis in this chapter be observed, let us consider the representations proposed for (22), presented above, and (24). These make apparent that (22) and (24) exemplify two particular subcases of the alternation discussed in this chapter, both licensed by the fulfilment of the same restriction: the existence of a single event associated to the full sentence, which is simultaneously an event associated to the modified noun.

[4] We assumed with Pustejovsky (1995) that copula verbs like *ser* (to be) denote an anchoring function associating, in a given time, the NPs in its subject and object positions, through some kind of identification relation. Given the contrast between *ser* ($be_{non\text{-}temp}$) and *estar* (be_{temp}), in languages like Portuguese, these claims have to be further specified: this anchoring function not only places the identification relation in time, but it also specifies its stability, determining whether it is permanent or temporary.

V.



So let us go through the representation in V. As in (22), there is only one event associated to (24), but this time it is not because the matrix verb is semantically empty. As made apparent above, in (24) the event denoted by the verb *disparou* (shot) and the event associated to the noun *tiros* (shots) is the same: $\mathbf{e_1}$ in the agentive role (AGENT) in the qualia structure of *tiros* (shots) and in the event structure (EVENTSTR) of *disparou* (shot). The event denoted by the verb and the event introduced by the noun being the same, it is quite natural that sentences (24)a and (24)b be semantically equivalent, since when the **shooting** event, $\mathbf{e_1}$, in the agentive role (AGENT) in the qualia structure of *tiros* (shots), is modified by the adjective *esporádicos* (sporadic), so is the event denoted by the matrix verb – also $\mathbf{e_1}$ –, and vice-versa.

Assuming an analysis such as the one delineated above, according to which sentences with event modifying adjectives can only be equivalent to sentences whose matrix verb is modified by a corresponding adverb when there is only a single event associated to the whole sentence at stake – either because the matrix verb is semantically light, like in (22), or because it denotes exactly the same event that is associated to the modified noun, like in (24) –, the non-equivalence of (25)a and (25)b is predicted.

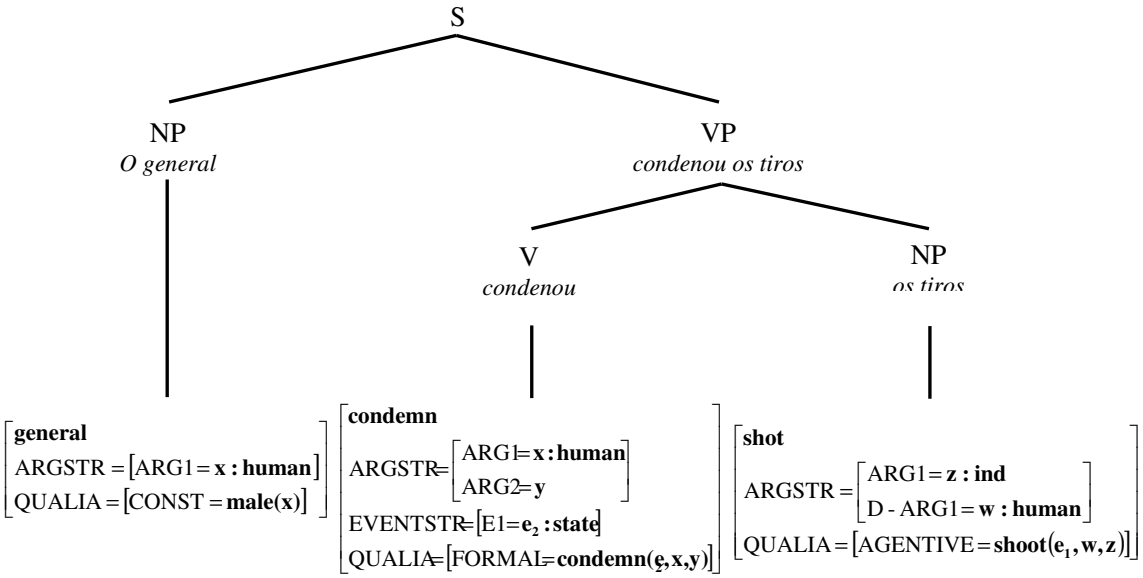
(25) a.O general condenou os tiros esporádicos.
'the general condemned the sporadic shots'

b. ≠ Esporadicamente o general condenou os tiros.
'sporadically the general condemned the shots'

c. = O general condenou que se dispare esporadicamente.
'the general condemned that one shoots sporadically'

Let us look at the representation in VI, where we can identify two distinct events.

VI.



Differently from what was the case in (24), there are two distinct events associated to a structure like VI: $\mathbf{e_1}$, introduced by the agentive role (AGENT) in the qualia structure of *tiros* (shots), just as in the previous example; and $\mathbf{e_2}$, denoted by *condenou* (condemned), as shown in the event structure (EVENTSTR) of this verb. Being so, the non-equivalence of sentences such as (25)a – where the event introduced by the noun *tiros* (shots), $\mathbf{e_1}$, is modified by the adjective *esporádicos* (sporadic) – and (25)b – where the event denoted by the verb *condenou* (condemned), $\mathbf{e_2}$, is modified by the adverbial counterpart of *esporádicos* (sporadic), *esporadicamente* (sporadically) – is to be expected, for the exact same reasons put forth above for why the equivalence between (21)a and (21)c is ruled out: there are two different events associated to the sentence.

Nonetheless, the data in (26) seem to indicate that in some particular circumstances it is possible to have two different events in the same sentence and still observe the

equivalence between the modification introduced by an event modifying adjective and an adverb operating over a matrix verb.

(26) a.O general ouviu tiros esporádicos.
'the general heard sporadic shots'

b. Esporadicamente o general ouviu tiros.
'sporadically the general heard shots'

(26)a introduces two different events: a **shooting** event, associated to the noun *tiros* (shots), as repeatedly observed in previous examples, and a **hearing** event, denoted by the verb *ouviu* (heard). Being so, although that does not seem to be the case, the equivalence between a sentence like (26)a, in which the event modification is introduced by an adjective, and (26)b, where the modification is performed by an adverb – the adverbial counterpart of *esporádicos* (sporadic) – with scope over the matrix verb, was expected to be ruled out.

We believe the contrast between (25) and (26) to be explainable by one particularity of the events involved in (26): the event denoted by the verb is somewhat implicated in the event associated to the noun. As mentioned with regard to previous examples, in (26), the noun *tiros* (shots) introduces a **shooting** event. And a typical **shooting** event produces noise as it takes place, therefore being **hearable**. Thus, the **hearing** event denoted by the matrix verb in (26) depends on the event introduced by the noun *tiros* (shots) and modified by the adjective *esporádicos* (sporadic). In fact, one of the subevents of a **shooting** process is the production of a **blast**[5], caused by the explosion of gunpowder needed to propel the projectile, typically a bullet. This dependence between the event denoted by the matrix verb and the event associated to the noun modified by the event modifying adjective seems to be a decisive factor accounting for the semantic behaviour of sentences like (26). Earlier in this chapter, as we discussed (42)–(14), we stated that, for a rigorous analysis of the phenomena involved in the data discussed here, it was necessary to make a clear distinction between available readings and propositions entailed by the sentences under discussion. Going back to the example in (26) and particularly (26)a' and (26)b below, we will argue that the apparent exceptionality of this example amounts to a confusion between the readings available for this sentence

[5] Let us only consider typical **shooting** events, not taking into account, for instance, cases in which a silencing device might be used.

and the propositions they entail. (26)a' presents a sentence equivalent to (26)a where the modification is performed by the adverbial counterpart of the event modifying adjective *esporádicos* (sporadic). As predicted by our analysis, given that there are two distinct events associated to the sentence – the **shooting** event associated to the noun *tiros* (shots) and the **hearing** event denoted by the matrix verb *ouviu* (heard) –, the event modification introduced by the adjective *esporádicos* (sporadic) can only have scope over the event associated to the modified noun *tiros* (shots): the **shooting** event. However, given that the **hearing** event denoted by the matrix verb *ouviu* (heard) depends on the **shooting** event modified by the adjective, i.e. if *there were shots being shot sporadically*, *there were shots being heard sporadically*, there is an entailment between (26)a and (26)b.

(26) a.O general ouviu tiros esporádicos.
'the general heard sporadic shots'

a'. = O general ouviu disparar tiros esporadicamente.
'the general heard shooting shots sporadically'

b. ⇒ Esporadicamente o general ouviu tiros.
'sporadically the general heard shots'

This example shows that a clear distinction between available readings and entailed propositions is not always easy to make. This constitutes an important problem, as a less accurate judgement can lead us in the wrong direction, hence making our analysis more fragile and less reliable. However, (27) provides us with additional evidence, showing that we are on the right track: by simply introducing a negation operator with scope over the matrix verb, we make apparent that the distinction between the two events in the sentence is crucial, and so is the restriction we identified earlier, according to which only when the event denoted by the matrix verb and the event associated to the modified noun are exactly the same can the event modification introduced by the adjective have scope over the matrix verb.

(27) a.O general não ouviu tiros esporádicos.
'the general did not hear sporadic shots'

b. = O general não ouviu disparar tiros esporadicamente.
'the general did not hear shooting shots sporadically'

c. ≠ Esporadicamente o general não ouviu tiros.
'sporadically the general did not hear shots'

(28) a.O general não disparou tiros esporádicos.
'the general did not shoot sporadic shots'

b. = O general não disparou tiros esporadicamente.
'the general did not shoot shots sporadically'

The only available reading for (27)a, paraphrased in (27)b, consists in the following: the general did not hear the shots being sporadically shot. Knowing this, there are two possibilities: there were no shots being sporadically shot and thus the general did not hear them; or there were shots sporadically shot, but the general did not hear them. What certainly cannot be entailed by (27)a is the sentence in (27)c: the general sporadically did not hear the shots, i.e. he sometimes heard them and sometimes not, although they were consistently and regularly shot. When, in sentences like (28), the event denoted by the matrix verb and the event associated to the modified noun is exactly the same, the introduction of a negation operator does not have the effect described for (27). This is a predictable effect of our analysis, and hence entirely consistent with it: if the event denoted by the matrix verb is exactly the same that is associated to the modified noun[6], negating one results in the negation of the other, and, therefore, the apparent 'mobility' of the event modifier continues to be possible, just like in affirmative sentences.

Below we present some data showing that, despite the set of rather specific restrictions identified above, (26) is not an exceptional or isolated case. In fact, perceptive verbs participate quite easily in this kind of context. Also, looking at (29)–(31) allows us to evaluate our analysis, by observing how it conforms to the data.

(29) a.Os cientistas viram relâmpagos frequentes.
'the scientists saw frequent lightnings'

b. ⇒ Frequentemente os cientistas viram relâmpagos.
'frequently the scientists saw lightnings'

[6] Or semantically light, like in the case of copula verbs, discussed earlier in this chapter.

(30) a.Os cientistas não viram relâmpagos frequentes.
'the scientists did not see frequent lightnings'

b. ≠ Frequentemente os cientistas não viram relâmpagos.
'frequently the scientists did not see lightnings'

(31) a.Os cientistas registaram relâmpagos frequentes.
'the scientists registered frequent lightnings'

b. ≠ Frequentemente os cientistas registaram relâmpagos.
'frequently the scientists registered lightnings'

Similarly to what was stated about (26), in (29) and (30) there is a dependence between the event denoted by the matrix verb and the event associated to the modified noun, but not an equivalence. Thus, like in (26), (29)a implies (29)b, but is not equivalent to it, as made apparent by its negative counterpart in (30). (31) illustrates the case in which the event denoted by the matrix verb and the event associated to the modified noun have no subevent or entailment relation, showing how no implication equivalent to the one holding between (29)a and (29)b is to be found in this case.

7.4. CONCLUSIONS

In this chapter we analysed event modifying adjectives which show adverbial readings, particularly data first noted by Bolinger (1967), in which the scope of the modification introduced by an event modifying adjective seems to go beyond the NP where it occurs, being extended over the whole sentence. We identified the restrictions determining the circumstances in which event modifying adjectives have available adverbial readings with scope over the matrix verb.

Our approach evidences the role played by events associated to the lexical items at stake, particularly nouns. Assuming, with Davidson (1967) and Pustejovsky (1991b), that adverbs are event modifiers, we provide a unified treatment of event modifying adjectives and adverbs. Such a unified treatment is particularly relevant if we consider that these two POS are the sole lexical items playing the role of modifiers in language. Our approach to these data makes apparent their kinship. Moreover, modelling this semantic similarity, hence making evident the number of semantic features shared by these POS, and particularly by event modifying adjectives and adverbs, also shows how the data discussed in this chapter are significant. In fact, although they constitute a very

specific group of contexts displaying an apparently exceptional semantic behaviour, our analysis shows that understanding them better allows us to better delineate the fine line distinguishing different POS in language, and particularly various types of modifiers.

Moreover, the discussion and analysis put forth in this chapter makes the adequacy of GL apparent. Having precisely modelled all adjective classes in previous chapters, we were able to straightforwardly deal with apparently very exceptional data, in a linguistically motivated way and without the need to introduce any changes in adjective lexical entries delineated in chapter 5.

CHAPTER 8
CONCLUSIONS AND FINAL REMARKS

As we presented the object of this dissertation, we stated that adjective semantic analysis and representation is far from being a trivial issue, since adjectives, more than any other POS, can take different meanings depending on their linguistic context. This apparently "unrestricted and random" linguistic behaviour often leads to the common sense intuition that with adjectives anything is possible, as so eloquently expressed by Humpty Dumpty's claim that "adjectives you can do anything with".

The data presented in this dissertation make the existence of clear distribution restrictions apparent, refuting Humpty Dumpty's presumption. Moreover, the results of our research crucially contribute to a better understanding of adjectives as a word class, particularly in what concerns the nature and linguistic behaviour of this POS in languages like Portuguese. In this final chapter we briefly go through the main conclusions proceeding from the work depicted in this dissertation.

Aiming at determining and modelling the syntactic and semantic properties of Portuguese adjective classes in view of their computation in large scale lexica and grammars, we developed a deep study of linguistic phenomena involving this POS and modelled it in an operatively efficient way. Our approach involved an integrated perspective of syntax and semantics and, even if its main motivation was of linguistic nature, the research was essentially developed under a computational perspective.

In the course of this dissertation we addressed the main questions identified in chapter 1, section 1.4, thus achieving the goals we had set ourselves to pursue.

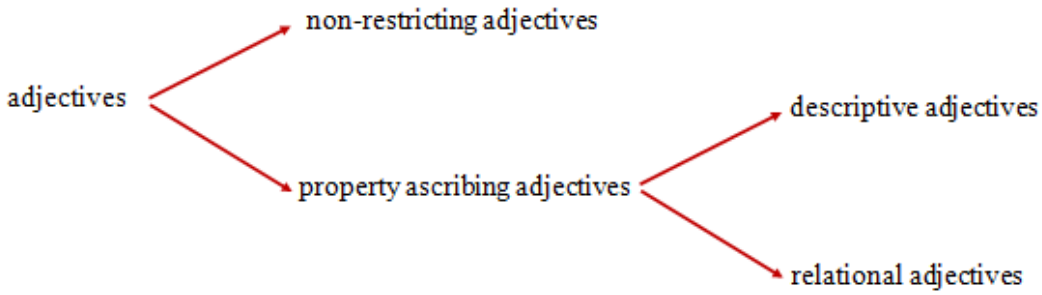
The idea that adjectives are an "independent" lexical category is far from being a universally accepted idea. In this dissertation, we provide strong evidence supporting and strengthening the thesis that adjectives constitute a separate category, particularly

through the contrastive description of the linguistic behaviour of adjectives, nouns and verbs. We defined adjectives both as a syntactic and as a semantic category, showing that it is possible to identify a set of common features which generally hold for all adjectives. This way, we were able to determine an operative definition of what is an adjective, showing that members of this POS are characterised by:

- a particular and precise function (adjectives are expressions that apply to expressions that denote entities to ascribe a property or a set of properties to them, via modification and predication relations);
- specific semantic properties (adjectives denote states and only exceptionally are transitive);
- and a set of 'typical' features (independence from the object, ability to ascribe properties to objects and gradability).

However, ascribing the status of lexical category to adjectives does not entail arguing that all adjectives display exactly the same characteristics. We deal with this fact very naturally, arguing that the presence or absence of some of these features, in combination with other properties, is precisely what is on the basis of the definition of adjective classes.

Focusing on contrasts that allow for grouping adjectives together, first, we defined and characterised adjective classes based on adjective intrinsic meaning, then discussing and characterising groups of adjectives with regard to the basic semantic relations they establish with the modified noun, stressing the fact that not all of the latter adjective groups – **individual-level** *vs* **stage-level** adjectives; **intersective** *vs* **non-intersective** adjectives; and **restrictive** *vs* **non-restrictive** adjectives – are lexically marked, thus being more accurate to consider them to be adjective readings, rather than adjective classes. The schema below depicts the organisation we argue for lexically marked adjective classes. These criss-cross with the distinctions mentioned above.



Still with regard to the characterisation of adjective classes, our analysis of **non-restricting adjectives** is particularly relevant. Being a relatively small adjective class, **non-restricting adjectives** display a very peculiar linguistic behaviour. We focused on the characterisation of the semantic contribution made by these adjectives, showing how they are associated to modal values, and how they operate on the nouns they modify, determining how the denotation of a term applies to a given referent. This allowed us to make their kinship with semantic operators apparent.

Having established and characterised adjectives classes in detail, we delineated a linguistically motivated approach for modelling their syntactic and semantic properties in computational relational lexica such as wordnets. We argued that the semantics of adjectives can be appropriately captured in wordnet-like lexica by means of the implementation of a small set of relations – particularly cross-POS relations –, which have a strong linguistic motivation and preserve the coherence of the wordnet model. With this goal in mind we used some Princeton WordNet relations (*antonymy*), refined or even redefined others (*characterises with regard to/is characterised by* and *near-antonymy*) and defined and implemented new relations in WordNet.PT (*sets attribute value to/is the attribute value set by*, *is related to* and *is a characteristic of/has as a characteristic*). Additionally we also used relations acknowledged under the scope of the WordNet.PT project, namely *has telic subevent/is telic subevent of*.

This way, the main structuring relations we are using for encoding adjectives in the lexicon are *characterises with regard to/is characterised by*, *sets attribute value to/is the attribute value set by* and *antonymy* to model descriptive adjectives, and *is related to* to model relational adjectives. In order to create richer and clearer synsets, we use some additional relations – *is a characteristic of/has as a characteristic*, *has telic subevent/is*

telic subevent of, and *near antonym* –, this way contributing to the accuracy of the model. We tested the adequacy of this set of relations by implementing a selection of Portuguese adjectives in WordNet.PT, a task which made apparent that increasing the expressive power of the system, with no significant loss in parsimony, as we did, has an important impact in precision concerning the specifications of all POS.

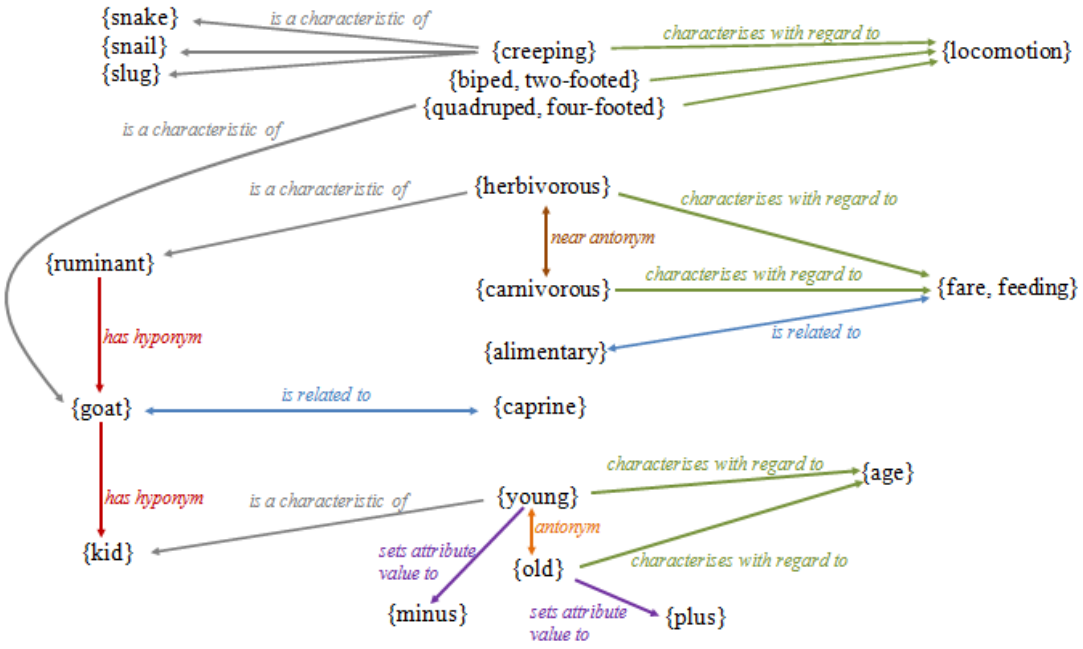


Fig. 14 – WordNet.PT fragment showing cross-POS relations involving adjectives

In Fig. 14 we recuperate Fig. 13, chapter 4, section 4.3.2, which allows us to clearly see how the contrast between relational and descriptive adjectives is encoded in the network: relational adjectives like *caprine* or *alimentary* are linked to the lexicalisation of the domain they relate to – *goat* and *food*, respectively – while descriptive adjectives such as *creeping*, *herbivorous* and *young* are linked to the attribute they set a value to – *locomotion*, *feeding* and *age*, in the examples considered. With regard to the latter class of descriptive adjectives, contrasts in terms of the nature of the attribute they relate to are also mirrored in the database, particularly in what concerns whether there is a scale or a boolean value associated to the relevant attribute. In our WordNet.PT fragment, *young* and *old*, which are scalar adjectives, are respectively linked to *minus* and *plus* values of the **age** scale, differently from what is the case of non-scalar adjectives like

carnivorous or *biped*. Finally, additional relations like *is a characteristic of* allows for semantic domains to emerge: if we take an adjective like *creeping* or *quadruped*, we realise that there are many *is a characteristic of* relations holding between them and living entities, a fact that allows us to deduce their belonging to this semantic domain.

As made apparent above, when we went through the examples in Fig. 14, the approach used for WordNet.PT adjective representation is linguistically motivated, encoding adjectives in computational relational lexica in a principled and integrated way. However, not all empirical aspects regarding adjectives are accounted for in the WordNet.PT modelling strategies delineated, as these are mostly concerned with adjective definitional properties. Hence, some of the syntactic contrasts involving adjectives remain unaccounted for in the modelling strategies for encoding adjectives in wordnet-like lexica.

Having realised this, we pursued our proposal for modelling adjectives in the lexicon arguing that wordnets should include information on event and argument structures. Discussing relevant data in detail, we concluded for the need for fine-grained, rich and structured lexical representations, in order to enable a principled account of the different ways the meaning of compound expressions is built. To achieve this goal, we adopt the Generative Lexicon framework. We put forth a homogeneous and economic approach for representing all adjective classes in the lexicon, while simultaneously accounting for crucial empirical data, particularly regarding the construction of meaning in context. Putting the main adjective representations argued for in the literature in parallel with the description of the data achieved in chapter 3, we showed how some adjective classes, particularly those displaying a less "typical" adjective behaviour – **relational** and **non-restricting adjectives** – call for alternative representation strategies. Designing such alternative modelling strategies resulted in the unified treatment of all adjective classes mentioned above.

Our main contribution with regard to descriptive adjectives amounts to an integrated approach to this adjective class. Our approach resulted from the thorough discussion of several existing – although often partial – analyses on this adjective class, which gained in strength as additional supporting data were provided, and allowed us to put forth a homogeneous GL representation for this adjective class in which:

- all descriptive adjectives were shown to be state-denoting lexical items, thus sharing a common semantic nature, despite their differences in terms of selection restrictions as illustrated in the examples below;

$$\begin{bmatrix} \textbf{fast} \\ \text{EVENTSTR} = [\text{E1} = \textbf{e1 : state}] \\ \text{ARGSTR} = [\text{ARG1} = \textbf{e2}] \end{bmatrix} \quad \begin{bmatrix} \textbf{narrow} \\ \text{EVENTSTR} = [\text{E1} = \textbf{e1 : state}] \\ \text{ARGSTR} = [\text{ARG1} = \textbf{x : physical entity}] \end{bmatrix}$$

- descriptive adjectives have a stable meaning:
  - they have the ability to modify a single aspect of noun meaning rather than modifying nouns as a whole (cf. selection restrictions of *good*, below);

$$\begin{bmatrix} \textbf{good} \\ \text{ARGSTR} = \left[\text{ARG1} = \left[\text{QUALIA} = \boxed{1}\right]\right] \\ \text{QUALIA} = [\text{FORMAL} = \textbf{positive evaluation(e1,} \boxed{1}\textbf{)}] \end{bmatrix}$$

  - sense changes in context result from combining this core meaning with the meaning of the lexical material combining with these adjectives – the modified noun, in particular – according to well-defined generative mechanisms (Selective Binding);
- as not all descriptive adjectives contribute to NP denotation in the same way, representing non-intersective readings in lexical models calls for specific strategies:
  - subsective adjectives are accounted for in terms of relativity to a standard of comparison, represented in GL in the constitutive role of the adjective, as proposed by Amaro (2002) – the data depicted in chapter 5 providing additional evidence in favour of this approach which thus gains in strength with our analysis;

$$\text{QUALIA} = \begin{bmatrix} \text{CONST} = \textbf{relative to a class(e1,} \boxed{1}\textbf{)} \\ \text{FORMAL} = \textbf{adjective content(e1, x,} \boxed{1}\textbf{))} \end{bmatrix}$$

- adverbial readings are shown to be only apparently non-intersective and are accounted for by the general mechanism: intersectively.

In what concerns relational adjectives, we propose a modelling strategy for representing these adjectives in the lexicon, which we designed from scratch, as this adjective class is not considered in Pustejovsky's (1995) discussion of adjectives in GL. We base our approach on these adjectives distinguishing properties, namely on them being characterised by denoting complex qualities and entailing complex and diversified semantic relations, rather than ascribing single properties. Being so, we claim that these adjectives make an underspecified semantic contribution, establishing a link between the modified noun and a domain that is exterior to it. We represent this in GL by stating that members of this adjective class denote a relation between the modified noun and a set of properties roughly corresponding to the denotation of another noun, and encode this in the adjective formal role as follows:

FORMAL = **relates to (e_1, modified_noun, domain_AVM)**.

Finally, we addressed the acknowledgedly different class of non-restricting adjectives, which do not denote properties, behaving more like semantic operators, a fact that has led many authors to leave them out of their analyses and theories, authors working in GL not being exception. So, as done for relational adjectives, we designed modelling strategies for representing non-restricting adjectives in the lexicon from scratch as well.

We treated non-restricting adjectives as functions that map the extension of the modified noun onto a new extension, which does not have to be related to the original one in terms of set inclusion, this way conforming to these adjectives semantic nature. Concerning these adjectives modelling in GL, we express the semantic contribution of non-restricting adjectives in terms of modality values, our proposal consisting in considering that non-restricting adjectives embed some aspects of the meaning of the modified noun into a modal context as follows:

FORMAL = $f_1(\boxed{1}) =$ **semantic_operator** $\boxed{1}$.

Assuming this analysis, we only have to define the modal contribution made by each non-restricting adjective in order to accurately represent them in the lexicon, which we do for a relevant set of members of this adjective class.

Moreover, we make apparent that putting a small set of economic generative operations to work – unification, underspecification and information sharing between structures – allows us to account for complex linguistic phenomena such as relativity to a comparison class, selection restrictions, construction of meaning in context, and sense change. This way, with our approach we account for the most characteristic and general syntactic and semantic aspects of adjective behaviour.

Given the important role played by adjective relative position in the NP with regard to the construction of NP meaning, we put forth an explicative principle for the distribution restrictions evidenced by adjective classes. Along with most authors in the literature, we assume the markedness of prenominal position, underlining its emphatic role and the contrast between prenominal and postnominal adjectives in terms of the relation they establish with the modified noun. Following González (1995), we identified a dependence between nominal items already identified in discourse, i.e. topics, and prenominal adjectives. As to our proposal, it follows from research on adjectives displaying sense change in context, whose results we extend to all adjective classes, providing further evidence for some of its claims. This way we provided a unified analysis for all adjectives occurring in prenominal position, accounting for the role played by adjective relative position in the NP in the definition of the meaning of adjective-noun groups. The analysis we put forth also provides a unified treatment of verbal and adjective alternations: with Amaro (2002) we analyse sense change adjectives as alternations, along the same lines of what Pustejovsky & Busa (1995) propose for causative/inchoative verbal alternations, but we show how Amaro's (*op. cit.*) proposal can be extended to all adjectives, hence providing a unified analysis for all adjectives occurring in prenominal position. Our approach not only conforms to the data without introducing language specific devices or radically different lexical entries to account for adjective alternations, but also provides a linguistically motivated explicative principle for the phenomena.

Moreover, we make our crucial assumptions apparent, by modelling them in GL. By representing full NPs, both with prenominal and postnominal adjectives, we are able to

straightforwardly make adjective semantic contribution self-evident, as well as the meaning contribution coming from the structure in which they occur – prenominal or postnominal position in the NP –, in a linguistically motivated way and without introducing any important changes to the adjective lexical entries proposed.

Finally, we addressed specific phenomena related to event modification by adjectives. We analysed event modifying adjectives which show adverbial readings whose scope seems to go beyond the NP where they occur, being extended over the whole sentence. As a point of departure, we identified the restrictions determining the circumstances in which event modifying adjectives have available adverbial readings with scope over the matrix verb. Our approach underlines the role played by events associated to the lexical items involved in these structures, providing a unified treatment of adjectives and adverbs. In fact, modelling this semantic similarity, made evident the number of semantic features shared by these POS. This is particularly relevant if we consider that these are the two POS that play the role of modifiers in language. This also shows the significance of the apparently exceptional data analysed in chapter 7: although they make up a very specific group of contexts displaying apparently exceptional semantic behaviours, our analysis shows that understanding them better allows for more accurately delineating the fine line distinguishing different POS in the language, and, particularly, various types of modifiers. Moreover, our approach to these specific linguistic phenomena makes the expressiveness of GL apparent: having thoroughly provided modelling strategies for members of all adjective classes, we are able to straightforwardly deal with apparently exceptional data, in a linguistically motivated way and without the need to introduce any changes in adjective lexical entries.

All the contributions made in this dissertation and briefly presented in this chapter clearly add up to a better understanding of adjectives as a word class and to an accurate and economic modelling of this POS in the lexicon, in constant dialogue with other related POS and in an integrated approach to syntax and semantics.

Also, we make apparent that, even if the main motivation of our work is linguistic at origin, the research was essentially developed under a computational perspective, resulting in a modelling of adjective classes suitable for its computation in large scale lexica and grammars. This is particularly crucial since the considerable advances made

in language study in the last decades are closely linked to a growing need to develop robust linguistic resources that can be used in large scale, in several subdomains of Language Engineering. As shown in this dissertation, the development of increasingly robust linguistic resources benefits from the incorporation in linguistic models of mechanisms such as unification, inheritance and recursivity, which allow for the representation and computation of the relation holding between form and meaning with economy of means and efficiency of results, also being more and more adapted to the caption of linguistic properties such as discreteness, compositionality, incrementality and productivity, among others. The modelling strategies developed under the scope of this dissertation make all these aspects apparent, simultaneously evidencing the increasingly stronger relation holding between a balanced expressive power and the deductive capacity of the representation languages used.

9. REFERENCES

Alonge, Antonietta, Francesca Bertagna, Nicoletta Calzolari, Adriana Roventini & Antonio Zampoli (2000) "Encoding information on adjectives in a lexical-semantic net for computational applications", *Proceedings of NAACL 2000*, Seattle, pp. 42-49.

Amaro, Raquel (2002) *Posição do adjectivo e ligação selectiva: especificações para a computação do significado*, MA dissertation, University of Lisbon.

Amaro, Raquel (2003) "Portuguese Adjective Position and Adverbial Readings in the Generative Lexicon", *Proceedings of GL 2003 – 2nd International Workshop on Generative Approaches to the Lexicon*, University of Geneva, pp. 155-160.

Amaro, Raquel, Rui Pedro Chaves, Palmira Marrafa & Sara Mendes (2006) "Enriching wordnets with new relations and with event and argument structures", *Proceedings of CICLing 2006 – Conferences on Computational Linguistics and Intelligent Text Processing*, Mexico City, pp. 28-40.

Antunes, Sandra (2002) *Computação da Polissemia Regular em Português*, MA dissertation, University of Lisbon.

Arnold, Doug (1989) *Theoretical and descriptive issues in Machine Translation*, PhD dissertation, University of Essex.

Arnold, Doug & Louisa Sadler (1994) *Noun modifying adjectives in HPSG*, Technical report, Department of Language and Linguistics, University of Essex.

Bach, Emmon (1986) "The algebra of events", *Linguistics and Philosophy*, 9, pp. 5-16.

Bache, Carl (1978) *The Order of Premodifying Adjectives in Present-day English*, Odense, Odense University Press.

Barbosa, Jerónimo Soares (1881) *Grammatica Philosophica da Lingua Portugueza ou Principios da Grammatica Geral Applicados à nossa Linguagem*, 7ª edição, Lisbon: Typographia da Academia Real das Sciencias.

Barros, João de (1540) *Grammatica da Língua Portuguesa com os mandamentos da Santa Madre Igreja*.

Bartsch, Renate & Theo Vennemann (1972) "The grammar of relative adjectives and comparison", *Linguistische Berichte*, 20, pp. 19-32.

Bartsch, Renate & Theo Vennemann (1973) *Semantic structures. A study in the relation between Syntax and Semantics*, Frankfurt: Athäeneum Verlag.

Berwisch, Manfred & Ewald Lang (eds.) (1987) *Dimensional adjectives – grammatical structure and conceptual interpretation*, Berlin: Springer-Verlag.

Bolinger, Dwight (1967) "Adjectives in English: attribution and predication", *Lingua*, 18, pp. 1-34.

Bosque, Ignacio (1993) "Sobre las diferencias entre los adjectivos relacionales y los calificativos", *Revista Argentina de Lingüística*, 9, pp. 9-48.

Bouchard, Denis (1995) *The Semantics of Syntax: a minimalist approach to Grammar*, Chicago: University of Chicago Press.

Bouchard, Denis (1998) "The distribution and interpretation of adjectives in French: a consequence of bare phrase structure", *Probus*, 10 (2), pp. 139-184.

Bouillon, Pierrette (1996) "Mental State Adjectives: the perspective of the Generative Lexicon", *Proceedings of COLING-96*, Copenhagen.

Bouillon, Pierrette (1998) *Polymorphie et sémantique lexicale: le cas des adjectifs*, Lille : Presse du Septentrion.

Boyd-Graber, Jordan, Christiane Fellbaum, Daniel Osherson & Robert Schapire (2006) "Adding dense, weighted connections to WordNet", *Proceedings of GWC'06: the 3rd Global WordNet Meeting*, Jeju Island, Korea, pp. 29-35.

Brito, Ana Maria (2003) "Categorias sintácticas – O sintagma adjectival", in Mateus, Maria Helena, Ana Maria Brito, Inês Duarte, Isabel Hub Faria et al., *Gramática da Língua Portuguesa,* 5th edition, Lisbon : Editorial Caminho, pp. 370-390.

Buitelaar, Paul (1998) *CoreLex: systematic polysemy and underspecification*, PhD dissertation, Brandeis University.

Câmara, Joaquim Mattoso (1970) *Estrutura da Língua Portuguesa*, Petrópolis: Editora Vozes Limitada.

Carlson, Greg (1977) *Reference to kinds in English*, PhD dissertation, University of Massachussetts-Amherst.

Casteleiro, João Malaca (1981) *Sintaxe transformacional do adjectivo – regência das construções completivas*, Lisbon: Instituto de Investigação Científica.

Chaves, Rui Pedro (2001) "WordNet and Automated Text Summarization", *Proceedings of NLPRS 2001, 6th Natural Language Processing Pacific Rim Symposium*, Tokyo, pp. 109-116.

Chierchia, Gennaro & Sally McConnell-Ginet (1990) *Meaning and grammar: an introduction to semantics*, Cambridge, MA: The MIT Press.

Chomsky, Noam (1981) *Lectures on Government and Binding*, Dordrecht: Foris Publications.

Croft, William (1991) *Syntactic categories and grammatical relations*, Chicago: The University of Chicago Press.

Cruse, David (1986) *Lexical Semantics*, Cambridge: Cambridge University Press.

Cunha, Celso & Lindley Cintra (1996) *Nova gramática do Português contemporâneo*, 12th edition, Lisbon: João Sá da Costa.

Davidson, Donald (1967) "The logical form of action sentences", in Rescher, Nicholas (ed.) *The logic of decision and action*, Pittsburgh: University of Pittsburgh Press, pp. 81-120.

Deese, James (1964) "The associative structure of some English adjectives", *Journal of Verbal Learning and Verbal Behavior*, 3, pp. 347-357.

Demonte, Violeta (1999) "El Adjectivo: classes y usos. La posición del adjectivo en el sintagma nominal", in Bosque, Ignacio & Violeta Demonte (orgs.) *Gramática descriptiva de la lengua española*, volume 1, Madrid: Espasa, pp. 129-215.

Demonte, Violeta (2008) "Meaning-form correlations and the order of adjectives in Spanish", in Kennedy, Christopher & Louise McNally (eds.) *The Semantics of Adjectives and Adverbs*, Oxford: Oxford University Press, pp. 71-100.

Demonte, Violeta (forthcoming) "Adjectives", in Maienborn, Claudia, Klaus von Heusinger & Paul Portner (eds.) *Semantics: An International Handbook of Natural Language Meaning*, Berlin: Mouton de Gruyter.

Dixon, Robert (1977) "Where have all the adjectives gone?", *Studies in Language*, 1 (1), pp. 19-80.

Dixon, Robert (1991) *A new approach to English Grammar, on semantic principles*, Oxford: Clarendon Press.

Dorr, Bonnie, Antonia Martí & Irene Castellón (1998) "Evaluation of EuroWordNet- and LCS-based lexical resources for machine translation", *Proceedings of the First International Conference on Language Resources and Evaluation*, Granada, pp. 393-397.

Dorr, Bonnie & Mari Olsen (1996) "Multilingual Generation: The Role of Telicity in Lexical Choice and Syntactic Realization", *Machine Translation*, 11 (1-3), pp. 37-74.

Fellbaum, Christiane (1998) "A semantic network of English: the mother of all wordnets", in Vossen, Piek (ed.) *EuroWordNet: a multilingual database with lexical semantic networks*, Dordrecht: Kluwer Academic Publishers, pp. 137-148.

Fellbaum, Christiane, Derek Gross & Katherine Miller (1993) "Adjectives in WordNet", in Miller, George, Richard Beckwith, Christiane Fellbaum, Derek Gross & Katherine Miller, *Five papers on WordNet*, Technical Report, Cognitive Science Laboratory, Princeton University, pp. 26–39.

Fellbaum, Christiane & George Miller (2003) "Morphosemantic links in WordNet", *Traitement automatique de langue*.

Fernández, Ana, María Antonia Martí, Glòria Vázquez & Irene Castellón (1999) "On the concept of diathesis alternations as semantic oppositions", *Proceedings of SIGLEX'99: Standardizing Lexical Resources*, pp. 22-29.

Gärdenfors, Peter (2000) *Conceptual Spaces*, Bradford Books, MIT Press

Geeraerts, Dirk (1997) *Diachronic Prototype Semantics. A Contribution to Historical Lexicology*, Oxford, Clarendon Press.

González, Guillermo Lorenzo (1995) *Geometría de las estructuras nominales: sintaxis y semántica del SDET*, Oviedo: Departamento de Filología Española, Universidad de Oviedo.

Grimshaw, Jane (1990) *Argument Structure*, Cambridge, MA: The MIT Press.

Gross, Derek, Ute Fischer & George A. Miller (1989) "The organization of adjectival meanings", *Journal of Memory and Language*, 28, pp. 92-106.

Hamp, Birgit & Helmut Feldweg (1997) "GermaNet – a lexical semantic net for German", *Proceedings of ACL workshop on Automatic Information Extraction and Building of Lexical Semantic Resources for NLP Applications*, Madrid, pp. 9-15.

Hernanz, Maria Lluisa & José María Brucart (1987) *La Sintaxis. 1 Principios teóricos. La oración simple*, Barcelona: Editorial Crítica.

Higginbotham, James (1985) "On Semantics", *Linguistic Inquiry*, 16, pp. 547-593.

Hundsnurscher, Franz & Jochen Splett (1982) *Semantik der Adjektive des Deutschen: Analyse der semantischen Relationen*, Opladen: Westdeutscher Verlag.

Jackendoff, Ray (1990) *Semantic Structures*, Cambridge, MA: MIT Press.

Jespersen, Otto (1924) *The Philosophy of Grammar*, London: George Allen & Unwin, Ltd.

Kamp, Hans (1975) "Two theories about adjectives", in Keenan, Edward (ed.) *Formal Semantics of Natural Language*, Cambridge: Cambridge University Press, pp. 123-155.

Kamp, Hans & Barbara Partee (1995) "Prototype theory and compositionality", *Cognition*, 57, pp. 129-191.

Katz, Jerrold (1966) *The philosophy of language*, New York: Harper and Row.

Keenan, Edward & Leonard Faltz (1980) "A new approach to quantification in natural language", in Christian Rohrer (org.) *Time, Tense, and Quantifiers – Proceedings of the Stuttgart Conference on the Logic of Tense and Quantification*, Tubingen: Niemeyer, pp. 223-268.

Keenan, Edward & Leonard Faltz (1985) *Boolean Semantics of Natural Language*, Dordrecht: Reidel Publishing.

Kennedy, Christopher (1999) *Projecting the adjective. The Syntax and Semantics of gradability and comparison*, New York: Garland.

Kennedy, Christopher (2007) "Vagueness and grammar: the semantics of relative and absolute gradable adjectives", *Linguistics and Philosophy*, 30 (1), pp. 1-45.

Kennedy, Christopher & Louise McNally (2005) "Scale structure and the semantic typology of gradable predicates", *Language*, 81, pp. 345-381.

Lakoff, George (1970) *Irregularity in Syntax*, New York: Holt, Rinehart and Winston.

Larson, Richard K. (1998) "Events and modification in nominals", *Proceedings of SALT VIII*, Ithaca, New York: CLL Publications.

Larson, Richard K. (1999) *Semantics of adjectival modification*, Lectures presented at the Dutch National Graduate School (LOT Winter School), Amsterdam.

Larson, Richard K. (2000) "ACD in AP?", Presented at the 19th West Coast Conference in Formal Linguistics (WCCFL), UCLA, Los Angeles, CA.

Lenci, Alessandro, Nuria Bel, Federica Busa, Nicoletta Calzolari, Elisabetta Gola, Monica Monachini, Antoine Ogonoski, Ivonne Peters, Wim Peters, Nilda Ruimy, Marta Villegas & Antonio Zampoli (2000) "SIMPLE – a general framework for the development of multilingual lexicons", in Fontenelle, Thierry (ed.) *International Journal of Lexicography*, volume 13, Oxford University Press, pp. 249-263.

Levi, Judith N. (1978) *The Syntax and Semantics of complex nominals*, New York: Academic Press.

Levin, Beth & Malka Rappaport Hovav (1995) *Unnacusatives: at the Syntax-Lexical Semantics Interface*, Cambridge, MA: The MIT Press.

Longobardi, Giuseppe (1994) "Reference and proper names. A theory of N-movement in syntax and logical form", *Linguistic Inquiry*, 25, pp. 609-665.

Lyons, John (1977) *Semantics,* Cambridge: Cambridge University Press.

Magnini, Bernardo & Gabriela Cavaglia (2000) "Integrating subject field codes into WordNet", *Proceedings of LREC 2000*, Athens, pp. 1413-1418.

Marrafa, Palmira (1993) *Predicação Secundária e Predicados Complexos: Análise e Modelização*, PhD dissertation, University of Lisbon.

Marrafa, Palmira (2001) *WordNet do Português: uma base de dados de conhecimento linguístico*, Lisboa: Instituto Camões.

Marrafa, Palmira (2002) "Portuguese WordNet: general architecture and internal semantic relations", *D.E.L.T.A.*, 18.

Marrafa, Palmira (2004) "Modelling constituency and predication in Portuguese", *Revista PaLavra*, volume 12 (special issue: Linguística Computacional), pp. 106-118.

Marrafa, Palmira (2005) "The representation of complex telic predicates in WordNets: the case of lexical-conceptual structure deficitary verbs", in Jesús Cardeñosa, Alexander Gelbukh & Edmundo Tovar (eds.) *Research on Computer Science*, volume 12, pp. 109-116.

Marrafa, Palmira, Catarina Ribeiro, Ricardo Santos & João Correia (2004) "Gathering Information from a Relational Lexical-Conceptual Database: a Natural Language Question-Answering System", *Proceedings of the 8th World Multi-Conference on Systemics, Cybernetics and Informatics*, Orlando, Florida.

Marrafa, Palmira, Raquel Amaro, Rui Pedro Chaves, Susana Lourosa, Catarina Martins & Sara Mendes (2006) "WordNet.PT new directions", *Proceedings of GWC'06: 3rd Global Wordnet Conference*, Jeju Island, Korea, pp. 319-321.

Marrafa, Palmira & Sara Mendes (2006) "Modeling Adjectives in Computational Relational Lexica", *Proceedings of COLING/ACL 2006*, Sydney, pp. 555-562.

Marrafa, Palmira & Sara Mendes (2007) "Using WordNet.PT for translation: disambiguation and lexical selection decisions", *International Journal of Translation, Vol. 19, ISSN 0940-9819*, Bahri Publications.

Mateus, Maria Helena, Ana Maria Brito, Inês Duarte, Isabel Hub Faria & Alina Villalva (1989) *Gramática da língua portuguesa*, 2nd edition, Lisbon: Editorial Caminho.

Mendes, Sara & Rui Chaves (2001) "Enriching wordnet with qualia information", *Proceedings of the NAACL Workshop on WordNet and other Lexical Resources*, Pittsburgh, PA, pp. 108-112.

Mihalcea, Rada & Dan Moldovan (2001) "Extended WordNet: Progress report", *Proceedings of the NAACL Workshop on WordNet and other lexical resources*, Pittsburgh, PA, pp. 95-100.

Miller, George A. (1990) "WordNet: an on-line lexical database", *Special Issue of the International Journal of Lexicography*, volume 3, nº 4.

Miller, Katherine J. (1998) "Modifiers in WordNet", in Fellbaum, Christiane (ed.) *WordNet: an electronic lexical database*, Cambridge, MA: The MIT Press, pp. 47-68.

Milner, Jean-Claude (1989) *Introduction à une science du langage*, Paris: Seuil.

Milsark, Gary (1974) *Existential sentences in English*, PhD dissertation, MIT.

Milsark, Gary (1977) "Toward an explanation of certain pecularities of the existencial construction in English", *Linguistic Analysis*, 3, pp. 1-29.

Moens, Marc & Mark Steedman (1988) "Temporal Ontology and Temporal Reference", *Computational Linguistics*, 14, pp. 15-28.

Móia, Telmo (1993) "Aspectos da modificação de estruturas nominais", *Discursos*, 4, pp. 37-63.

Montague, Richard (1970) "English as a formal language", in *Linguaggi nella Societá e nella Technica*, Milan: Editione di Comunitá.

Parsons, Terence (1968) "A semantics for English", ms.

Parsons, Terence (1990) *Events in the Semantics of English: a study in Subatomic Semantics*, Cambridge, MA: The MIT Press.

Peres, João (1992) "Questões de semântica nominal", *Cadernos de Semântica*, 1, Lisbon: Faculdade de Letras da Universidade de Lisboa.

Peters, Ivonne & Wim Peters (2000) "The treatment of adjectives in SIMPLE: theoretical observations", *Proceedings of LREC 2000*.

Platts, Mark (1979) *Ways of Meaning*, London: RKP.

Pollard, Carl & Ivan Sag (1994) *Head-driven Phrase Structure Grammar*, Chicago: CSLI Publications.

Pullum, Geoffrey & Rodney Huddleston (2002) "Adjectives and adverbs", in Huddleston, Rodney & Geoffrey Pullum (eds.) *The Cambridge grammar of the English Language*, Cambridge: Cambridge University Press, pp. 525-595.

Pustejovsky, James (1991a) "The Generative Lexicon", *Computational Linguistics*, 17, pp. 409-441.

Pustejovsky, James (1991b) "The syntax of event structure", *Cognition*, 41, pp. 47-81.

Pustejovsky, James (1995) *The Generative Lexicon*, Cambridge, MA: The MIT Press.

Pustejovsky, James & Frederica Busa (1995) "Unnaccusativity and Event Composition", in Pier Marco Bertinetto, Valentina Bianchi, James Higginbotham & Mario Squartini (eds.) *Temporal Reference: Aspect and Actionality*, Turin: Rosenberg and Sellier.

Ribeiro, Catarina, Ricardo Santos, João Correia, Rui Pedro Chaves & Palmira Marrafa (2004) "INQUER: a WordNet-based Question-Answering application", *Proceedings*

of LREC 2004, International Conference on Language Resources and Evaluation, Lisbon, Portugal.

Rosch, Eleanor (1975) "Cognitive reference points", *Cognitive Psychology*, 7, pp. 532-547.

Ross, John R. (1972) "The category squish: Endstation Hauptwort", *Papers from the 8th Regional Meeting of the Chicago Linguistic Society*, Chicago, pp. 316-328.

Sadler, Louisa & Doug Arnold (1994) "Prenominal adjectives and the phrasal/lexical distinction"*, Journal of Linguistics*, Vol. 30, nº 1, Cambridge: Cambridge University Press, pp. 187-226.

Saint-Dizier, Patrick (1998) "A Generative Lexicon perspective for adjectival modification", *Proceedings of ACL-COLING'98*, pp. 1143-1149.

Schachter, Paul (1985) "Parts-of-speech systems", in Shopen, Timothy (ed.) *Language typology and syntactic description*, Vol I, pp. 3-61.

Schmidt, Reinhard (1972) *L'adjectif de relation en français, italien, anglais et alemand*, Göppingen: Alfred Kummerle.

Stump, Gregory (1981) "The interpretation of frequency adjectives", *Linguistics and Philosophy*, 5, pp. 221-256.

Vendler, Zeno (1967) *Linguistics in Philosophy*, New York: Cornell University Press.

Vossen, Piek (1998) (ed.) *EuroWordNet: a multilingual database with lexical semantic networks*, Dordrecht: Kluwer Academic Publishers.

Vossen, Piek (ed.) (2002) "EuroWordNet General Document", *EuroWordNet Project LE2-4003 & LE4-8328 report*, University of Amsterdam.

Waugh, Linda R. (1977) *A Semantic analysis of word order: position of the adjective in French*, Leiden: E. J. Brill.

Wetzer, Harrie (1996) *The typology of adjectival predication*, Berlin/New York: Mouton de Gruyter.

Williams, Edwin (1980) "Predication", *Linguistic Inquiry*, 11, pp. 203-238.

Williams, Edwin (1981) "Argument Structure and Morphology", *The Linguistic Review*, 1, pp. 81-114.

Wilmet, Marc (1986) *La détermination nominale*, Paris: PUF.

Wheeler, Samuel C. (1972) "Attributives and their Modifiers", *Nous VI*, 4, pp. 310-334.

Zimmermann, Malte (2003) "Pluractionality and Complex Quantifier formation", *Natural Language Semantics*, 11 (3), pp. 249-287.