Quantificational Modification:
The Semantics of Totality and Proportionality

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Abstract

The thesis explores the syntactic and semantic dimensions of four linguistic elements that appear in Modern Greek arguably as quantifiers and modifiers, i.e., in the form of Quantificational Modifiers (QMods) *olos* `all, whole, overall` and its extension *olikos* `total`, *merikos* `some, a few, partial`, *ligos* `some, few, little, insignificant` and *polis* `many, great, considerable`. Such QMods are analyzed as `measure` quantifiers of scalar semantics that appear in a syntactic position common to adjectival modifiers. The thesis explores specific sets of reading and their interpretations. Such a phenomenon is common to Modern Greek, English, French and Arabic QMods and gives evidence to the universality of Quantificational Modification as a semantic subclass of Quantification.

Chapter 1 discusses Quantification as semantic interpretation along with the main questions this research intends to answer, while Chapter 2 reviews recent literature on Quantification within and across languages. Chapter 3 focuses on Modern Greek expressions of Quantification and extends chapter 2 into a further discussion about their various syntactic manifestations. Chapter 4 and 5 are extensions to chapters 2 and 3 as they discuss the semantics of specific QMods as `total` and `partial` quantifiers, which operate on homomorphic sets of degrees and amounts.

Chapter 6 discusses the broader issues in the thesis from a theoretical and typological perspective that establish Quantificational Modification as a universal and purely semantic subclass of Quantification. Our findings are summarized in chapter 7 followed by suggestions for expanding our investigation into other related areas.

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Author's declaration

No portion of the work referred to in this dissertation has been submitted in support of an application for another degree or qualification of this, or any other University.

CHAPTER ONE

Introduction

Language is our human means for communication; what we communicate through language is meanings that appear in the way we put words together in order to talk about an idea, a concept, a notion or an entity. Natural languages have the ability to generalize about fundamental concepts like that of Quantification (cf. Bach et al, 1995). Aristotle's classical syllogism, below, is an example of showing how the human mind processes meaning:

Every man is a mortal
Socrates is a man

Therefore: Socrates is mortal

Concepts like Quantification are mentally processed similarly to show how an utterance is the result of the mental process of meaning x in relation to meaning y. The way we interpret words is important to our perception of concepts, ideas and the `world`. And it is in relation to our experience with the `world` that we understand meanings expressed verbally in utterances.

Questions about how Quantification is expressed have contributed in describing human language. Semantically, the power of language might describe notions like Quantification as a way of formalizing Truth, Falsity and their measures. In terms of Semantics and Language, quantificational expressions appear in Syntax in the form of a variety of syntactic categories which with the means and rules of Compositionality combine with other lexical elements and their interpretation aim in expressing the notion of Quantification in terms of Proportionality or Cardinality.

Quantification is a universal phenomenon used for the mental activity of `counting` and `measuring` that appear either in the form of numbers and numerals or as quantities that allow a collective, distributive or proportional reading such as English *all*, *every*, *few*, *many*, *much*, *more* and their counterparts in other natural languages. Cushing (1981) thinks that "…it would be surprising indeed to discover a linguistic community whose members had no interest in quantities and their comparison, even if this interest included only the proverbial one, two, many form of `counting`" (Cushing, 1981: ix).

Research has shown that Quantification is detected in most recorded human languages (with the possible exception of Pirahã, an Amazonian language)[1] in the restricted form of numerals or as abstract as A and E quantifiers. A few simple examples of quantified sentences in English, Modern Greek, Standard Arabic and French testify to the universality of Quantification.

(1) ***All*** *the students came* (English)
(2) ***Oli*** *i mathites irthan* (Modern Greek)
(3) ***Kul*** *al tulab ataw* (Standard Arabic)
(4) ***Tous*** *les etudiants sont venues* (French)

[1] "It has been claimed that there are languages that have no quantification at all, a claim that has led to a widely publicized controversy: see Everett 2005 on Pirahã, critique in Nevins et al. 2007, and reply by Everett 2007" (Bach and Chao, 2008 [To appear])

Such sentences, and perhaps many more of the identical meaning in other languages, have one common logical interpretation:

(5) Ax [st (x) → c(x)]

Logic[2] has successfully described the differences and similarities recorded in various natural languages by making generalisations of how the human mind works and how concepts and notions (e.g., Quantification) are perceived and expressed in a shared manner, explicitly encoded in logical reasoning. The logical representation in (5) is semantically equivalent to examples (1)-(4). What is conveyed in (5) is the identical semantic sense of the above examples from different languages, expressed with different syntactic constructions and vocabulary, which confirms that quantifiers are a semantically unified class.

The meaning, analysis and understanding of Quantification have puzzled the minds of philosophers, logicians, linguists and semanticists throughout the years. The outcome of such investigation sees quantifiers as "one of the very few expressive devices of language for which it is known how to break out of the circle of language and explain what a word means other than essentially in terms of other words' meanings." (Peters and Westerstahl, 2006: Preface vii). "It is possible to explain the meaning of quantifiers in mathematical and other non-linguistic terms. This foundation not only provides a satisfying clear account of the meaning of quantifiers themselves, but also lies behind the widespread use of quantifiers in analyzing the meaning of an extensive range of non-logical expressions, including tenses and temporal adverbs, modal verbs, conditionals, attitude verbs, and some noun phrases that may not be explicitly quantified" (ibid).

1.1 Quantification as semantic interpretation

"των λεγομένων τα μέν κατά συμπλοκήν λέγεται, τα δ' άνευ συμπλοκης' τά μέν ουν κατά συμπλοκήν οιον άνθρωπος τρέχει, άνθρωπος νικα' τά δ' άνευ συμπλοκης οιον άνθρωπος, βους, τρέχει, νικα."[3]
(Aristotle, Categories: 1, a. 16)

Aristotle was the founder of the logic of quantifiers, which have been expanded into a broad field of linguistic and philosophical research in our present time. In our above quotation Aristotle notes that the meaning and the function of a word can only be explained in relation to the complete proposition whose truth is judged through experience. This is the case with the way we mentally process meanings associated with all kinds of words including ***quantifiers***. And we bring our attention to quantifiers since quantifiers are the focus of this thesis, described not as linguistic elements but as semantic objects which classify as such because of the way they interpret, independent of their syntactic manifestations. `Interpretation` is the way we understand an entity, an idea or a concept; and it is the interpretation of quantificational entities that allow them such a classification. Grammatical categories like nouns, verbs, adjectives and adverbs are put together to form propositions; it is important that these propositions are evaluated as true or false in order for the sentence to be true or false. For instance, for an individual called *John* to be described as *tall* it is important that the height of *John* is <u>above average</u> for a proposition like *John is tall* to be evaluated as true; and it is our inner experience

[2] The structure of the formal language of logic "is made to resemble that of a real natural language" (Faltz, 1995: 272).

[3] `It will be seen that the meaning and function of the single word can only be explained relatively to the complete proposition, which must be assumed as foreknown` (Translation by Bair and Robertson, 1872: 88 (footnote a)).

with the world that allows to judge *John* as *tall* when we compare him to other individuals like *Peter* and *Mary* who are not *as tall*, nor *taller than John*.

The same mental process occurs with quantifiers and the way our mind understands propositions that include them and require a `quantificational interpretation`. In semantic terms `quantificational interpretation` requires a model structure, a set of values to variables and an evaluation function in order to understand a quantifier: a semantic object interpreted in relation to sets of entities, so that for the proposition *every boy named John is tall* it is necessary that we generalize over the individual entities that are boys in the universe and we pick the set of boys that are called *John*; then, all boys named *John* are evaluated as having a height above average that will allow them to be classified as *tall*. If at least one boy named *John* is found of a height not above average that would determine the values of our proposition as false and therefore, our claim: *every boy named John is tall* would be false. These are our standards used to evaluate the `quantificational` interpretation of certain elements examined in the thesis.

1.2 Research background and research questions

Quantification is not a new research area of the present. It has been the subject of philosophical and linguistic study since ancient times. The philosophers' contribution to the analysis of Quantification began with Aristotle "who initiated the logical study of the four quantifiers all, some, not, and not all" (Peters and Westerstahl, 2006: 21), and discussed the relational view of quantification. Aristotle saw quantifiers as expressions that "denote relations between sets of individuals" (Peters and Westerstahl, 2006: 30). His logical analysis of quantifiers influenced logicians who analyzed quantification over discrete individuals rather than over pluralities of them; linguists applied the logicians' semantic analysis of quantification to human language and expanded it by discussing other forms of quantificational expressions such as quantification over times and events.

The linguistic study of quantifiers began much later than Aristotle "and until recently focused mainly on the grammatical expression of quantification rather than its meaning" (Peters and Westerstahl, 2006: 1). Besides Aristotle, other important names in the development of the linguistic analysis of Quantification are those of Russell, Frege, Mostowski, and Montague. "Russell explained the quantifiers in terms of a propositional function's being `always true`, `sometimes true`, etc., with a syntax using the notion of `real` (free) versus `apparent` (bound) variables" (Peters and Westerstahl, 2006: 37). "Frege was clear about the syntax as well as the semantics of quantifiers" (Peters and Westerstahl, 2006: 38) and distinguished "between names and … their denotations, free and bound variables … and the fact that quantifier symbols are not syncategorematic, but denote well-defined entities, quantifiers, i.e. second-order (second-level) relations" (Peters and Westerstahl, 2006: 40). Mostowski was concerned with the logical form of quantifiers and their semantic types, while the work of Montague "represents the first systematic attempt to apply the logician's methods of formal syntax and semantics to natural language" (Partee, 1976: 51). Montague treated English as a Formal Language which could be treated "within the logical tradition in syntax and semantics" (ibid); "work on NP's as Generalized Quantifiers … began with Montague and was continued and elaborated by Barwise and Cooper (1981). In Montague's theory, phrases like `John`, `every man` and `he`, are all members of a single category, term-phrase or NP, and they are given a single type of interpretation as sets of properties" (Bach et al., 1995: 7). Initially logicians analyzed "the meaning of quantification over discrete individuals rather than over pluralities of them or parcels of non-discrete stuff" (Peters and Westerstahl, 2006: 1), while linguists concentrated "on quantification over domains denoted by

individual count nouns such as *person* and *table*, rather than domains denoted by collective count nouns such as *crowd* and *suite* or by mass nouns such as *protoplasm* and *furniture*" (ibid).

Our investigation into quantificational expressions revolves around the following fundamental works in the treatment of Quantification: Barwise and Cooper (1981) who extended Montague's work, and Bach (1981) who discusses `eventology` in terms of subsets of `events` along with Bach's et al., (1995) typological work which "provides data on the syntactic and morphological expressions of quantificational notions in a range of natural languages" (Bach et al., 1995: 10). Such works will be looked at in more detail in Chapter 2.

The research questions this thesis will attempt to answer range over the semantics of Quantification and Modification, and how they both relate in the case of certain elements that appear in adjectival position but induce `quantificational` interpretation. Such cases appear in various natural languages. We compare data from English, French, Standard Arabic and Modern Greek. This research moves from the cross-categorial findings of various morpho-syntactic devices that take the same semantic interpretation, to cross-linguistic issues that address the interplay between ***Quantification*** and ***Modification*** in our analysis of ***QMods***. QMods are found to share similarities with adjectival (gradable) modifiers and quantifiers and were therefore, branded as QMods, i.e., ***Quantificational Modifiers***. Hence, ***Quantificational Modification*** is seen as another way of expressing Quantification, perhaps as universal as Quantification itself. Often QMods are polysemous; as a result of their polysemy they allow appearing in more than one syntactic position and are semantically ambiguous between two interpretations. QMods syntactically resemble adjectival modifiers in terms of linear order and morphological inflection and agreement – if the language allows inflection as in the case of Greek, Arabic, etc. - with the noun and definite article they combine to form an NP that induces quantificational interpretation. Because of their interpretation and semantic analysis as operators over set relations they semantically pair with quantifiers. In addition they also resemble gradable adjectives in terms of scalarity and the comparison they allow between the proportional sets they operate on.

In our discussion of QMods we have used data from Modern Greek, Standard Arabic, English and French in order to provide evidence that will establish Quantificational Modification as a universal semantic subclass of Quantification. Our comparison between Greek, Arabic, English and French throughout the thesis intends to show that such languages can relate typologically but not geographically and the means of such relation is purely linguistic. Our modest typological assessment of Greek, Arabic, English and French QMods target to answer questions posed initially by Bach et al., (1995: 1) as the following:

- How do natural languages provide for quantificational expressions?
- How much of such structures and meanings is universal and to what extent do languages vary in their quantificational tool-boxes?
- Are differences among languages in the domain(s) of quantification systematically correlated with other differences?

With such a variety of morpho-syntactic manifestations ranging from determiners, modal verbs, affixes, adjectives, nouns and adverbs it is natural to ask `what constitutes really `quantificational interpretation` and `is there a possible mapping between morphology/syntax and semantic interpretation` and `if there is, then how is such a mapping realized in natural language`?

Quantification is an abstract notion; what happens on the ground of Quantification is really something like the relation between light and energy in the form

of a torch as a source of light. The energy would not be perceived if there was no actual physical appearance of light. This is exactly what happens with Quantification. Its actual semantic interpretation is exposed in the morpho-syntactic mechanisms it uses and such a mapping only shows in the logical representation of quantifiers. Montague used a λ-categorial language as the base for a logical analysis. The λ-calculus enforces compositional interpretation of different semantic notions such as Quantification. A quantificational treatment in a categorial language follows the syntactic rules which allow combining syntactic elements in a certain way so that quantificational expressions are formed that possess a unified semantic analysis represented in the logic. The machinery used is the Lexicon and the specific categories words belong to[4]. We examine QMods in terms of proportional set relations; the proportionality of these sets confirms that `proportion` is a "notional ingredient of many instances of quantification" (Partee, 1995: 561); it is evident from our discussion on QMods that we interpret proportion as `total` or `partial`.

We feel that in the case of various syntactic manifestations of quantifiers, Proportionality and Totality are related issues, determined by context; such issues will be the focus of this thesis discussed in the form of `total` and `partial` QMods.

1.3 Primary area of study: Quantificational Modification in Modern Greek

This thesis is an attempt to describe specific phenomena of Quantificational Modification in Modern Greek by examining the syntactic behaviour of certain Greek elements that allow quantificational interpretation in specific contexts. We are concerned with the more controversial quantificational expressions in Modern Greek, as they appear mainly in adjectival position.

Our focus is on Modern Greek QMods manifested in the form of adjectives and their counterparts in English, French and Arabic. Modern Greek QMods maintain strong morpho-syntactic bonds with their Classical Greek ancestors as shown in their adjectival syntactic manifestations, morphological inflection and agreement with other components in their host NP and their polysemous nature. This explains why such quantifiers have been branded `adjectival` even though they induce quantificational interpretation. QMods are viewed as `total` and `partial` quantifiers analyzed in terms of relations between proportional sets of degree and amount. They resemble `normal` modifiers in terms of linear order, restriction and morphology; QMods resemble `gradable` adjectives

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[4] Basic categories are *t* for truth-value (i.e. sentence) and *e* for entities (i.e. noun phrase). These categories combine following certain syntactic rules and yield quantificational expressions with the same semantic interpretation. This mapping between the syntax and the semantics of notions such as Quantification shows in the logical representation of each sentence. Montague's paper: `The proper treatment of Quantification in Ordinary English` deals with such mapping in English. Partee (1976) notes, "The two basic categories are *t*, the category of sentences (t for truth bearing), and *e*, the category of `entity-expressions`. The category *e* seems quite mysterious if one looks only at the syntax, since it turns out that no words or phrases of English are assigned to that category. But it along with the category *t*, is used in defining the remaining categories, and in the language of intensional logic into which the English expressions are translated, there *are* expressions of category *e*, and they are interpreted as denoting in a straightforward way" (Partee, 1976: 55-56). Partee (1976) explains how Montague's paper analyzes quantificational phrases such as *every man*, *the unicorn*, *a woman*, as term phrases along with *John* and *Mary*. "The way Montague manages a uniform treatment of *every man* and *John* is to interpret both as denoting sets of properties of individual concepts. The individual concept of John is the function which picks out John at each possible world and time. The constant *j* in the intensional logic is of category *e* and simply denotes the individual *John* (assuming we have fixed on a particular interpretation of the constants of the intensional logic" (Partee, 1976: 59-60).

in terms of scalarity that appears either morphologically, lexically or semantically. Their adjectival properties are also confirmed by their ability to grammaticalize into adverbs and prefixes of the same root to which we will refer as ***QMod-advs*** and ***QMod-prefixes*** (cf. 1.3, 2.3 and 2.4).
Our analysis of QMods is an attempt to show the possible common semantics between D- and A- quantifiers in this special class of `adjectives` that induce `quantificational` interpretation. This shows up in their composition that necessarily includes a restriction and a scope.

1.4 Outline of dissertation

Chapter 2 deals with ***Quantification*** within and across languages; it reviews recent literature on Quantification and discusses the semantic properties that classify quantifiers in terms of `entities` and `events` as GQs in the sense of Barwise and Cooper (1981) and Bach (1981, 1986). Chapter 2 also discusses the syntactic manifestations of GQs and their further classification into D- and A- quantifiers in the sense of Bach et al., (1995). A special section of this chapter is devoted to certain Arabic quantificational modification expressions that share morpho-syntactic properties with adjectives. Therefore, chapter 2 sets the scene for the investigation of another class of quantifiers which adopt a modification form to syntactically manifest themselves but maintain a uniform semantic interpretation as expressions of Totality and Proportionality.

Chapter 3 extends chapter 2 and our discussion about Quantification in natural language and its various manifestations; it focuses on Modern Greek and discusses the diachronic relations of Modern Greek quantifiers and their relation to their Classical Greek ancestors. It compares Arabic, English and French `total` and `partial` quantifiers to the same Modern Greek QMods. Modern Greek QMods are peculiar in their ability to appear in different syntactic positions as the very same lexical element; such a peculiarity is attributed to their polysemous nature.
Chapter 4 and 5 are extensions to chapter 3 as they discuss `total` and `partial` quantifiers as expressions of ***Totality*** and ***Proportionality***. Chapter 4 offers a brief discussion of possible cases of Quantificational Modifiers in the light of three English elements: *entire*, *total* and *partial*; it also offers a primary semantic analysis of QMods, while chapter 5 discusses the semantics of Quantificational Modification in more detail and in the light of Modern Greek related data. Our typological discussion in 2.4 and 3.4 of chapters 2 and 3 and our semantic analysis of QMods in general offered in chapters 4 and 5 set the scene for our discussion in chapter 6.

Chapter 6 discusses the broader issues in the thesis from a theoretical and typological perspective that establish Quantificational Modification as a purely semantic subclass of Quantification as universal as Quantification itself. A special section in chapter 6 compares and evaluates Standard Arabic and Modern Greek QMods in order to claim the universality of Quantificational Modification.

Finally, chapter 7 concludes our findings and presents possible ways of expanding our investigation to other related areas.

CHAPTER TWO

Quantification within and across languages

2.0 Introduction

Quantification in natural language can be thought of as a means by which generalisations can be expressed[5]. The nature and characteristics of quantification has been the subject of enduring fascination and research; philosophers, logicians and linguists have investigated the logical, ontological and semantic properties of quantificational phenomena and their syntactic expressions.

The focus on the formal processes and manifestations of quantification across languages from the perspectives of typology and language universals is a more recent enterprise, and the results of one of the main research programs in this area are published in the volume *Quantification in Natural Languages* (1995) by Bach, Jelinek, Kratzer and Partee (eds.) (henceforth Bach et al (1995)), which in many ways serves as the departure point for the work in this dissertation. Following Bach et al., we consider two main aspects of research on Quantification:

"a very old one, [concerning] the systematic import of syntactic categories, a question [which requires] a combination of theoretical work and cross-linguistic study. The other area, only recently under active investigation, concerns the structure and interpretation of expressions of quantification, including not only quantification expressed by NP's with determiners like `every` and `no` but also what Lewis (1975) called `adverbs of quantification` (`always`, `in most cases`, `usually`, etc), `floated` quantifiers, and quantifiers expressed by verbal affixes and auxiliaries" (Bach et al., 1995: 4-5).

We are interested in particular in the question of what may be the 'similarities and differences, within and across languages, in the structure and interpretation of quantification' (ibid.) in the domains of morphology, syntax and semantics. The papers in Bach et al.(1995) provide a rich basis for this research, where studies of the morphological and syntactic manifestations of quantificational semantics in a variety of natural languages (English, Hindi, Mayali, Mohawk, Navajo, and others) allow for on the one hand, a better understanding of the complex nature of the different things which the term *Quantification* is used to cover and, on the other hand, of the ways in which *Quantification* may be expressed in the syntax and morphosyntax of different languages.

The rest of this chapter presents aspects of Quantification within and across natural languages. Section 2.2 presents Bach's et al. syntactically-based classification of quantificational elements *(D-quantification and A-quantification)* first introduced in 1987. Subsection 2.1.1 discusses the semantic interpretation of quantifiers and the ontological nature of the elements which they are taken to quantify over, while subsection 2.1.2 briefly introduces the theory of Generalized Quantifiers. Section 2.3 concentrates on the typological aspects of quantification, their morphosyntactic and categorial realisations and the range of their lexical meanings and interpretations. In section 2.4, through a more detailed description of related phenomena in Standard Arabic, I argue that certain elements in adjectival positions induce quantificational interpretation in specific contexts. This leads to a discussion of one of the main issues I will address in this dissertation: the status of elements that semantically are interpreted as quantifiers, even though their syntactic status is arguably that of adjectival modifiers.

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[5] Quantifiers are seen as devices for generating statements, so that in a sentence like *All babies cry* the quantifier *all* expresses a generalisation about certain individuals that are babies and have the property of crying. This implies that all individuals who are babies cry, with no exception.

2.1 Quantification in Natural Language

Quantification is inextricably linked to Semantics, and it is in semantic terms that we identify a word or expression as a quantifier – where the interpretation involves, in some sense or another, the 'quantity' of some entity. In this semantic sense quantifiers cannot be consistently identified with a single syntactic category. Instead, as demonstrated by much previous research (see for example, Bach et al. 1995), they may be realised in a wide range of morpho-syntactic positions more typically associated with elements assigned to other syntactic categories – not only determiners, but also adverbs, adjectives, nouns, auxiliaries, modal verbs, affixes and possibly others not yet identified. Although some lexical elements such as ***every*** and ***always*** always seem to induce quantificational interpretations, there are many other cases, such as the English form ***one*** which as a pronominal N might be associated with a referential interpretation in sentences like *I like* [*the red* ***one***], but as a Determiner can receive a quantificational interpretation like [**O*ne*** *man*] *came in.* In the latter case it is arguable that the quantificational interpretation, possibly associated with the syntactic environment in which one appears, leads us to consider ***one*** as a quantifier.

In the following two subsections we explore two aspects of quantificational semantics: (1) the nature of the elements that natural language quantifiers may quantify over, i.e. the ontological commitments that natural language semantics requires (cf. 2.1.1) and (2), the formal characterisation of natural language quantifiers under the *Theory of Generalised Quantifiers* (cf. 2.1.2).

2.1.1 The ontology of quantified elements

When we talk about *Ontology* we refer to the nature of things. The term derives from the Classical Greek word οντολογία [*ontologia*] which in its turn derives from ὀν [*on*] `being, creature'. Ontology, the study of the various aspects of 'existents', in this broadest sense has been linked to Quantification from its earliest days.

In *Metaphysics,* Aristotle examines the nature of *ousia* `matter, substance`, and its possible forms and manifestations. The Aristotelian o*usia* might be variously regarded as the 'essence,' 'form,' or 'matter' (in the sense of material substance) of the entity question, possibly describable in terms of the characteristics which distinguish it from other 'things'.[6] Aristotelian *atoma*, on the other hand, are distinct from other things on the basis of their indivisibility.[7] In defining natural language metaphysics for model-theoretic semantics (e.g., Bach (1986a, b)) one fundamental question to consider is whether a single universal ontology underlies the process of semantic interpretation in natural languages. In other words, do all languages use the same sorts of 'basic' entities

[6] For this reason, when Bach (1986a) talks about the `stuff` of apple or apple as a mass-term, he refers to what actually constitutes what we know as being `apple`. Thus, when we talk about an apple-pie we mean a pie made of apple where apple is a mass entity referring to the stuff, or the *ousia*, that relates to apple as the main ingredient in the pie. And *apple* is *apple* because our world has taught us to view it as such, that is a round, reddish, yellowish or even greenish fruit, of a particular shape, size and taste attributed only to apples, which comes only from what, is known as an apple tree. And it is the *ousia* – to use Aristotle's term- of apple that makes it an apple and make us differentiate between an apple and an orange, so that, we automatically realize why an orange is not an apple.

[7] Cohen, S. Marc, "Aristotle's Metaphysics", *The Stanford Encyclopedia of Philosophy* (Fall 2008 Edition), Edward N. Zalta (ed.), forthcoming URL = <http://plato.stanford.edu/archives/fall2008/entries/aristotle-metaphysics/>.

when computing meaning? In this thesis I wish to explore the extent to which this may be the case in quantificational semantics.

What sorts of entities should be included in the domains of models for natural language interpretation? Aristotle's *atoma*, the indivisible primitives, may be thought of as the basic elements in the domain. In a typical 'basic' model these would be *individual entities*, the referents for nominal expressions such as proper names (such as the person named ***John*** or the English city known as ***London***). Aristotle's multifaceted notion of o*usia* - essence, form and material substance – finds its modern counterparts in the different sortal domains which classify the different sorts of entities in the model. In the nominal domain, the 'essence' interpretation of o*usia* may be related to *generics* and *natural kinds*, e.g., HORSES as in *Horses are widespread*. The counterparts to the notion of 'form' may be found in the entities sorted as *count* (e.g., TABLES) and *mass* (e.g., FURNITURE). 'Material substances' (e.g., WOOD) are often expressed as mass terms.

Davidson (1967, 1980) and Bach (1986a) were the first to argue that events should be included alongside individuals as entities in the semantic domain. The Aristotelian concepts of *energeia* `action`, `actuality` or `activity` and *kinesis* `motion` or `change` may be considered from this perspective, where *energia* is `actualized` as soon as an action begins, while *Kinesis* `change` has *arche* `beginning` and *telos* `end,` where *telos* is the outcome of *energeia* `action`. Similar notions are currently used in classifying different 'sorts' of events/eventualities - as states, activities and telic or atelic processes.

Quantification in natural language expresses generalisations over entities in the semantic domain. Although there is no generally accepted proposal on what would constitute a complete ontology for natural language metaphysics, it is arguable that it would have to be sufficiently rich to express quantificational interpretations, and thus would have to include in its domain at least the distinct sorts of entities discussed above: kinds, count and mass entities, and events. The sortal distinctions outlined above are often reflected across its quantificational mechanisms and expressions in natural language. For example, quantification over individuals typically involves quantificational determiners such as *every*, *some*, *many* or *few*, while forms such as *much* or *little* can only quantify over mass terms.

Events can be similarly defined. Lewis (1975) argued that certain adverbs should be seen as quantifiers over `times` or 'cases,' since they relate to events that occur at certain `times`[8] or as quantifiers over `events` or `cases`[9]. Bach (1986b) argued that `events` and `things` should both be treated as ontological entities in the domain, on the basis that quantification/measuring applies to both domains. Thus, we may refer to the number of things or to `all things` in the same way we may refer to the number of events or to `all events` as in questions like *how many things are there in the room* and *how many events took place in the last hour*. Quantification over `events/eventualities` in the sense of

[8]An adverb like *always* would be a modifier that combines with a sentence Φ to make a sentence *Always* Φ that is true iff the modified sentence Φ is true at all times. *Sometimes* Φ, *Never* Φ, *Usually* Φ, *Often* Φ, and *Seldom* Φ are analyzed similarly and are found true iff Φ is true *at some times, none, most, many*, or *few* (cf. Lewis, 1975).
In his second attempt to define semantically adverbs of quantification Lewis (1975) analyzes them as quantifiers over `events` as he realizes that often such adverbs refer to abstract entities that can not be identified in time.

[9] A `case` corresponds to "each moment or stretch of time, or to each in some restricted class. But sometimes we have a case for each event of some sort; or for each continuing relationship between a man and his donkey [as in his example (10) *A man who owns a donkey always beats it now and then*] or for each quadratic equation [as in examples (11) *A quadratic equation never has more than two solutions* and (12) *A quadratic equation usually has two different solutions*]. In other words, Lewis considers `cases` to be the admissible assignments of values to variables such as the relationship between the man and his donkey or for each quadratic equation.

Davidson (1967) and Bach (1986a) is typically expressed in the verbal domain via adverbial operators such as *always, usually,* and *occasionally*. Bach (1986a) considers "events to be analogous to the singular and plural individuals, while bounded processes are analogous to the parting of matter that make up the "material extensions of those individuals" (Bach (1986a) reprinted in Portner and Partee, 2002: 327); "tenseless clauses of English are to be interpreted as denoting sets of eventualities" (ibid). In his `partitive puzzle` Bach (1986a) makes the parallelism between the verbal aspect and the nominal domain; "in both domains there are clear and ordinary examples of count items that don't follow these restrictions. These are words like *thing*, *event*, *happen*, and so on. Suppose it is true that something happened, then in the normal case there are smaller subevents that make up the big thing that happened that are also happenings. Similarly for things." (Bach (1986a) in Portner and Partee, 2002: 332). And for this reason questions like `How many things are there in the room` and `How many events took place in the last hour` are similar. Then, a sentence like *John always visits his mother on Sundays* analyzed in the sense of Bach (1981, 1986a) would imply that *always* operates over a set of events that include all the Sundays which refer to the times John visits his mother; in a similar way *all the students came to the party* would imply that *all* operates over the set of individuals (i.e., *the students*) who came to the party. This is in accordance with Bach's (1986a) view that events can also be counted in a way mass-terms can be counted; then, events can be analyzed similarly to entities as sets of sets. Then, other quantifiers like *many* in *many students came to the party* quantify over the number of students and quantifiers like *often* in *John often visits his mother* quantify over the number of times John visits his mother; therefore, it is evident that GQs quantifying over `things` or `events` share similar semantics and the way an entity expresses a property of entities is similar to the way a VP expresses properties of eventualities.

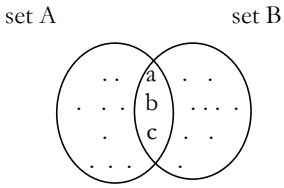
2.1.2 Generalized Quantifiers (GQ)

Our discussion of Generalized Quantifiers (GQ) starts with the work of Barwise and Cooper (1981) who develop Montague's (1973)[10] theory of Generalized Quantifiers where NPs such as *every student* are taken to denote a set of properties, in this case, the set of all the properties which contain the set of students as a subset. Thus in this view, "quantifiers correspond to Noun Phrases, not to Determiners" (Barwise and Cooper, 1981:162) and in a sentence like *most people came to the party*, "it is the NP `*most people*` that is the quantifier" (Barwise and Cooper, 1981:162) and not just the determiner *most*. Quantifiers then "denote families of sets" (Barwise and Cooper, 1981: 163) and "are used to assert that a set has some property" (ibid); "a quantifier may be seen as dividing up or partitioning the family of sets provided by the model. When combined with some sets it will produce the value `true` and when combined with others it will produce the value `false`. In order to capture the idea this formally, quantifiers are taken to denote the family of sets for which they yield the value `true`." (Barwise and Cooper, 1981: 164). For instance, in a sentence like *few students came to the party*, the GQ *few students* can be analyzed as the set which contains all the sets which contain few students as its members,

[10] Montague (1973) interprets the NP as denoting Generalized Quantifiers, (i.e. sets of sets) and uses logic in order to describe natural language. He defines categories for the lexicon which combine with rules to yield more complex categories; such combinations result to the formation of sentences. He treats noun phrases like *every man*, *unicorn*, *a woman*, etc. as term phrases like *John* and *Mary*. "The way Montague manages a uniform treatment of *every man* and *John* is to interpret both as denoting sets of properties of individual concepts. The individual concept of John is the function which picks out John at each possible world and time." (Partee, 1976: 59).

and *few students came to the party* will be true just in case the intersection of the set of students (A) and the set of those who came to the party (B) contains few members as in the diagram below:

(1)



Quantifiers denote sets of sets in a given domain E of discourse. ***Conservativity*** is that semantic property of quantifiers that defines the smaller set of sets and appears in Barwise and Cooper's (1981) equivalences given below in (2):

(2) Many men run ↔ Many men are men who run
Few women sneeze ↔ Few women are women who sneeze
John loves Mary ↔ John is John and loves Mary

Barwise and Cooper (1981) propose that all natural language quantifiers are conservative. Quantifiers like those given in (2) "live on the set men, women and the singleton set containing John, respectively" (Barwise and Cooper, 1981: 179). The following (3a, 4a, 5a and 6a) are examples of English sentences whose predicate logic formula is given in (3b, 4b, 5b and 6b), while (3c, 4c, 5c and 6c) provides their Generalised Quantifier interpretation:

(3) a. *All students came*
b. Ax [student (x) → came (x)]
c. ⟦All (A,B)⟧ = 1 iff A $\underline{\subset}$ B A: the set of students
B: the set of those who came

(4) a. *Some students came*
b. Ex [students (x) ∧ came (x)]
c. ⟦Some (A,B)⟧ = 1 iff A∩B ≠ Ø

(5) a. *Few students came*
b. Ex [students (x) ∧ came (x) ∧ |students(x) ∩ came(x)| ≤ m]
c. ⟦Few (A,B)⟧ = 1 iff |A∩B| ≤ m/n |A| (a proportional reading)

(6) a. *Many students came*
b. Ex [students (x) ∧ came (x) ∧ |students(x) ∩ came(x)| ≥ m
c. ⟦Many (A,B)⟧ = 1 iff |A∩B| ≥ m/n |A| (a proportional reading)[11]

GQs may denote Totality, often expressed in terms of ***Exhaustivity*** (cf. Kadmon and Landman (1993)), in the case of collective universal *all*, distributive universals *every* and *each* or polarity item *any* in specific syntactic environments. Exhaustivity is expressed

[11] *Many* and *few* can take either a proportional (as in *There are many male students in this class*, in which many depends on the number of students) or a cardinal (as in *Many students in this class are male*, in which many refers to the proportion of students in this class who are male) reading.

in examples like ***all*** *the men*, ***each and every*** *man*, ***every single*** *boy* and *I don't have* ***any*** *money*, in a way that excludes any exceptions in the described situation. GQs may also denote ***Proportionality,*** often expressed in `partitive` constructions common to existential quantifiers *some*, *many*, (*a*) *few*, and the like. This can be found in constructions like ***some*** *men* and ***some of the*** *men*, ***many*** *places* and ***many of the*** *places*, etc., where the partitive preposition *of* is associated with the proportional reading of the NP.

Quantifiers may also be described in terms of their ***Monotonicity*** (Barwise and Cooper, 1981: 187)[12]. Quantificational expressions are divided according to their model semantics into ***monotone increasing*** (e.g. *a man, some man, some men, somebody, the man/men, these/those men, most men, many men, several men, either man, at least two men*), ***monotone decreasing*** (e.g. *no man/men, few men, neither man, nobody, none, nothing, at most two men*) and ***not monotone*** (e.g. *exactly two men, exactly half the men*)[13]. Barwise and Cooper (1981) define a quantifier Q as "monotone increasing (mon ↑) if X∈Q and X $\underline{\subset}$ Y $\underline{\subset}$ E implies Y∈Q (i.e. for any set X∈Q, Q also contains all the supersets of X.)" (Barwise and Cooper, 1981: 184). Similarly, a quantifier Q is monotone decreasing (mon ↓) "if X∈Q and X $\underline{\subset}$ Y $\underline{\subset}$ E implies Y∈Q (i.e. for any set X∈Q, Q also contains all the subsets of X.)" (Barwise and Cooper, 1981: 185). Barwise and Cooper (1981) further explain that a quantifier can be tested for monotonicity if we consider two verb phrases: VP_1 and VP_2 "such that the denotation of VP_1 is a subset of the denotation of VP_2 and then check whether either of the following seem logically valid:

If NP VP_1, *then* NP VP_2. (NP is mon ↑)
If NP VP_2, *then* NP VP_1. (NP is mon↓)" (Barwise and Cooper, 1981: 185).

Another further classification of Quantifiers is into ***positive strong*** (e.g. English *the 1, the 2, both, all, every, each, most*), ***negative strong*** (e.g. English *neither*) and ***weak*** (e.g. English *a, some, one, two, three, many, a few, few,* and *no*) - terms borrowed from Milsark (1977) who defines ***weak*** determiners as those which create noun-phrases which sound good after *there is* or *there are*. Usually positive strong determiners are monotone increasing while negative strong determiners are monotone decreasing. Weak determiners are sensitive to Milsark's (1977) `there-is` test and appear as in example *many men love Mary* that paraphrases as `there is many men who love Mary`. Strong determiners like *all* are not usually sensitive to such a test; for instance, *all men love Mary* can not be paraphrased as `there is all men who love Mary`.

2.2 Quantificational expression in natural languages

In 2.1 we discussed how ontological primitive elements: `things` and `events` appear in quantificational constructions in the nominal and verbal domain and adopt a unified semantic analysis as GQs.

GQs are manifested in natural languages with various syntactic devices. Partee, Bach and Kratzer's (1987) unpublished NSF proposal offers a discussion on `Cross-Linguistic Quantification` that led to the formation of Bach et al., (1995) and the classification of quantificational expressions into two main categories: the D- and A-quantifiers, where `D` refers to Determiner and `A` refers to Adverbs, Auxiliaries, Affixes, and Argument-structure Adjusters. Such a classification is based on the syntactic manifestations of quantifiers independent of their analysis as GQs, discussed already in

[12] We only refer to these examples of quantifiers since these are the cases we will investigate in this thesis in connection to our claim. As we will see in the coming chapter 4, QMods can often occupy a D- position and analyze as monotonic GQs. In their normal adj-position they are not monotonic but proportional.

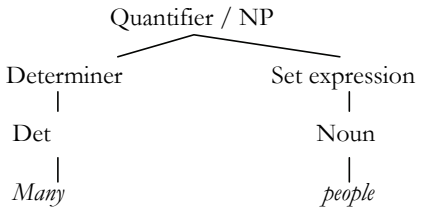
[13] A quantifier like *a few* is not monotone when it means `some but not many`.

2.1.2. D- and A- quantification is the focus of the next two subsections 2.2.1 and 2.2.2. When quantifiers appear in a Determiner position they are referred to as D-quantifiers which at the syntactic level combine with a nominal expression to create a *quantifier* in the GQ sense, quantifying over count or mass entities. A-quantifiers appear in the form of Adverbials, Auxiliaries, Affixes and Argument-structure Adjusters and quantify over `events`.

2.2.1 D-quantification

In 2.1.2 we discussed how an NP such as *many people* is treated as a quantificational NP in the sense of Barwise and Cooper (1981), with the following syntactic structure:

(7)



In the Barwise and Cooper (1981) framework natural language quantifiers follow two fundamental universals: the ***NP-Quantifier Universal*** which states that "every natural language has syntactic constituents (called noun-phrases) whose semantic function is to express generalized quantifiers over the domain of discourse" (Barwise and Cooper, 1981:177) and the ***Determiner Universal*** which indicates that "every natural language contains basic expressions, (called determiners) whose semantic function is to assign to common count noun denotations (i.e. sets) A a quantifier that lives on A" (Barwise and Cooper, 1981: 179).

A typical language with examples of determiner-quantifiers is English. The term **D-quantifier** refers to those elements associated with the syntactic category of determiners, such as English *every*. For most linguists, *every* is "the prototypical, garden-variety quantifier" (Gil, 1995: 321), while to philosophers *all* as the default example of a quantifier[14]. Both English *all* and *every*, belong to the category of determiners. Others are *some, most, many, each, no*, etc. Throughout the history of studying Quantification, *all* has been seen as a default example of universal quantifiers and *some* as the default example of existential quantifiers.

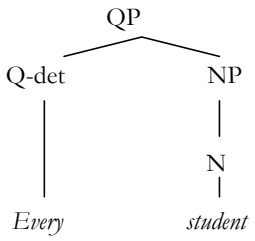
Expressions formed by D- quantifiers and their associated nominal restrictions in both subject and object positions are equivalent to representations of Determiner Phrases

[14] Regarding our choice in the terminology we use to refer to such semantic elements Peters and Westerstahl (2006) clarify that there is no obvious difference between the terms ***quantifier*** and ***generalized quantifier***. They note, "Logicians call these objects `generalized` quantifiers, since they were originally generalizations of the universal and the existential quantifiers from first-order logic. But once the naturalness and the ubiquity of the concept is appreciated, it becomes natural to drop the qualification, and just call them *quantifiers*" (Peters and Westerstahl, 2006: 53).[14]
Barwise and Cooper (1981) believe that "noun phrases act, semantically, like the logician's generalized quantifiers" (Barwise and Cooper, 1981: 166); they emphasized that it is the NP which corresponds to the Generalized Quantifier and not the Determiner, which is a function that maps common noun denotations onto Generalized Quantifiers. The Generalized Quantifier takes a VP as its argument to build a proposition.

(DPs) (sometimes also referred to here as NPs or QPs). "A quantificational expression in an argument position will be assumed to be headed by its quantificational determiner of category D. The whole expression will therefore be a Determiner Phrase (DP), whose complement is the NP with which it is in construction." (Higginbotham, 1995: 405). Quantificational expression in an argument position could be syntactically analyzed as [DP [D X] [NP Y]] (cf. Higginbotham (1995: 405, ex. 58)). Other English quantifiers can receive a similar analysis that is, as heads of DPs. Thus, *every* in `*every book*` can be analyzed as [DP [D every] [NP (book)]], *much* in `*much gold*` as [DP [D much] [NP (gold)]], *some* in `*some men*` as [DP[D some] [NP(men)]], *most* in `*most students*` as [DP [D most] [NP (students)]], and so forth. This has already been discussed in 2.1.2 in Barwise and Cooper's (1981) theory of Generalized Quantifiers.

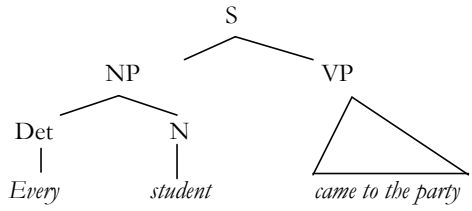
Semantically, a determiner is the head of a Quantifier Phrase (QP) as shown in (8) below:

(8)



Thus, a sentence like *every student came to the party* receives the following syntactic construction as in (9):

(9)



"Syntactically the roles of determiner, domain predicate, and predicate quantified can be distributed in many different ways. In case of nominal quantifiers of the form determiner (in a syntactic sense) plus noun, the determiner functions as a determiner in the semantic sense, the noun serves as the domain predicate, and the rest of the sentence – as long as it does not contain any higher operators – serves as the predicate quantified" (Loebner, 1986: 57). Examples of GQs in the form of NPs with a determiner operator are *two girls*, *most men*, *all men*, *much gold*. This description of syntactic construction of quantifiers reflects their semantic composition which appears in syntax as the combination of the quantifier in the form of a determiner or an adverb, its restriction and its scope.

2.2.2 A-quantification

A-quantification involves quantification over `events`. It is restricted to other non-determiner kinds of Quantification, and occurs in all natural languages, in one form or the other, with adverbs as the most common form of A-quantifiers, others be Auxiliaries, Affixes and Argument-structure Adjusters. A-quantification is not as homogeneous as D-quantification but common in all natural languages since it is manifested across natural languages not only in the form of adverbials such as English *always, usually, never, seldom,* etc., but also in the form of invariant paticles, coverbs, preverbs, enclitics to the verb, or verbal prefixes (cf. Bach et al., (1995)).

An A(dverbial)-quantifier is a syntactic operator which can occur in different positions: "in the VP of the main clause, in sentence-initial position, or in the VP of the subordinate clause" (de Swart, 1993: 208), while A(ffix)-quantifiers are word-internal operators; they quantify over their stem and function at the morphological level[15]. "Syntactically, an A-quantifier forms a constituent from some projection of V […], whereas a D-quantifier is, or forms a constituent with, a projection of N" (Bittner, 1995: 59). While D-quantifiers find their first and second argument internally in the NP, often adverbial A-quantifiers find their first argument in the verb, and the second one in the whole VP. The verb, "modified by an adverbial, specifying a quality of the event or the way in which the action is performed" (de Swart, 1993: 172); regarding the second argument, i.e. the VP, de Swart explains that a relation can be established "between the denotation of the verb and a subset of it, given by the modified VP. We may quantify over the relation denoted by the verb and vary over its arguments, or the other way round, etc." (de Swart, 1993: 174). Hence, in an example like *John always visits his mother*, *always* would be the quantifier, its restriction would be the verb *visits* and it will take scope over the event *e* of *John* visiting his mother, or over the times John visits his mother. And the event of the individual *John* visiting his mother when quantified by an adverbial like *always* would include all those subevents of the individual times that John visited his mother which accumulate into the main event of John **always** visiting his mother.

A-quantifiers do not include only A(dverbial)-quantifiers. Bach et al., (1995) offer a wide list of A-quantifiers that includes Affixes, Auxiliaries and Argument-structure adjusters. A-quantifiers in the form of Affixes function at the morphological level. Such a form of A-quantification exposes a more complex form of semantic information carried by morpho-syntactic elements at the level of NP or VP (cf. Bach et al., 1995). A(ffix)-quantifiers are often seen as the morphological alternatives to A(dverbial)-quantifiers as they often appear as nominal or verbal affixes that perform in the nominal or verbal domain respectively.

Some natural languages rich in A(ffix)-quantification are Mayali, Asurini Do Trocara and several Slavic languages. Mayali possesses certain verbal affixes that function as A-quantifiers. It has been argued by Evans (1995) that Mayali verbal affixes with quantificational interpretation take scope over the subject or subset of subjects; examples of such affixes are "*djarrk*- `all, altogether` which universally quantifies over semantic agents" (Evans, 1995: 217), "*bebbeh*-, a marker of distributive share, whose commonest reading is to distribute over all members of the agent set…" (ibid), and "*wernh*- and *who*- [which are concerned with the effectiveness and] in some cases the best translation is with an adverb like `properly` or `half-heartedly`, but in other cases the scope is over a NP" (ibid). Mayali A-quantifiers like *mirnde*-, *djangged*-, and *gaberrk*- mean `many`, and provide spatial information about their referents, taking absolutive scope over the

[15] We make a brief reference to A-quantifiers in the form of Adverbial and Affixes, since other forms of A-quantifiers such as Auxiliaries and Argument-structure Adjusters do not relate to the issues discussed in the thesis.

subjects of intransitive verbs, and the objects of transitives. Evans believes that often many of Mayali A-quantifiers also have a corresponding D-quantifier.

Vieria (1995) mentions Asurini Do Trocará and certain cases of affixes that convey quantificational meanings; such are the nominal collective suffix *–toa*, which gives the equivalent of `all` and "whose use is narrowly restricted to kinship terms and to words referring to humans, such as `girl`, `boy`, etc." (Vieira, 1995: 715). Other examples she mentions are "the augmentative suffix *–oho* (`big`)" (ibid) which conveys the idea of `many/much` and can be suffixed to nouns and verbs; when attached to a noun it has scope over the noun; when attached to a verb it takes scope over the verb itself or over any argument of the verb. The following are a collection of examples of A(ffix)-quantifiers from Mayali, Asurini Do Trocará, Czech and Russian:

(10) Mayali (Evans, 1995: 218, ex. 43)

a. *Garri -**djarrk** -dulubom duruk*
we.plu-**together**-shootPP dog
`We all shot the dog(s)`
(Evans, 1995: 221, ex. 53)

b. *Gunj barri-**bebbe**-yame-ng*
kangaroo **3aP-DISTR**-spear-PP
`They each killed a kangaroo`

(11) Asurini Do Trocara (Vieira, 1995: 715, ex. 52, 53, 54, 55)

a. *kosoe-**toa** o-seʔenan*
woman-colective 3ag.-sing
`All the women sang`

b. *h-ẹys-**oho**-a sekwehe h-aro pane*
3poss.-family-many-nom 3pt.-wait-dep. in vain
`Many (of) his relatives, they waited (for) him, in vain`

c. *o-pam-tar-**oho** rimo ipira ore-rewiri*
3pt.-finish-fut-many modal fish lexcl-behind
`Many fishes will die behind us`

d. *Soowia o-saaʔa-**oho***
Soowia 3ag.-cry-much
`Soowia cried much`

(12) Czech (Filip, 2005b: 129, ex. 5b)

***Na**.dělalᵖ chyby*
ACM.do.PAST mistake.PL.ACC
`He made a lot of mistakes`

(13) Russian (Filip, 2005a: 244, ex. 16a)

Na daču *po-**NA**-exalop* *p'janyx*
on weekend-cottage DIST-**CM**-go.PAST.3SG.NEUT drunk.PL.GEN
gostej
guest.PL.GEN
`There were many/ a lot of drunk guests who gradually arrived at the dacha`.

Our example of prefix quantifier in Czech mentioned by Filip (2005b) shows the accumulative *na-* in Slavic languages is "compatible with any expression of quantity or measure that `matches` its meaning of a relatively large measure or quantity: e.g., in Czech, weak adverbial quantifiers like *mnoho* `a lot of`, *hodne* `a lot of`, nominal quantifiers like *hromada* (fem. Sg. Nom) `a pile of, a heap of`" (Filip, 2005: 138); "*na-* [is also] being treated as an intersective modifier of nominal meanings (that is, a predicate of the intersection of sets). In this respect, the accumulative *na-*, and other verb-internal operators with uses that fall under lexical A-quantification in Slavic languages, behaves like weak indefinite quantifiers, such as *a lot (of)*, *some*, *several*, *five*, *many* (in its cardinal reading)" (Filip, 2005b: 139). Filip (2005a) describes the Russian variation of *na-* as a cumulative prefix while the distributive prefix *po-* "distributes the property expressed by the verb root (i.e., the property of going or arriving) to separate (subgroups of) individuals and to separate running times" (Filip, 2005a: 244, footnote 15).

Filip (2005a) also discusses a possible tripartite structure of Slavic verbal prefixes and notes that these prefixes are "operators that require a restrictor clause in the DRT-type tripartite structure, which is `filled in` by information from the context, and include tense, modality, genericity and crucially perfective and imperative operators, which correspond to the categories of the grammatical aspect" (Filip, 2005a: 270). What we are concerned with is not Filip's compositional analysis of Slavic verbal prefixes but the fact that such A-quantifiers also have a tripartite structure which allows them to be analyzed as quantifiactional operators similar to D-quantifiers and A(dverbial)-quantifiers. After all, it is such tripartite structures of quantificational sentences that allow us to represent them in a compositional way and make the relation between syntax and semantics more apparent. The focus of the following section 1.3 will be on alternatives ways of expressing Quantification, their interpretation and categorial patterns common in a variety of natural languages.

2.3 Quantificational expression from a cross-linguistic perspective

According to Cushing (1981) even though quantifiers are a semantic category, they still occupy a syntactic category which differs from language to language; for this reason there is the possibility of having quantifiers in the position of articles (e.g. English *all*, *every*, *some*, *many* and *no*, or Swedish *varju* `every`, *(de) flesta* `most` and *ingen* `no`), of pronouns (e.g. English *somebody, anybody, someone* and *anyone*, Portuguese *algun* `someone` (cf. Haspelmath (1997)), and M. Greek *kapios-a-o* `someone` (cf. Holton, Mackridge and Philippaki-Warburton (1997)), in adverbial position (e.g. English *always*, *often* and *usually* or French *toujours* and *souvent* (cf. de Swart (1993)) but also in morphological constructions in the form of affixes (e.g. Mayali *djarrk-* `all acting together (at the same place and time`), Eskimo *–tigut* `-most` or Asurini Do Trocara *–toa* `-all`) (cf. Bach et al., (1995)). The possibility of classifying quantifiers into D- and A-quantifiers has already been discussed. Such a classification reflects the syntactic structure of quantifiers. However, quantificational expressions could also be classified in terms of their semantics. Research has shown that quantifiers appear in a variety of syntactic positions as discussed

in 2.2, which receive a unified semantic analysis and interpretation. The various syntactic manifestations of quantifiers ranging from determiners, adverbs and affixes to temporal prepositions (cf. Pratt and Francez (2001))[16] and their similar quantificational interpretation in various natural languages give evidence to the universality of Quantification and the syntactic devices used for the expression of such a semantic notion. This is the focus of the next subsections.

2.3.1 Morpho-syntactic alternatives and cross categorial patterns

English is one of the natural languages that manifest Quantification in the form of all three categories, i.e. determiners, adverbs and affixes. Primarily English is viewed as a natural language rich in D-quantifiers; however, A-quantifiers in the form of adverbials also occur in English (e.g. *always*, *usually*, *often*, etc.). During our investigation we also came across cases of English elements that could relate semantically to quantifiers but appear in adjectival position; such elements grammaticalize into adverbs, affixes and compound formations of the same interpretation. It is understood that such grammaticalized extensions are common to most adjectival modifiers. It appears that their grammaticalizations[17] are the result of the initial appearance of such elements in adjectival position.

English *all* occurs with full NPs as in *all the men*, *all my books*, *all that work* "as well as with common noun phrases, and also with expressions of a variety of other categories as in *all wet*, *all gone*, *all up*, *all over the country*, *all along the road*, *all clear*, *all night*, etc." (Partee, 1995: 583). Such a variety of positions could be "suggesting that *all* is not so much acting as a determiner as it is adding an `exhaustiveness` meaning to what is otherwise still the meaning of a bare plural" (ibid). Besides the positions of `all` there are other possibilities, such as the appearance of *all* in a partitive like *John talks to* ***all of us*** referring to a group as a `whole`. *All* also occurs as an adverbial in *I've seen it* ***all*** meaning `everything` and in *my car is* ***all*** *damaged* meaning *entirely* or *completely damaged*.

During this investigation into additional mechanisms of Quantification and their interpretation we came across compound formations with *all* as in *all-around*, *all-clear*, *all-inclusive*, *all-important*, *all-powerful* and *know-all* and words like ***alright*** and ***always***. Could this be the combination of *all* and the word *right* or *ways* combined to mean `everything is right` or `all the time` respectively? And how would we interpret such occurrences of *all*? Is *all* in such occurrences quantificational? And if it isn't, then what is the function of *all* in *alright* and *always*?

It is common knowledge that *all* relates semantically to *whole* and *whole* in its turn relates to `pure`, `full`, `total` and `complete` (cf. Haspelmath (1995)). *Whole* also appears in an affix constructions as in ***wholefoods*** meaning `pure` or *a* ***wholehearted*** *support* referring to a support that involves one's *whole heart* or *total devotion*, or in compounds like ***whole-life*** *insurance* and ***whole-tone*** *scale* referring to a life insurance policy and a musical scale consisting entirely of intervals of a tone, respectively. It also appears as adverbial *wholly* meaning `completely`, `entirely`, `fully` or `totally` as in the following examples borrowed from the Oxford Advanced Learner's Dictionary (2003: 1478): *a* ***wholly*** *inappropriate behaviour*; *the government is not* ***wholly*** *to blame for the recession*; *the company is a*

[16] Pratt and Francez (2001) discuss the function of temporal prepositions as temporal generalized quantifiers (tGQs) and explain how English temporal prepositions like *during* can "restrict domains of quantification arising elsewhere in a sentence" (Pratt and Francez, 2001: 187 (abstract)). Their discussion includes examples like *Mary kissed John* ***during*** *every meeting*.

[17] Grammaticalization is the process words undergo that gives rise to new grammatical categories (cf. Kiparsky (2008)).