
Quantificational aspects of LF

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Contents

1	Introduction	8
2	Definite and superlative determiners	12
2.1	A cross-linguistic perspective	12
2.1.1	What's a determiner?	13
2.1.2	What's a definite determiner?	21
2.1.3	What is a superlative determiner?	24
2.1.4	Focus	28
2.1.5	The readings of superlative determiners	35
2.2	The truth conditions	41
2.2.1	Formal language L^*	42
2.2.2	Definite determiner	46
2.2.3	Majority superlative determiners	47
2.2.4	Plurality superlative determiner	50
2.2.5	Comparison of the representations	52
2.3	The cross-linguistic prediction	53
2.3.1	The data	55
2.3.2	The discussion	70
2.4	The Slovenian corpus data	71
2.5	Conclusion	73
3	Syntax and semantics	74
3.1	Standard minimalism	75
3.1.1	The substantive minimalism	75
3.1.2	The architecture	78
3.1.3	X-bar theory	80
3.1.4	The cartography of syntactic expressions	82
3.2	Semantic Form	86
3.3	The modularity of the language faculty	91
3.3.1	Standard Minimalism	93
3.3.2	Nanosyntax	98

3.4	Conclusion	101
4	L* theory	102
4.1	Formal language L*	103
4.1.1	The definition	104
4.1.2	Directional Entailingness	114
4.1.3	Negative Polarity Items	125
4.2	Basic aspects of LF–L* correspondence	131
4.2.1	The preservation of hierarchical structure	131
4.2.2	Conservativity and restricted quantification	135
4.2.3	The basic correspondence principles	140
4.3	Atomic formulas	142
4.3.1	Variables	143
4.3.2	X-bar theory without specifiers	147
4.3.3	Predication in X-bar theory without specifiers	149
4.3.4	Predication using standard X-bar theory	154
4.4	Quantification	155
4.4.1	The scope of quantifiers	156
4.4.2	Type of quantification and negation	160
4.5	Integration of atomic formulas	164
4.5.1	Conceptual variables	165
4.5.2	Focus in L* theory	168
4.5.3	Head predicates and implicit quantifiers	176
4.5.4	Elliptic structures	182
4.5.5	The numerical spine	184
4.6	Conclusion	191
5	Quantificational structures in L* theory	192
5.1	The definiteness pattern	193
5.1.1	The definite determiner	193
5.1.2	The majority reading of a superlative determiner	197
5.2	Numerical spine in verbal extended projection	201
5.2.1	Gradable adjectives in L*	201
5.2.2	Copular sentences	203
5.2.3	Universal determiners	205
5.2.4	Conclusion	211
5.3	The plurality reading of a superlative determiner	211
5.3.1	Superlative determiner <i>največ</i> as an adverb	212
5.3.2	<i>Največ</i> as a determiner	214
5.3.3	Non-superlative reading of <i>največ</i>	216
5.3.4	On the cross-linguistic prediction	217

CONTENTS

5.4	Superlative adjectives	218
5.4.1	The absolute reading	218
5.4.2	The relative reading	222
5.4.3	The non-superlative reading	226
5.5	Comparatives	226
5.5.1	Comparative determiners	228
5.5.2	Comparative adverbs and adjectives	230
5.5.3	A comparison to other approaches	233
5.5.4	Comparative structures with <i>od</i>	239
5.6	Negative gradable adjectives	241
5.7	Sentential negation	247
5.7.1	Semantic decomposition of NegP	248
5.7.2	Negative concord and double negation	249
5.8	Conclusion	250
6	Further research	252
6.1	Generalization of the cross-linguistic prediction	253
6.1.1	Adjectival definite determiner	253
6.1.2	Parallel generalizations	254
6.2	Positive features having disjointness as head predicate	255
6.2.1	Topicalization	255
6.2.2	Coordination	257
6.3	Binary features	258
6.4	On realization of focus: word order and prosody	259
6.5	Other hints for further research	263
6.5.1	Grammatical number	263
6.5.2	Donkey anaphora	265
6.5.3	Binding theory	265
6.5.4	Superlative and comparative determiners, and cardinals	266
6.5.5	Mass nouns	266
7	Conclusion	267
A	Correspondence principles	271
	References	273

Foreword to the English translation

This was meant to be a quick and dirty translation of my doctoral thesis. It turned out, however, to be a slow, but still dirty translation. Although you will no doubt notice that, despite writing about definite determiners, I don't really know how to use English definite article, I hope that the translation is still useful in conveying some of my ideas about the syntax–semantics interface.

Since the translation process took, on and off, more than a year, even I consider some parts of the thesis outdated, not clear enough or simply wrong. I have added some extra footnotes (marked with a star) to signal these parts and/or add some extra thoughts.

I'm looking forward to any comments, which should be sent to `saso.zivanovic@guest.arnes.si`.

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Abstract

The dissertation is an attempt at unifying syntax and formal semantics. In the Minimalist Program two levels of representation are postulated: logical form (LF) and phonological form (PF). Semantic theories postulate the existence of an additional representational system, call it semantic form (SF). Adopting the view that mind is a modular system, it is argued in the dissertation that LF and SF should be identical.

It is well known that the meanings of some natural language constructions are inexpressible in ordinary predicate logic (PLO). Specifically, PLO is insufficient for representing the meaning of English superlative determiner (SD) *most*. Logical language L^* , developed in the dissertation, is an extension of PLO that overcomes this problem. Furthermore, it allows for formal characterization of directional entailingness environments, and the notion of conservativity known from the theory of generalized quantifiers.

Empirically, the adequacy of language L^* is argued for based on an original cross-linguistic prediction stemming from the analysis of the English definite determiner (DD) *the*, English SD *most* and Slovenian SD *največ*. The prediction claims that a language having an English-like SD also has a DD.

The possibility of having identical LF and SF is demonstrated by constructing an isomorphism between the two representational levels. Roughly, its main features are the following. Variables of L^* correspond to sequences of functional projections in head–complement relation. Predicates of L^* correspond to (conceptual and) formal features of LF. Feature projection in LF is predication in L^* . There are no explicit quantifiers in LF/ L^* : the scope of quantifiers is predictable from the occurrences of variables.

In the dissertation syntactic/semantic analysis of a wide range of constructions is given, the emphasis being on superlative and comparative constructions, and focus. A unified analysis of these constructions is provided. Importantly, negative gradable adjectives receive a completely non-stipulative account.

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The thesis surely woudn't be as it is, if my schizophrenic person didn't have its phonological half. This half was heavily influenced by Friedrich Neubarth, John Rennison, Jonathan Kaye, Markus Pochträger, Peter Szigetvári and Tobias Scheer.

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While I was sitting in front of my computer, the thing that kept my mind relatively sane was the group effort of all open source authors—for someone writing a thesis it is especially important that *L^AT_EX* *et al.* stop him from wasting his time cursing over windings.

During the short breaks, it was Srečko and Herman who kept me sane. They required enormous quantities of green stuff. Herman was constantly bugged by his Norwegian friend Bratso, but he liked it.

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Chapter 1

Introduction

This dissertation is an attempt to unify syntax and formal semantics in the framework of generative grammar. The Minimalist Program assumes the existence of two levels of representations, called interface levels: Logical Form (LF) provides the syntactic structure of a linguistic expression, Phonetic (Phonological) Form (PF) its phonological structure. The theories of formal semantics, including the generative theories, introduce a third, semantic level of representation I shall call Semantic Form (SF). I claim that LF and SF should be one and the same.

The conceptual argument for the claim is cognitive in nature. Cognitive sciences claim that the mind is build modularly. Specifically, the language faculty (FL) is modular. Investigation of the features used for building linguistic representations will show that these are build by two modules, the phonological module (Phon) and *syntactic–morphological–semantic* module (SMS).

Traditionally, the research on the SMS module is divided among the linguistic fields of syntax, morphology and semantics. Each of these is a wide and interesting research field by itself, and each has yielded a number of descriptions, generalizations and explanations. It is old news, however, that these linguistic disciplines are not independent and that syntactic, morphological and semantic aspects of linguistic analysis have much in common.

Baker's mirror generalization started to spread the now relatively well-established belief that syntax and morphology are not only dependent systems, but actually a single system. Traditional fields of syntax and morphology are thus describing the same system, but from different angles.

On the other hand, very few linguists believe that syntax and semantics form a single system. This of course doesn't mean that it is thought that syntax and semantics are independent. Semanticists try to make semantic

structures compatible with syntactic structures; syntacticians pay attention to the meaning and use of linguistic expressions. However, there is—to the best of my knowledge—no theory of formal semantics on the market, that would not assume the existence of the semantic structure as a representational level different from the syntactic structure; vice versa, no syntactic theory explicates all aspects of the formal meaning of linguistic expressions—a separate semantic theory is always needed.

The hypothesis that the language faculty is a modular system disallows viewing syntax and semantics as two separate systems. First, syntax and semantics use the same set of features, at least partly. Second, some formal-semantic properties of linguistic expressions influence the syntax. It follows by the definition of a module that syntax and semantics are describing the same module.

In the dissertation I claim that LF and SF should be the same. The argument is mainly constructive: I extend the first-order predicate logic (PLO) to a logical language I call L^* , and show that if expressions of SF are generated in L^* , SF is isomorphic to LF. (I call the developed theory the L^* theory.)

The first version of L^* was developed by Law and Ludlow [1985]. Ludlow's belief that L^* is a suitable language for SF stemmed from his doubt that the set theory employed by the theory of generalized quantifiers (GQ) can be part of human biological endowment, and his discovery that (unlike PLO) L^* has enough expressive power to be the language of SF. Furthermore, in L^* it was possible to provide a syntactic (i.e. formal) characterization of environments allowing directional entailing and NPI licensing environments.

My own belief in L^* arose when I found out that by using L^* one can provide a syntactic characterization of conservativity, a notion known from GQ: L^* formulas built using no unrestricted quantifiers denote precisely conservative functions.

These properties of L^* form an important argument in favor of the hypothesis that L^* is a language of SF. However, the best support for a hypothesis can be provided only by the validity of the novel predictions it makes.

Comparison of SFs for English definite determiner (DD) *the* and superlative determiner (SD) *most* in language L^* reveals a remarkable similarity of their structures. Roughly speaking, SF for *the* is a substructure of SF for *most*. Since L^* is meant to be a language of SF universally, SFs for determiners corresponding to English *the* and *most* must be in substructure relation in any language. Adopting a natural assumption that the existence of some (complex) structure implies the existence of its substructure (which is simpler), the cross-linguistic prediction is derived to the effect that any language

having a *most*-like SD must have a (*the*-like) DD.

As far as I know, the prediction is novel, therefore my belief in the validity of hypothesis that L^* is the language of SF grew with every language I had checked. So far, I have checked the prediction against twenty languages, without finding a convincing counterexample.

Slavic languages form an important subset of investigated languages, because they show that the prediction is independent of genealogy. The only Slavic languages having a DD are Macedonian and Bulgarian. These are thus the only Slavic languages predicted to be able to have an *most*-like SD. The investigated languages confirm the prediction: Macedonian has a *most*-like SD, other Slavic languages I've checked (Czech, Polish, Slovenian and Serbian) do not.

The bulk of the L^* theory consists of the mapping that transforms LF representations to L^* formulas. Since we assume that syntax and semantics belong to the same module, the mapping must be an isomorphism: it preserves information; LF and L^* representations are merely a different transcription of the same information.

Virtually all modern semantic theories testify that it is not possible to pick an arbitrary syntactic and semantic theory and construct an isomorphism between the syntactic and semantic structure postulated by the theories. Therefore the decision to use L^* as a language of SF constrains the choice of syntactic theory—both the content of syntactic representation and their mode of composition.

Syntactic representations in the former varieties of generative syntax were not sufficiently articulated to be isomorphic to semantic representations. Presently, the flourishing of the cartography of syntactic structures makes the situation very different. Syntactic representations are getting more and more detailed and can make an increasing number of meaning distinctions, thereby beginning to make possible the construction of the LF–SF isomorphism.

The mode of composition of syntactic structures is constrained by the X-bar theory. The choice of having L^* as a language of SF therefore constrains the choice of the X-bar theory: in the dissertation I argue against standard minimalist X-bar theory and adopt the X-bar theory of Starke [2004], which I call the X-bar theory with complex heads. The L^* theory even allows us to derive many aspects of this X-bar theory from independently motivated assumptions about SF.

I tried to construct the L^* theory as deductively as possible. The basic assumptions are (i) that L^* is a language of SF and (ii) that LF and SF are isomorphic. By comparing independently motivated LFs and SFs of cer-

tain linguistic expressions (indefinite determiners, (some aspects of) universal determiners, theta theory, cardinal numerals and focus) correspondence principles of the isomorphism are postulated.

L* theory is then applied to the following: gradable adjectives; small clauses; universal determiners; definite determiners; superlative and comparative determiners, adjectives and adverbs; negative gradable adjectives; sentential negation. I conclude that LF and SF of these constructions are isomorphic as predicted by the L* theory.

The dissertation is organized as follows. Chapter 2 derives and verifies the above-mentioned cross-linguistic prediction, which forms an empirical motivation for using L* as a language of SF. Chapter 3 introduces the conceptual motivation for assuming that LF and SF are isomorphic. The L* theory is constructed in chapter 4 and applied to independent data in chapter 5. Chapter 6 some ideas for further research are given. Chapter 7 concludes the dissertation.

Chapter 2

Definite and superlative determiners

In this chapter we motivate the adoption of L^* as the language of SF. (The L^* language will be informally introduced in §2.2.1; the formal definition will be given in §4.1.1.) The nature of the motivation is empirical: using the semantic analysis of DDs and SDs in L^* , we will make a cross-linguistic prediction correlating the existence of DDs to the existence of a certain class of SDs, which we will call majority SDs (MSDs). The data presented in §2.3 will confirm the prediction, thereby indirectly confirming the hypothesis that L^* is the language of SF.

§2.1 defines the subject of our investigation, definite determiners (DDs) and superlative determiners (SDs), and illustrates different readings of SDs. In §2.2 we will formalize the truth conditions of DDs and SDs using logical language L^* , and compare the resulting formulas. In §2.3 we will formulate the above-mentioned cross-linguistic prediction and test it on eighteen languages (excluding Slovenian and English, which the prediction is based on). §2.5 concludes the chapter.

2.1 A cross-linguistic perspective

Before we begin to formalize the truth conditions of DDs and SDs, the meaning of these terms should be clarified (also the meaning of the term focus). This is not an easy task at all. Universally valid definitions of linguistic terms belonging to any traditional linguistic field are slippery, both cross-linguistically and within a single language. Determinerhood, definiteness, superlativity and focus—the terms we need in the present chapter—are no exception.

In this section pretheoretical, working definitions of these terms (i.e. the guidelines used in the fieldwork upon which §2.3 is based) will be given. Note that I believe that we shouldn't let the working definitions cement the subject of our investigation. As linguists, we have intuitions on what empirical phenomena allow or even require a unitary analysis. Working definitions should only help sharpen our linguistic intuition by making it explicit.

I think the way Rooth [1996: 296] concludes the section on focus is illustrative.

Does it follow that we should drop any broad notion of focus from our theoretical vocabulary, replacing a discussion of the semantics of focus with e.g. “the semantics of the prominence feature in English” and “the semantics of such-and-such movement in Hungarian”? In the medium term, I think this might be a good idea. The right kind of question to ask at this point is not “is construction X in language Y a focusing construction”, but rather “what is the semantics of X in Y, and how does this explain the properties of X in Y”. In pursuing the second question, it is a handy research strategy to check whether the analogues of English prominence-feature-sensitive constructions are X-sensitive in language Y. This does not mean that we are using these constructions as diagnostics for an abstract formative with a universal semantics.

In a nutshell, we shouldn't allow the pretheoretical definition to hinder our research. In words of Popper [1998: 8]: »[...] ne obstaja logična metoda za pridobivanje novih idej, ali logična rekonstrukcija tega procesa. [...] vsako odkritje vsebuje “iracionalni element” ali “kreativno intuicijo” [...] «

In §2.1.1 the pretheoretical definition of determinerhood is given. §2.1.2 deals with definiteness, §2.1.3 with superlativity and §2.1.4 with focus. §2.1.5 introduces two readings of SDs: the majority and the plurality reading (the latter is intimately associated to focus).

2.1.1 What's a determiner?

In this dissertation the term determiner is used in a wide sense, since I want it to encompass all lexical items whose formal meaning helps determine the reference of noun phrases, regardless of the morphological realization of these lexical items.

A *noun phrase* (NP)¹ by itself does not determine the reference. In order to determine the reference, NP must be merged with a determiner (D) into

¹In this thesis the term *noun phrase* (NP) shall be used to refer to a phrase containing

a *determiner phrase* (DP). I shall use the term *nominal expression* when the difference between an NP and a DP will be irrelevant. In generative grammar, an NP is a *complement* of a determiner, which is the head of the phrase: $[_{DP} D NP]$.

Pretheoretically, English determiners are words like cardinal numerals (*three, five*), universal determiners *each, every* and *all*, vague numerals (*many, few*), indefinite determiners (*a, some*), superlative determiner (*most*), comparative determiner (*more*) (usually as part of a *more than* construction), and perhaps also possessive adjectives (*John's, brother's*), possessive pronouns (*my, your*) and ordinal numerals (*first, fifth*). [cf. Keenan and Stavi 1986]

In order to gain a preliminary insight of the relevant data, the linguistic intuition used to recognize a potential determiner is more important than the strict definition of the term. Therefore the definition that will be provided in this section is only an working definition.

Before the universal criteria of determinerhood used in the thesis are given, some false criteria shall be discussed: properties, determiners have only in some languages, or even only in some constructions in a single language. These criteria can be grouped into semantic (conservativity), syntactic (adjacency) and morphological (the case of the complement, inflectional properties).

Conservativity. On some views, *conservativity* is the defining property of determiners. *Five* is conservative since, in order to determine the truth value of (1) in a given context, it is only necessary to consider what the boys are doing—it is unnecessary to consider teachers or parents. (The formal definition of conservativity will be given in §4.2.2.)

- (1) Five boys went playing football.

By the criterion of conservativity, *only* is not a determiner. In order to see if (2) is true in a given context, it doesn't suffice to consider what the boys are doing. What other individuals are doing is also important: the sentence can only be true if they are not playing football.

- (2) Only boys are playing football.

both noun and its modifiers, e.g. adjectives and relative clauses. (This corresponds to Kind Determiner Phrase (KIP) of Zamparelli [2000].) Strictly speaking, NP is a projection of head N and thus does not contain adjectives. However, since adjectival modification is not directly relevant for the discussion in the thesis (except in the case of comparatives and superlatives), the internal structure of a noun phrase can be safely ignored. When the difference between the two senses of the term NP is important for the discussion, this will be explicitly mentioned.

Only differs from typical determiners like *every* in its syntax, as well. *Only* can be adjoined to virtually anything: that’s why Herburger [2000] half-jokingly calls it “admanythings”. (Examples from Herburger [2000: 86–87].)

- (3) a. Albert only grows VEGETABLES.
 b. [Only A FEW camellia shrubs] survive winters in this city.
 c. Šli smo samo v kino. [Only after MAY 1st] can you safely plant anything in this area.
 č. [Only WHEN IT RAINED FOR THREE WEEKS] did the shiitake finally grow.

Nevertheless, I wish to assume a definition of determinerhood that is wide enough to encompass *only*. It will become clear that a too narrow definition could hide important empirical generalizations. Specifically, in Slovenian the superlative determiner *največ* ‘most’ behaves similarly to *samo* ‘only’. (i) It can function as an adverb, (4). (ii) If its complement is focused it is not conservative—the truth value of (5) also depends on how many elephants, giraffes and lions I’ve seen at the zoo. (For the definition of focus see §2.1.4.)

- (4) a. Moj cimer samo BERE.
 my roommate only READS
 ‘My roommate reads does nothing but reads.’
 b. Moj cimer največ BERE.
 my roommate mostly READS
 ‘What my roommate does the most is reading.’
- (5) V torek sem v živalskem vrtu videl največ OPIC.
 in Tuesday am in zoo see most MONKEYS
 ‘On Tuesdays, the most animals I’ve seen at the zoo were monkeys.’

If our definition of a determiner does not include *samo* ‘only’, *največ* ‘most’ is probably also excluded. Consequently, the semantic and formal similarity of Slovenian *največ* and English *most* remains unnoticed, although a substantial part of this thesis is based on this similarity.

Adjacency. A determiner and its complement (NP) are usually adjacent at the surface, cf. *pet prijateljev* ‘five friends’ in (6). (7) shows that this is not always the case.

- (6) Na počitnice je šlo pet prijateljev.
 on holiday is went five friends-GEN
 ‘Five friends went on holiday.’

- (7) a. Na počitnice jih je šlo pet.
on holiday they-GEN is went five
‘The five of them went on holiday.’
- b. Pet jih je šlo na počitnice.
five they-GEN is went on holiday
‘The five of them went on holiday.’

When the complement of cardinal numeral (*pet* ‘five’) is a clitic form of the personal pronoun, the numeral and its complement are not adjacent (7a), or sometimes adjacent by accident (7b).² The case of the NP proves that the relation between the numeral *five* and the pronoun *jih* in (7a) is the same as the relation between (6): both the pronoun *jih* and NP *prijatelj* are genitive, which is the default case of complements in the DP in Slovenian. (The genitive case on *jih* cannot be a genitive of negation, since the sentence is positive.)

The case of the complement. The case of the NP also cannot be a criterion of determinerhood. Some determiners in Slovenian, e.g. *štiri* ‘four’ in (8), do not require their complement to bear a specific case—the case of NP is determined DP-externally. On the other hand, in Slovenian all numerals ending in 0 or a number from 5 to 9 require a genitive complement whenever the whole DP is nominative or accusative (the so-called four-case agreement pattern [Toporišič 2000:333]), as exemplified by (9). Let us call the numerals triggering the four-case agreement pattern *nominal*; the others are *adjectival*. Since the semantic contribution of both kinds of numerals is the same, we do not wish to claim *a priori* that only numerals of one of both kinds are determiners.

- (8) a. Štiri študente je snov zelo zanimala.
four-ACC students-ACC is subject matter very interested
‘Four students were very interested with the subject.’
- b. Štirim študentom ni uspelo priti na predavanje.
four-DAT students-DAT not succeeded come on lecture
‘Four students didn’t make it to the lecture.’

²Adjacency of the numeral *pet* and the pronoun *jih* in (7b) is a result of conspiracy: (i) the D(P) is in sentence-initial position because of the requirements imposed by the information structure; (ii) the clitic cluster always appears in sentence-second (so-called Wackernagel) position; (iii) the linear order of clitics in the cluster is predetermined: *jih* must precede *je*; and (iv) only two clitics, *jih* and *je* appear in (7b).

- (9) a. Pet študentov je snov zelo zanimala.
five-ACC students-GEN is subject matter very interested
'Five students were very interested with the subject.'
- b. Petim študentom ni uspelo priti na predavanje.
five-DAT students-DAT not succeeded come on lecture
'Five students didn't make it to the lecture.'

Inflectional properties. Taking the inflectional properties to be a criterion of determinerhood is problematic as well. In English determiners do not inflect, whereas many Slovenian determiners do. *Vsak* *each/every*, *vsi* (*all* and all cardinal numerals inflect; *samo* 'only', *veliko* 'many', *malo* 'few', *najmanj* *least*, etc. do not.) It probably doesn't follow that the semantic properties of English and Slovenian determiners are radically different. If that were the case, we would expect to find differences language internally (between inflecting and non-inflecting determiners in Slovenian) as well, which does not seem to be the case. Furthermore, in Slovenian some determiners are inflected by some speakers but not the others, e.g. *primveč* 'more' and *največ* 'most' (the prescriptive grammar discourages using the inflected forms), with no difference in meaning.

I reject the above-mentioned criteria (conservativity, adjacency, the case of the complement and inflectional properties) as being too narrow. The criteria that will be used in the thesis are the following: determiners should (i) select for an NP, and (ii) have formal meaning.

NP-complement. Determiners take NP complements. A lexical item qualifies as a determiner even if the determiner and its complement are not adjacent on the surface (as a result of other syntactic processes, which must be independently motivated in the theory). Furthermore, lexical items which do not take an NP complement *obligatorily* shall still be considered determiners. (For example, *samo* 'only' and *največ* 'most' can be used adverbially.)

Formal meaning. Determiners have formal, but no substantive meaning. In §3.2, the difference between the two will be discussed in detail.

Every meaning is either substantive or formal: substantive meanings are studied by lexical semantics, formal meanings by syntax and/or formal semantics. The formal meaning of determiners is usually logical: the determiners contribute to quantificational aspects nominal phrases. (When determiners are used adverbially, they contribute to quantificational aspects of whole sentences.) Substantive meaning is mostly carried by words belonging to open, lexical categories: nouns (*(guinea) pig, umbrella, love*), adjectives

(*red, big, careful*), verbs (*cook, run, snow*), and also adverbs (*yesterday*). At first sight, the meaning of these words is clearly different than the meaning of words like *every, a, three* etc. Borderline cases exist, however: lexical items lexicalising some aspects of the formal meaning, e.g. *definite, majority*, or *deny*. The meaning of these words is mostly substantive: the existence of adjective *določen* ‘definite’ in Slovenian does not imply that there is a morphosyntactic category of definiteness in Slovenian.

Only formal aspects of meaning are being investigated in the thesis, therefore the term determiner should not encompass lexical items with substantive meaning. For our theory to be falsifiable, borderline cases should be carefully investigated in order to determine whether they carry formal or substantive meaning. The thing to keep in mind is that (by definition) formal but not substantive meaning can influence syntax.

Furthermore, it is worth noting that although not every lexical item carries substantive meaning, all of them probably carry at least one formal feature: its category feature. In determining whether the choice of one lexical item over the other influences the syntax, one should be careful to determine the source of the difference: it is unwise to claim that (in a language with gender-agreement) a masculine noun has no substantive meaning simply because its presence as a subject requires a masculine form of the verb. . .

A reasonable starting point for determining whether a lexical item is a determiner or not, is the difference between open and closed categories. We expect the items carrying only formal meaning (functional items) to belong to closed categories. Thus we suspect the above-mentioned cases of *definite, majority* and *deny* to carry substantive meaning, since it is fairly obvious that they are an adjective, noun and verb, respectively.

In the remainder of the section I want to argue that the meaning of the Slovenian word *večina* ‘majority’ is substantive—a claim of utmost importance for the present chapter and also the whole thesis.

At first sight, *večina* is an ordinary (feminine) noun. The data presented below, however, cast a shadow of doubt upon this claim. Both the agreement pattern (10)–(12) and morphological realization of a pronominal complement (13) suggest that *večina* behaves as a numeral (*pet* ‘five’), not a noun (*lastnica* ‘owner-FEM’).

- (10) a. ? Večina stolov je
majority-F,NOM,SG chairs-GEN,PL AUX-3,SG
pokvarjena.
broken-F,NOM,SG
- b. Večina stolov je pokvarjenih.
majority-F,NOM,SG chairs-GEN,PL AUX-3,SG broken-GEN,PL

- ‘Most of the chairs are broken.’
- (11) a. Lastnica stolov je pokvarjena.
owner-F,NOM,SG chairs-GEN,PL AUX-3,SG broken-F,NOM,SG
- b. *Lastnica stolov je pokvarjenih.
owner-F,NOM,SG chairs-GEN,PL AUX-3,SG broken-GEN,PL
‘The owner of the chairs is bad.’
- (12) a. ?Pet stolov je pokvarjeno.
five-NOM,SG chairs-GEN,PL AUX-3,SG broken-N,NOM,SG
- b. Pet stolov je pokvarjenih.
five-NOM,SG chairs-GEN,PL AUX-3,SG broken-GEN,PL
- (13) a. Večina jih je pokvarjenih.
majority-F,NOM,SG they-GEN,PL AUX-3,SG broken-GEN,PL
‘Most of them are broken.’
- b. *Lastnica jih je pokvarjenih.
owner-F,NOM,SG they-GEN,PL AUX-3,SG broken-GEN,PL
- c. Pet jih je pokvarjenih.
five-NOM,SG they-GEN,PL AUX-3,SG broken-GEN,PL
‘Five of the are broken.’

However, additional data shows that these examples cannot prove that *večina* does not carry substantive meaning: *kopica* ‘pile’ and *skladišče* ‘warehouse’ (the latter’s meaning is certainly substantive) exhibit the same agreement pattern as *večina* (14)–(15), and also impose the same requirements to their complement (16).³

- (14) a. ?Kopica stolov je pokvarjena.
pile-F,NOM,SG chairs-GEN,PL AUX-3,SG broken-F,NOM,SG
- b. Kopica stolov je pokvarjenih.
pile-F,NOM,SG chairs-GEN,PL AUX-3,SG broken-GEN,PL
‘A pile of chairs is broken. (Many chairs are broken.)’
- (15) a. ?Celo skladišče stolov je pokvarjeno.
whole warehouse-N,NOM,SG chairs-GEN,PL AUX-3,SG broken-N,NOM,SG
- b. Celo skladišče stolov je pokvarjenih.
whole warehouse-N,NOM,SG chairs-GEN,PL AUX-3,SG broken-GEN,PL

³Cf. Corvet and van Riemsdijk [2002].

- (16) a. 'A warehouse of chairs is broken. (Many chairs are broken.)'
 Kopica jih je pokvarjenih.
 pile-F,NOM,SG they-GEN,PL AUX-3,SG broken-GEN,PL
 'A pile of them is broken.'
- b. Celo skladišče jih je
 whole warehouse-N,NOM,SG they-GEN,PL AUX-3,SG
 pokvarjenih.
 broken-GEN,PL
 'A warehouse of them is broken.'

This counters the objections to the claim that *večina* carries substantive meaning. An additional piece of data confirming the claim is the fact that in some constructions,⁴ unlike numerals, *večina* does not require a complement, (17)–(18).

- (17) Večina je pokvarjena.
 majority-F,NOM,SG AUX-3,SG broken-F,NOM,SG
 'The majority (of people) is bad.'
- (18) *Pet je pokvarjeno.
 five AUX-3,SG broken-N,NOM,SG

In a nutshell, determiners are lexical items having only formal meaning that take NPs as complements.⁵

2.1.2 What's a definite determiner?

A definite determiner is a determiner which contains a morpheme having the formal meaning of definiteness.

⁴In examples with a genitive subject complement *večina* and numerals behave identically.

- (i) Večina je pokvarjenih.
 majority-F,NOM,SG AUX-3,SG broken-GEN,PL
 'The majority of them is broken.'
- (ii) Pet je pokvarjenih.
 five AUX-3,SG broken-GEN,PL
 'Five of them are broken.'

⁵ It seems to me that Zamparelli [2000] has a similar view on the meaning of the term *determiner*. He divides a noun phrase into three layers: Strong Determiner Phrase (SDP), Predicative Determiner Phrase (PDP) and KInd determiner Phrase (KIP). In the terminology of this thesis, KIP corresponds to NP, while »[t]ogether, SDP and PDP constitute the 'determiner system' of a language.« [Zamparelli 2000: 18].

Ihsane and Puskás [2001: 40] define definiteness as a category which »selects one object in the class of possible objects.« Therefore one crucial aspect of definiteness is uniqueness [Russell 1905]. A necessary condition for the truth of (19) is the existence of exactly one king of England. The sentence is false both if there is no king of England and if there are two or more of them.

(19) The king of England is bald.

In literature definiteness is sometimes mistaken for specificity, which Ihsane and Puskás [2001: 40] define as a category which »relates to pre-established elements in the discourse«. Enç [1991] claims that all definite NPs are specific. However, Ihsane and Puskás [2001] argue that definiteness and specificity are independent properties.

(20) J' ai pris le train.
I have taken the train
'I took the train.'

In (20) the definite DP *le train* 'the train' can be interpreted both as specific and non-specific. In the latter case its »referent of the DP *le train* is not pre-established in the discourse. [...] the sentence describes the event of *taking the train*, the train being any, non-specified train.« [Ihsane and Puskás 2001: 40]

In Hungarian the difference between definiteness and specificity is also reflected in the word-order. While (21a) is ambiguous (the definite DP *a vonatrol* 'the train' is either specific or non-specific), the same DP in the topic position (21b), can only be interpreted as specific. [Ihsane and Puskás 2001]

(21) a. Anna lemaradt a vonatrol.
Anna down-stayed the train-from
'Anna missed the train.'

b. A vonatrol lemaradt Anna.
the train down-stayed Anna
'Anna missed the train (specific).'

Toporišič [2000: 494] claims that all »[Slovenian] nouns are definite, the indefiniteness must be specially marked.« I strongly disagree: in all languages where the existence of definiteness as a syntactic category is not disputed, it

is always definiteness that is morphologically realized [Lyons 1999].⁶ I believe that there is no morphosyntactic category of definiteness in Slovenian and that in principle in Slovenian NPs can be used either specifically (22) or non-specifically (23), regardless of the presence of the indefinite determiner *nek/neki* ‘a’.⁷

- (22) a. Fant je pritekkel, kar so ga nesle noge.
 boy is here-run, what are him carry legs
 ‘The boy has run here as fast as he could.’
 b. Pred vrati te čaka nek prijatelj.
 in front doors you wait a friend
 ‘A friend is waiting for you at the door.’
- (23) a. Čakam, da pripelje mimo taksi.
 wait, that drive by taxi
 ‘I’m waiting for taxi.’
 b. Zagotovo je nek jezikoslovec že opazil ta pojav.
 certainly is some linguist already notice this phenomenon
 ‘This phenomenon has certainly been noticed by some linguist.’

On the other hand I agree with Toporišič [2000] that (colloquial) Slovene has a definite article *ta*, which can be used with adjectives ((*ta črna krava* ‘the black cow’), also nominalized ones (*ta mlada* ‘the young one’). The article *ta* cannot be used with nouns (**ta krava* ‘the cow’),⁸ so it is not a determiner and is as such irrelevant for the discussion in this section (but see §6.1.1).⁹

I emphasize that the thesis deals only with the meaning of definiteness as a syntactic category. Specifically, I deal neither with (i) the meanings of the other categories that might be contained in a definite determiner in some language, nor with (ii) morphological realization or (iii) distribution of definite determiners.

⁶Lyons [1999] claims that the markers of indefiniteness (so-called indefinite articles) are actually *cardinal articles* and do not realize the morphosyntactic feature [-Def]. See also the discussion on Turkish in §2.3.1.

⁷It seems that Toporišič [2000] doesn’t distinguish between definiteness and specificity, since he claims that known things are marked as definite. [Toporišič 2000: 493]. Actually, he does not use the term definiteness at all. Furthermore, the property of being definite is mistakenly ascribed to nouns instead of noun phrases. [Toporišič 2000: 275–6].

⁸NP *ta krava* ‘this cow’ is grammatical only if *ta* is used as a demonstrative.

⁹For a detailed discussion on article *ta* see Marušič and Žaucer [2005].

(i) Lexical items often contain more than one morpheme.¹⁰ Thus a definite determiner of some language can contain some other morpheme as well, e.g. the specificity morpheme. The dissertation doesn't deal with the meaning of these categories.

(ii) In different languages definite determiners can have various morphological realizations: in the languages that will be investigated in this chapter, the determiner is either an independent word (i.e. definite article, e.g. English *the*) or a suffix (e.g. Macedonian *-ot/-ta/-to*). The meaning of a morpheme is (by definition) independent of its realization, so the discussion of the realization can be safely left out of the thesis.

(iii) Cross-linguistically, the distribution of definite determiners varies a lot. Let us illustrate this variability with some examples. (a) Some languages have definite agreement: in Norwegian some DPs contain two definite determiners, one an article, the other a suffix on the noun, (24) [Giusti 2002]. (b) Languages differ in requiring/allowing a definite article before proper nouns of superlative determiners: English disallows it in both cases (25), German requires it before the superlative determiner, while it is allowed before names only in colloquial German (26) [Wikipedia 2006a]. (c) Languages differ with respect of cooccurrence restrictions on the definite article and demonstratives: English disallows their cooccurrence, (27); Spanish requires the cooccurrence if demonstrative is post-nominal and disallows it if it's pre-nominal (28) [Giusti 2002].¹¹

(24) *den* store gutten
the big boy-the

(25) a. *The John is here.
b. *The most people are drinking beer.¹²

(26) a. Ich spreche mit der Claudia. (colloquial)
I talk with the Claudia
'I talk with Claudia.'
b. Die meisten Leute trinken Bier.
the most people drink beer
'Most people are drinking beer.'

¹⁰The findings of modern generative grammar make us think that a great majority of lexical items is such.

¹¹The phenomena and language differences described above are subject of intensive research [see e.g. Cinque 2002, Zamparelli 2000, Aboh 2004, Alexiadou and Wilder 1998] but will not be dealt with in a semantically oriented dissertation. I believe them to be a consequence of (i) and (ii).

¹²The sentence is acceptable in some varieties of English, however not in the intended majority reading, but in the plurality reading, see §2.3.1.

(27) * the this book

(28) a. este libro
this book

b. el libro este
the book this

c. * este el libro
this the book

č. * libro este
book this

2.1.3 What is a superlative determiner?

This section provides a working definition of a superlative determiner. The formal definition will arise from the analysis in chapter 5.

We begin by discussing what is not a superlative determiner: the intuitive translation of English *most* to a language is not necessarily a superlative determiner. The Slovenian translation of (29) contains a word *večina* ‘majority’, and native Slovenian speakers who speak English as a second language usually claim without hesitation that *večina* is a translation of English *most*. However, we have claimed in §2.1.1 that *večina* is not a determiner. It obviously follows it cannot be a superlative determiner.

(29) Most people were eating noodles with chicken.

‘Večina ljudi je jedla rezance s piščancem.’

The question how English *most* is translated into various languages can be an interesting field of research. It is not, however, a subject of this thesis. As examples in (30) on the following page show, a sentence containing *most* can be paraphrased in English itself. Although the meanings of sentences in (30) are (virtually) the same, it doesn’t follow that they have the same LFs. (Mathematical expression 4 and $2 + 2$ have the same meaning (i.e. value), but their syntactic forms differ: 4 is a number, while $2 + 2$ is a two-term addition.) This is best illustrated by (30č)–(30d), which remind us that, in principle, the same meaning can arise in an infinite number of ways.

We reach the same conclusion by comparing examples containing *most*, *majority* and *more than half*. Their formal properties differ. The most special case is *majority*, which is a noun. *most* in *more than half* also differ: while the former is morphologically simple, the latter has a richer internal structure. It belongs to the paradigm *more than X*, where X is some “fractional” expression, derived from an ordinal numeral. It follows that in the

formal representation of (30c) there is a position reserved for a fractional expression. Such a position is not required in representation of (30b). Therefore the same meanings of (30b) and (30c) arise through different means.

- (30) a. The majority of people were eating noodles with chicken.
b. Most people were eating noodles with chicken.
c. More than half of the people were eating noodles with chicken.
č. More than twice more than one quarter of the people were eating noodles with chicken.
d. More than three times more than one sixth of the people were eating noodles with chicken.

So, the thesis does not investigate the (cross-linguistic) variability of linguistic means for expression the majority meaning. It rather investigates how English *most* gets its meaning, i.e. what semantic primitives it contains. We shall assume—in the spirit of generative grammar—that these primitives are universal and therefore in principle available in any language. We shall therefore use the term superlative determiner to refer to any lexical item containing the same semantic primitives as English *most*.¹³ The given definition of a superlative determiner is obviously dependent upon the employed semantic theory. Since no semantic theory is not adopted in the thesis, because a novel one is being created, the definition is useless as an working definition. In the empirical part of the dissertation the superlatives will be determined mainly by using the following morphological criterion.

Many languages (especially indoeuropean) have adjective gradation. Some adjectives can appear in three grades, as illustrated by Slovenian examples in (31). In Slovenian the adjectives are generally graded analytically (31a) using adverbs *bolj* ‘more’ and *najbolj* ‘the most’. Some adjectives can also be graded synthetically (31b), a comparative is created from a positive using suffix *-š/-j/-ejš* (followed by a morpheme carrying ϕ features and case); prefix *naj-* ‘most’ is used to form a superlative from a comparative.¹⁴

¹³The reason that the starting point of the investigation is English is rooted in anglocentricism of current semantic theories. While there has been a lot of discussion on English *most*, not much has been written on superlative determiners in other languages. One of the aims of the thesis is to overcome the anglocentric view and deal with a wider range of data.

¹⁴I believe it cannot be predicted which adjectives are graded synthetically and which suffix is used in the process. I assume that synthetic gradation is not productive in Slovenian and that all synthetic forms are stored in the lexicon. Synthetic forms of comparatives are therefore “diachronic remains”, in view which is confirmed by Toporišič [2000: 326] who claims that synthetic gradation is »doing well only with often used adjectives.« On the other hand the formation of superlatives is predictable: if the comparative form is synthetic, prefix *naj-* attaches to this form, otherwise it is attached to the adverb *bolj*.

- (31) positive, comparative, superlative
 a. zabaven, *bolj* zabaven, *najbolj* zabaven
 b. lepa, lepša, *najlepša*

Prefix *naj-* cannot be found in the word *večina* ‘majority’. We have argued in §2.1.1 that *večina* is not a determiner. It follows from the morphological criterion introduced above that it is not a superlative either, so we can confidently claim it is not a superlative determiner.

The superlative prefix *naj-* is found in the word *največ*, which is a determiner according to criteria from 2.1.1. determiner. (i) It merges with an NP, (32). (ii) It influences the reference of a DP: (32a) is not about all guinea pigs; if guinea pigs are partitioned into groups according to the sound of which kitchen appliance they recognize, (32a) is about the largest of these groups, asserting that the guinea pigs in the largest group can recognize the sound of refrigerator. (iii) It has formal meaning only, since it belongs to no major (open) category. (iii.a) It is obviously not a verb. (iii.b) It is not a noun, since it cannot appear on its own (33). Although some speakers decline it as a adjectival numeral, *največ* is not an adjective. For example, it cannot be modified by *very*—the result of relative gradation of *največ* is much worse than the result of relative gradation of adjective of kind, cf. (34). We conclude that *največ* is a superlative determiner.

- (32) a. Največ pujsov pozna zvok hladilnika.
 most pigs know sound refrigerator
 ‘The most pigs recognize the sound of refrigerator.’
 b. Največ porednih pujsov, ki imajo radi solato, pozna zvok
 most naughty pigs who have like lettuce know sound
 hladilnika.
 refrigerator
 ‘The most of naughty pigs who like lettuce recognize the sound
 of the refrigerator.’
- (33) a. Največ pujsov imam doma.
 most pigs have home
 I keep most of the pigs at home.
 b. *Največ imam doma. (indented meaning: (33a))
 most have home
- (34) a. Zelo poredni pujsi poznajo zvok hladilnika.
 very naughty pigs know sound refrigerator
 ‘Very naughty pigs know the sound of refrigerator.’

- b. ? Zelo slovenski pujsi poznajo zvok hladilnika.
very Slovenian pigs know sound refrigerator
'Very Slovenian pigs know the sound of refrigerator.'
- c. * Zelo največ pujsov pozna zvok hladilnika.
very most pigs know sound refrigerator

Of course one should be careful when trying to figure out whether adjectives are gradable in a given language. For example, how do we distinguish positive-comparative-superlative type of gradation and relative gradation using *very* or *too*? A useful criterion seems to be the fact that while positive-comparative-superlative gradation allows for explicitly mentioning the comparison class (this is actually the norm with comparatives), (35), this is impossible with relatives (36). In the dissertation I use the term adjective gradation to refer only to positive-comparative-superlative type of gradation.

- (35) a. Mary is more beautiful than John.
b. Today Mary is more beautiful than she ever was.
c. Mary is the most beautiful girl in the world.
- (36) a. * Mary is very beautiful than John.
b. * Today Mary is very beautiful than she ever was.
c. * Mary is too beautiful than John.
č. * Today Mary is too beautiful than she ever was.

The criterion of explicit comparison class is also useful directly for determiners, (37).

Za določanje pripadnosti razredu primerniških določilnikov je kriterij eksplicitno izraženega razreda primerjave uporaben tudi neposredno, (37).

- (37) More pigs recognize the sound of a refrigerator than the sound of a typewriter.

To sum up, in languages that have gradable adjectives the class of superlative determiners (and also comparative determiners (CDs)) shall be determined based on (i) similarities to morphemes used in adjective gradation and (ii) criteria for determinerhood from §2.1.1.

In languages having no adjective gradation the first criterion is of course useless, therefore the only guidelines that can be given are (i) similarity to structures containing superlative determiners in languages that do have adjective gradation and (ii) criteria for determinerhood.

2.1.4 Focus

Focus will play an important role in the thesis. In linguistic literature, the term focus is used in a variety of ways. It is therefore important to specify how the term will be understood in the thesis.

The research on syntactic constructions signaling the organization of the discourse has a long history reaching all the way to the Prague school. I adopt the view of Kadmon [2001] and Rooth [1996], which can be traced back to Jackendoff [1972] and is relatively prominent in the literature.¹⁵ The first part of this section adapted from Kadmon [2001] and Rooth [1996]; the second part deals with realization of focus in Slovenian.

As we shall see, the focus is often a prosodically prominent part of the sentence. Prosodic prominence can be perceived (among other things) as loudness, length or higher pitch of the accented syllable. In the thesis we shall refer to prosodic prominence as stress, regardless of its actual realization. It is important to keep in mind that terms focus and stress are not synonymous. As we shall see, (i) unstressed foci exist and (ii) not every stress marks a focus. (Stressed words will be written in *italics* and focused constituents in CAPITALS.)

Pragmatic and semantic effects of focus

Focus can be illustrated using the pair of sentences in (38). They differ only by stress placement, which creates a pragmatic difference: while the usages in (39) are felicitous, the ones in (40) are not.¹⁶

- (38) a. John introduced *Frank* to Mary.
 ‘Janez je predstaval Mariji Franca.’
 b. John introduced Frank to *Mary*.
 ‘Janez je predstaval Franca Mariji.’
- (39) a. A: Who did John introduce to Mary?
 B: John introduced *Frank* to Mary.
 ‘A: Koga je Janez predstaval Mariji?
 B: Janez je Mariji predstaval Franca.’

¹⁵Kadmon [2001] believes that Jackendoff’s understanding of the term focus is different than the meaning of Bolinger’s [1972] term *information focus*. The meaning of the latter term is narrower than the meaning of the term focus adopted in the thesis.

¹⁶# marks an infelicitous use of the sentence. Examples (38)–(41) also provide Slovenian translations of the sentences and mark their felicitousness. Note that in (40c) only the English sentence is infelicitous.

- b. A: Who did John introduce Frank to?
B: John introduced Frank to *Mary*.
'A: Komu je Janez predstavil Franca?
B: Janez je Franca predstavil Mariji.'
- c. A: What did John do at the party?
B: John introduced Frank to *Mary*.
'A: Kaj je naredil Janez na zabavi?
B: Janez je na zabavi Franca predstavil Mariji.'
- (40) a. A: Who did John introduce to Mary?
B: # John introduced Frank to *Mary*.
'A: Koga je Janez predstavil Mariji?
B: # Janez je Franca predstavil Mariji.'
- b. A: Who did John introduce Frank to?
B: # John introduced *Frank* to Mary.
'A: Komu je Janez predstavil Franca?
B: # Janez je Mariji predstavil Franca.'
- c. A: What did John do at the party?
B: # He introduced *Frank* to Mary.
'A: Kaj je naredil Janez na zabavi?
B: Janez je na zabavi Mariji predstavil Franca.'

Furthermore focus is illustrated using pairs of sentences in (41). There the placement of stress is again the only phonetic difference. However, a difference in truth conditions arises: if John introduced Frank to Mary and Christina but hasn't performed any other introductions, (41a) is true, while (41b) is false. (The phenomenon where the truth conditions of a sentence containing a word such as *only* in (41) depend on the choice of focus, is called *association with focus* by Rooth [1996].

- (41) a. John only introduced *Frank* to Mary.
'Janez je predstavil Mariji samo *Franca*.'
- b. John only introduced Frank to *Mary*.
'Janez je predstavil Franca samo *Mariji*.'

We notice that there is (at least in English) a correlation between prosodic patterns and certain pragmatic and semantic effects. *Focus* is the analytic tool used to talk about this correlation. A part of a sentence is called *focus*; we also say it is focused. This part of the sentence is (i) prosodically the most prominent part of the sentence and (ii) has certain pragmatic and semantic effects.

Simplified, focus is “an answer to the question”.¹⁷ Thus the focus in (38a) is *Frank*; in (38b), the focus can be either (i) *Mary*, as in dialogue (39b), or (ii) *introduced Frank to Mary* as in dialogue (39c). In (41a) the focus is *Frank*, therefore the sentence has the “only Frank” reading; in (41b) the focus is *Mary*, therefore the sentence has the “only Mary” reading.

It is a common view that the focus refers to a certain value from *the set of alternatives*—we will also say that focusing *evokes* a set of alternatives. (The theory of focus based on this view is called the semantics of alternatives [Rooth 1996].) Each member of the set of alternatives fits a gap in the unfocused part of the sentence. In (38a) Frank is some individual chosen from the set of individuals that fits the gap in (42).¹⁸

(42) John introduced _____ to Mary.

¹⁷By using the term answer I want to refer to *truly direct answers*, i.e. statements that explicitly state the answer to the question. Other appropriate responses, like e.g. Bs responses in (i), are not considered to be truly direct answers, although they might supply the required information. The intuitions about truly direct answers can be somewhat unclear. However, the basic idea is clear: the answer is truly direct, when it tells no more and no less than the question requires. So in (ii) only the first answer is truly direct. (Italic form of *officially* signals a special intonation; an appropriate continuation of the sentence is *but noone really wants to see him there.*) [prim. Kadmon 2001: 261–3]

- (i) a. A: Who hit you?
B: I don't know.
- b. A: Was Smith officially invited?
B: Jones was officially invited.
- (ii) Was Smith officially invited?
- a. He was officially invited.
- b. Everybody was officially invited.
- c. He was officially invited three months in advance.
- č. He was *officially* invited. . .

Another problem is the fact that usually questions are not answered by full sentences. It is more natural to use short, often one-word responses. Nevertheless, I believe that the difference in acceptability of answers in (39) and (40) is clear enough to be used as a criterion for determining the focus.

¹⁸Above the set of alternatives was defined to include the value that is the actual interpretation of the focus: in (38a), the focused name (*Frank*) refers to Frank and the set of alternatives can be e.g. {Frank, John, Leo, Tony}. However, we shall define the term alternative non-reflexively: so John, Leo and Tony are alternatives to Frank, while Frank is not an alternative to himself.

Prosodic and word-order realization of focus in Slovenian

In Slovenian the correlation between prosodic and pragmatic/semantic aspects of focus seems weaker than in English. E.g., it is unclear whether some word carries stress in the Slovenian translation of the answer in (39c); furthermore, in the translations in (39a) and (39b), where only one word is focused, the stress seems to be weaker than in English.¹⁹

However, the focusing influences the word order in Slovenian. In all translations of examples in (38), (39) in (41), the focus can be found in the sentence-last position. Furthermore, (40) shows that sentence-last element must be interpreted as focus. Thus, the first hypothesis on position of focus in Slovenian is that focus appears in the sentence-last position. [cf. Stopar 2006]

Association with focus

Rooth [1996] observes that some operators²¹ are *associated with focus*, i.e. the truth conditions and/or presuppositions of a sentence containing such an operator are dependent upon the choice of focus. (Among operators that are associated with focus, we find adverbs such as *only*, *also* and *even*, modal verbs, quantificational adverbs such as *always*, etc.)

Examples in (43) show that Slovenian *samo* ‘only’ is associated with focus: (i) the truth conditions of sentences differ; (ii) sentences differ only in focus placement.

- (43) a. Samo Janezov sin je pojedel kosilo.
only John’s son is eaten lunch
‘Only John’s son has eaten the lunch.’
- b. Samo *Janezov* sin je pojedel kosilo.
only John’s son is eaten lunch
‘Only *John’s* son has eaten the lunch.’
- c. Samo Janezov *sin* je pojedel kosilo.
only John’s son is eaten lunch
‘Only John’s *son* has eaten the lunch.’

¹⁹Acoustic measurements fall outside the scope of the thesis. Stopar [2006] claims that there are no prosodic differences between sentences differing only in the size of the focus (like Slovenian translation of answers in (39)).

²¹In the semantic literature term operator is usually reserved for linguistic elements, that correspond to operators of the formal language employed for semantic analysis. (For a discussion on what is an operator in a formal language see page 162.)

(i) The following context demonstrates that the truth conditions of sentences in (43) differ. Imagine a group of six children: John's son and daughter, Mathew's son and daughter and Leo's son and daughter. Assume that John's son, John's daughter and Leo's daughter have eaten the lunch, but Mathew's son, Mathew's daughter and Leo's son have not. Then (43a) and (43c) are false, but (43b) is true.

(ii) Based on observation about the alternatives evoked we can assume that in (43a) the focus is *Janezov sin* 'John's son' (alternatives are John's daughter, Mathew's son and daughter and Leo's son and daughter), in (43b) the focus is *Janez(ov)* 'John('s)' (alternatives are Mathew and Leo), and in (43c) the focus is *son* (alternative is daughter).

We conclude based on the above examples that in Slovenian, the prosodic realization of a focus contained in the complement of an operator (associated with focus) depends on whether the focus forms the whole complement or only a its proper subpart. As the examples in (43) show, in the former case the focus is not stressed, whereas in the latter case it is. Thus (43a) contains no stress, in (43b) the word *Janezov* 'John's' is stressed and in (43c) the word *sin* 'son' is stressed.

So far we have dealt with focus in two constructions. In the first type the focus is an answer to a question and in the other it is associated to some (non-interrogative) operator. It is claimed for English that data of both kinds can be explained using the same theoretical tool, focus. Arguments in favor of the hypothesis are the following: (i) the prosodic realization of the alleged focus is the same in both constructions (it is stressed); (ii) the distribution of focus in both constructions is the same (free); (iii) in both constructions focusing evokes alternatives. Are these arguments valid also for Slovenian?

In Slovenian only the third argument is valid: both in question–answer pairs and in *samo* 'only' sentences alternatives are evoked. The remaining two arguments are not valid. The first one because the focus as an answer to a question is never stressed and because the presence of stress on a focus associated with an operator depends on whether the entire complement is focused. The second one because the distribution of focus depends on the construction: answer or association to an operator. In neither case is the distribution free: on an answer, focus must be sentence final, in the association with an operator, it cannot appear outside the complement of the operator.

Working definition of focus

Kadmon [2001:261] believes »that the intuition that focus is the answer to the question being addressed is a basic and crucial one« and therefore

believes in »using question–answer pairs as a central means of identifying foci.« However, Rooth [1996: 276] (citing Rooth [1985]) claims that »evoking alternatives is the general function of focus.« Note that although the authors differ in their view on the essence of focusing, both feel that the basic criterion for identifying focus should be semantic.

We shall follow Rooth and assume that the essential aspect of focusing is evoking alternatives. Focus as an answer to the question will be taken as a sufficient, but not required indicator of focus.

I argue for the above decision based on the operators associated with focus. The criterion of evoking alternatives works both for focus as an answer to the question and for focus associated with an operator. On contrary the criterion that the focus is an answer to the question obviously does not work for the latter type of foci. (This is not surprising, since the interrogative operators are only one of many types of operators.)

Imagine the sentence (43a) with the word order used to answer the question. In (44) the answer to the question is the whole phrase *samo Janezov sin* ‘only John’s son’ and not only the complement of *samo* ‘only’, i.e. *Janezov sin* ‘John’s son’, which has above been identified as a focus. Bs response in (44) thus contains two foci: *samo Janezov sin* ‘only John’s son’ is the (primary) focus that answers the question, while *Janezov sin* ‘John’s son’ is the (secondary) focus associated with the operator *samo* ‘only’.

(44) A: Kdo (vse) je pojedel kosilo?
Who (all) is eaten lunch?

B: Kosilo je pojedel [samo [Janezov sin]_{secondary focus}]_{primary focus}.
Lunch is eaten [only [John’s son]]

‘A: Who has eaten the lunch?

B: Only John’s son has eaten the lunch.’

The above working definition of focus demotes the realizational aspects of focus.²² I believe this not to be problematic, since phonological, prosodic and word-order realization of focus vary too much to be a reliable criterion for identifying foci—both cross-linguistically and within a single language (this has already been illustrated by Slovenian examples: the realization of the “answer” focus is different from the realization of the “operator” focus.)

Even in English the stress gives only partial information about what part of the sentence is focused.²³ In other languages, the correlation between focus and stress can be even weaker. For example, Slavic languages are known as

²²For additional discussion on realization of focus in Slovenian see §6.4.

²³In particular, prosody does not distinguish between narrow and wide focus. As dia-

languages where the information structure of the discourse is reflected more in word order than in prosody [prim. Stopar 2006]. Then there are languages that mark focus using (exclusively) morphosyntactic means, e.g. African language Gungbe (Gungbe \subset Gbe \subset Kwa) marks focus using the work *wè*. This word has a fixed position in the sentence; the focus must move in front of it. (We can see that this is really the focus as is understood in this thesis by observing that interrogatives obligatorily move into this position as well.) [Aboh 2004]

Contrastive focus in Slovenian

Contrastive focus is a type of focus which is realized by stressing a word in the focus. Its word-order realization is relatively free.^{24,25} It is typically used to reject or correct the previous assertion, (45).

(45) A: Janez je Bojana predstavil Mariji.
John is Bill introduced Mary.

B: Ne, to ni res. Janez je *Franca* predstavil Mariji.
No, this not true. John is Frank introduce Mary.

‘A: John introduced Bill to Mary.

B: No, that’s not true. John introduced FRANK to Mary.’

In English the contrastive stress is used to answer the question. In Slovenian questions are usually answered using the non-contrastive stress (39a)

logues in (39b) in (39c) illustrate, in sentence (38b), where *Mary* is stressed, the focus can be either (i) only the word *Mary* (narrow focus) or (ii) the entire VP *introduced Frank to Mary* (wide focus).

²⁴The borderline between the stress marking a focus and the stress not marking a focus is unclear. Observe e.g. the sentence (i): in the first occurrence of the word *sladoled* ‘icecream’ the third syllable is stressed; in the second occurrence the first syllable is stressed. There are contexts where (i) is appropriate. If the speaker knows that the hearer possesses relevant knowledge about Slovenian dialects, the utterance can be used to communicate that Metka comes from Celje. Would it be sensible to claim that (i) contains a focus? (If this is so, does the set of alternatives consist of all the words for icecream in Slovenian dialects!?)

(i) Metka ne liže sladoléda, ampak sládoled.
Metka not lick icecream, but icecream

²⁵Stopar [2006: 62] even claims that in a sentence containing a transitive verb the contrastive focus has a *completely* free distribution: he claims that the words of the sentence *Janez piše pismo* ‘John writes (a) letter’ can be linearized arbitrarily and that any of them can be contrastively stressed. Neither myself nor the speakers I’ve consulted with agree with the claim. Furthermore, Stopar does not cite any text corpora or experimental data to back up the claim. (He argues for similar claims based on such data.)

to (39c) on pages 28–29; however, answering with contrastive stress also seems to be possible, (46).²⁶

(46) A: Koga je Janez predstavil Mariji?
Who is John introduce Mary?

B: Janez je *Franca* predstavil Mariji.
John is Frank introduce Mary.

‘A: Who did John introduce to Mary?
B: John introduced *Frank* to Mary.’

Summary

I recognize three types of focus in Slovenian. What they have in common is the semantics of alternative. (i) Non-contrastive focus is an answer to the question. It can be found at the sentence-last position. If it forms the entire constituent in this position, it is not prosodically prominent. (ii) Contrastive focus is used to reject the previous assertion. It has no special word-order position and is always prosodically prominent. (iii) Focus, associated with an operator, is contained in the complement of the operator. It is prosodically prominent if it does not form the entire complement.

2.1.5 The readings of superlative determiners

Comparison of sentences in (47)–(49) shows the difference in usage and meaning of the superlative determiner in Slovenian and English. First, Slovenian sentences containing a superlative determiner are grammatical only if the sentence-last constituent (or an embedded constituent) is interpreted as focused, cf. (47) and (48). Second, the meaning of English sentence (49) differs from the meaning of the Slovenian sentence (48a), although it is its word-by-word translation.

(47) * Največ ljudi pije pivo.
most people drink beer

(48) a. Največ ljudi pije PIVO.
most people drink beer
‘The plurality of people is drinking beer.’

²⁶Some speakers accept Bs answer in (46) only as an answer to the rhetorical question *Janez je koga predstavil Mariji?* ‘John introduced *who* to Mary?’.

- b. Največ ljudi pivo PIJE.
 most people beer drink
 ‘What the plurality of people is doing with the beer is drink it.’
- c. Največ ljudi pije pivo ZA ŠANKOM
 most people drink beer behind bar.
 ‘The plurality of people is drinking beer at the bar.’
- č. Pivo pije največ študentov ZADNJEGA letnika.
 beer drink most students last year
 ‘The plurality of students drinking beer is in their final year.’

(49) Most people are drinking beer.

The words marked as focused in (48) can function as answers to questions, (50). We have concluded in §2.1.4 that this is a sufficient condition to analyze them as foci. (Later we will discuss the alternatives evoked.)

- (50) a. A: Kaj pijejo ljudje?
 what drink people
 B: Največ jih pije PIVO, nekaj pa tudi vino, viski in
 most them drink beer some but also wine whisky and
 vodko.
 vodka
 ‘A: What are the people drinking?
 B: The plurality of them is drinking beer; some are drinking wine, whisky or vodka.’
- b. A: Kaj počnejo ljudje s pivom?
 what do people with beer
 B: Največ jih ga PIJE, nekateri ga točijo, spet drugi
 most them him drink some him pour again other
 polivajo.
 spill
 ‘A: What are the people doing with the beer?
 B: The plurality of them is drinking it; some are pouring it, the others spilling.’
- c. A: Kje pijejo ljudje pivo?
 where drink people beer

B: Največ jih ga pije ZA ŠANKOM, nekateri za
 most them him drink behind bar some behind
 mizo, spet drugi pred gostilno.
 table again other before pub

‘A: Where are the people drinking beer?’

B: The plurality of them is drinking it at the bar; some drink it at the table, the others in front of the pub.’

č. A: Največ študentov katerega letnika pije pivo?
 most students which year drink beer

B: Pivo pije največ študentov ZADNJEGA letnika.
 beer drink most students last year

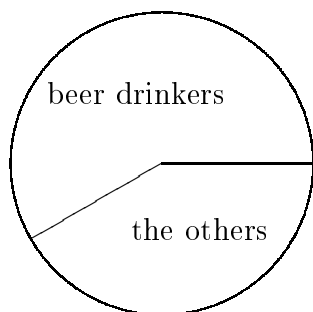
‘A: The plurality of students from which year is drinking beer?’

B: Final.’

Let us describe the meanings of these sentences containing superlative determiners. We start with English *most*, since its meaning is simpler to describe. (49) is true in every situation where more than half of the people are drinking beer. An example situation is illustrated using the pie-chart in (51).

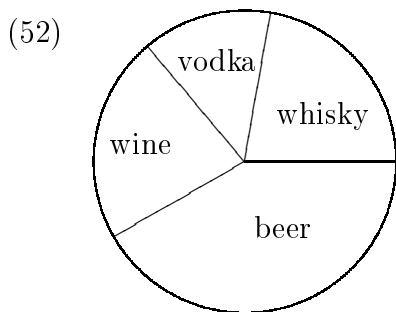
(We assume that the set of relevant people is given by context. So sentences in (48)–(49) are not about all the people in the world; they are only about the people determined by the context. To determine the truth conditions, we must only observe the contextually relevant people, say the people in the pub.)

(51)



The truth conditions of a Slovenian sentence containing the SD *največ* depend on the identity of the focused constituent. *Največ* is associated with focus. Sentence (48a) *je* is true in every context where the number of people drinking beer is greater than the number of people drinking some other contextually relevant beverage. Crucially, each of these beverages must be

considered separately. It is not necessary that the number of people drinking beer is greater than the number of people who are drinking anything but beer. It suffices that for any alternative beverage, the number of people drinking beer is greater than the number of people drinking the alternative beverage. Pie-chart in (52) illustrates a situation where the relevant drinks are beer, wien, vodka and whisky. Sentence (48a) is true in this context, since the largest chunk of the pie corresponds to beer.



(48c) and (48a) differ in two ways. (i) Which subset of the people is being considered: in (48a) the people who are drinking, in (48c) the people who are drinking beer; in general, the individuals that are doing whatever the non-focused part of the sentence asserts. (ii) How is this subset being partitioned: in (48a) people are grouped with respect to what they are drinking; in (48c) with respect to where the event takes place; in general, the subset is partitioned according to the focus. So (48c) asserts that the number of people drinking at the bar, surpasses the number of people drinking anywhere else (at the table, in front of the pub).

The same is true for (48b). Here people who are doing something with the beer are considered; they are partitioned into those drinking it, pouring it, spilling it, etc. The sentence asserts that the number of people drinking beer is greater than the number of people pouring it, and also greater than the number of people spilling it.

At first sight, (48č) is weird. To determine whether it is true, it does not suffice to observe the final-year students. (In traditional terms, this means that *največ* is not conservative—many people might thus claim it is not a determiner at all.) Also the other students must be taken into account. However, the truth conditions of the sentence can be determined using exactly the same method as used for the other sentences in (48). The group of individuals we should consider is the group of all individuals satisfying the assertion of the non-focused part of the sentence, i.e. the groups of all students drinking beer. This group is then partitioned according to the focus, i.e. by years.

The sentence asserts that the number of last-year students drinking beer, is greater than the number of first-year students drinking beer, greater than the number of second-year students drinking beer, etc.

An important difference between English and Slovenian sentences containing an SD is that in English the whole contextually determined group of individuals is considered, whereas in Slovenian the group being considered is narrowed to the individuals fulfilling the conditions of the non-focused part of the sentence.

There is also a pragmatic difference between the usage of SDs in English and Slovenian. English sentences containing an SD can be used “out of the blue”, i.e. without some appropriate context or a possibility of context-adjustment. It might not be wrong to claim that they can be useful for a first description of a situation. So, an inspector can enter a hospital and utter (53).

(53) Hey, what’s the matter here? Most people are drinking beer.

On contrary, a Slovenian sentence containing *največ* cannot be used for a first description. If an inspector comes to a hospital in Slovenia and utters (54), the listener must adjust the context. The sentence is being understood as presupposing that some drinks are not being drunk enough in the hospital, and the listener automatically starts figuring out which drinks this could be.

(54) Tukaj je nekaj narobe. Največ ljudi pije PIVO.
 here is something wrong. most people drink beer
 ‘Something’s wrong here. The plurality of people is drinking beer.’

The pretheoretical generalization about truth conditions of sentences containing an SD is therefore the following.

In English, a sentence containing an SD is true iff the number of individuals participated in the described event is greater than the number of all other individuals (referred to by the NP). Since we compare the size of some group of individuals to the size of the group of all other relevant individuals, we shall say that the English SD *most* has the *majority reading*. (*Most* will be called a majority superlative determiner (MSD).)

In Slovenian the truth of the sentence containing an SD is determined as follows. The set of all individuals satisfying the conditions imposed by the non-focused part of the sentence is partitioned with respect to the focus (so groups are the focus and its alternatives). The sentence is true iff the group of the individuals corresponding to the focus is the most numerous of all these groups. Since the comparison is made to each of the alternative

groups separately, we shall say that the Slovenian *most* has the *plurality reading*.²⁷ (*Največ* will be called a plurality superlative determiner (PSD).)

Above we have described two readings an SD can have: the English-like majority reading and the Slovenian-like plurality reading. Can both readings be found in a single language?

In Slovenian the SD cannot have the majority reading. It is impossible to describe a situation illustrated in (51) using a sentence containing (only) *največ*. To describe such a situation (55) containing *večina* must be used.

- (55) *Večina ljudi pije pivo.*
majority people drink beer
'Most of the people are drinking beer.'

English SD cannot have the plurality reading.²⁸ Focusing in a sentence like (49) does not change the truth conditions. In functions contrastively, i.e. the sentence with a focus can be used to reject the previous assertion, (56).

- (56) A: Most people are drinking wine.
B: No, most people are drinking BEER.

German illustrates that the answer to the above question is nevertheless positive. (57a) has the majority reading illustrated in (51), whereas (57b) has the plurality reading illustrated in (52).

- (57) a. *Die meisten Leute trinken Bier.*
'Most people are drinking beer..'
b. *Die meisten Leute trinken BIER.*
'The plurality of people is drinking beer.'

There is another usage of the SD *največ* in Slovenian, illustrated in 2.1.5. 2.1.5 can be paraphrased as (58a). Also synonymous is (58b) (in one of its readings). In this reading, (58c) is an appropriate continuation of 2.1.5.

²⁷It is interesting to note that in Slovenian in a situation where only one alternative to the focus (associated to the SD) exists, the speakers judge the sentence to be less acceptable. Why this is so remains a mystery. At first sight one might assume that this has to do with the fact that there is dual in Slovenian and guess that focusing should partition the individuals into a "plural" number of groups, so at least two in English and at least three in Slovenian. However, this cannot be correct, since in the Primorska dialect, where there is no dual, the above-mentioned requirement on more than one alternative remains.

²⁸Actually, the claim only holds for Standard English, since for some speakers the SD *the most* has the plurality reading, see §2.3.1.

- (58) Lojzek na testu ni dosegel ravno največ točk.
Leo on test not is achieve exactly most points
'Leo hasn't achieved a good score at the test.'
- a. Lojzek na testu ni dosegel veliko točk.
Leo on test not is reach many points
'Leo hasn't reached a good score at the test.'
- b. Lojzek na testu ni dosegel preveč točk.
Leo on test not is reach too many points
'Leo hasn't reached a good score at the test. (or: Leo hasn't got too many points at the test.)'
- c. ...pravzaprav ni dosegel skoraj nobene.
actually not is reach almost none
'... actually he scored almost zero.'

Since sentence —although it contains a superlative—does not have a superlative meaning, we shall call this reading *non-superlative*. The non-superlative usage of an SD is parallel to the non-superlative usage of a superlative adjective (SA), illustrated in (59).

- (59) Lojzek ni najbolj bister (fant).
Leo not is the most clever (boy)
Leo is not the cleverest (boy).
- a. Lojzek ni bister (fant).
Leo not is clever (boy)
'Leo is not clever.'
- b. Lojzek ni preveč bister (fant).
Leo not is too clever (boy)
'Leo is not very clever. (or: Leo is not too clever.)'
- c. ...pravzaprav je kar nekoliko omejen.
actually is PARTICLE somewhat retarded
'... actually he's a bit retarded.'

2.2 The truth conditions

In this section the truth conditions for sentences containing DDs and SDs will be formalized and then compared with one another.

In this thesis the truth conditions shall be formalized using a special formal language called L^* (read ‘1 star’);²⁹ L^* will be introduced in §2.2.1. (The formal definition will be postponed until § 4.1.1.) Then we start investigating the truth conditions: in §4.1.1 for DDs, in §2.2.3 for MSDs (like English *most*) and in §2.2.4 for PSDs (like Slovenian *največ*). In §2.2.5 these truth conditions will be compared to one another.

2.2.1 Formal language L^*

At first sight, L^* is similar to ordinary first-order predicate logic (FOL). The difference is that in L^* the variables do not stand for objects but for groups of objects. Nevertheless, L^* is not an ordinary plural logic, which in general allows for non-distributive predicates—in L^* , almost all predicates are distributive. There are only two exceptional predicates: $\#$, counting the objects in a group, and the overlap predicate \checkmark . Below all the symbols used in L^* are listed and their meaning is informally described. (The rules of interpretation will be given in §4.1.1.)

- Connectives: \wedge ‘and’ is the conjunction, \vee ‘or’ is the disjunction, \neg ‘not’ is the negation and \Rightarrow is the material implication.
- Objectual variables of various types (sorts). In this subsection, only the individual variables will be used (x , y , etc.). In L^* objectual variables are plural, i.e. variables stand for groups of objects.*
- Numerical variables stand for positive integers ($1, 2, 3, \dots$).³⁰ and are treated as singular variables.
- Existential quantifier \exists . If ϕ is a formula then $\exists x: \phi$ means that there is an x such that $\exists x: \phi$ is true. (The meaning of the universal quantifier \forall is defined standardly by $\forall x: \phi \stackrel{\text{def}}{\sim} \neg \exists x: \neg \phi$.)
- Individual predicates. In this section these will be used to represent the lexical meaning of various open syntactic categories: $\text{mother}(x)$,

²⁹The name of the formal language is inherited from its predecessor, originally defined in Law and Ludlow [1985] and later discussed in Ludlow [1995, 2002].

³⁰0 is not a positive integer.

*In the thesis the term individual variables refers to a type of objectual variables. This terminological decision is based on the usage of the term objectual in Ludlow [1995], where objectual variables/quantifiers are opposed to substitutional variables/quantifiers. In this thesis, the latter correspond to numerical variables and quantifiers over these.

$\text{lunch}(z)$, $\text{good}(z)$, $\text{cook}(x, z)$.³¹ In general examples they will be denoted by capitals A , B , etc.) Let all individual predicates be distributive: intuitively this means that if $A(x)$ is true for some group of objects x , then $A(y)$ is true for every object y in group x , and vice versa. (Since all objectual variables are plural, the terminology shall be intentionally misused: if something is true for a group of objects y of cardinality 1, we shall say that this is true for the object y . Another terminological convention: if for some x $A(x)$ is true, we shall say that x is A .)

- Predicate $\#$ counts the objects in a group. The atomic formula $\text{quant}(5, x)$ is true iff x is a group of five objects.
- The *overlap* predicate \checkmark . The atomic formula $x \checkmark y$, where x and y are groups of objects, is true iff x and y have at least one common member. (We shall denote the negation of \checkmark by \asymp . The atomic formula $x \asymp y$ is true iff x and y do not have any common members.

It is trivial to see that predicates $\#$ and \checkmark are not distributive. If x has n members (for some positive integer n) it does not follow that every member of x has n members—except for $n = 1$ this is actually never the case. Next, it does not follow from $x \checkmark y$ ‘ x and y overlap’ that for every member x' of x and every member y' of y , $x' \checkmark y'$ is true.

The equality predicate ($=$) will not be used. Note that if the size of x and y is 1, equality ($=$) and overlap (\checkmark) are synonymous.

The meaning of the existential quantifier \exists is standard and simple. (60) means that there is a group of objects such that ϕ is true. However, one should be careful when intuitively evaluating the meaning of constructions using the universal quantifier \forall . Contrary to standard plural logic (61) does not mean that, for every group of objects, it holds that ϕ is true for every object of the group. By definition, (61) is synonymous to (62) and therefore means that it is not true that there is a group of objects such that ϕ was false for every object of this group. This is of course equivalent to the claim that, in every group of objects, ϕ is true for at least one object of the group.

$$(60) \quad \exists x: \phi$$

$$(61) \quad \forall x: \phi$$

$$(62) \quad \neg \exists x: \neg \phi$$

These properties become interesting only if $\#$ or \checkmark occur in a formula. (63) and (64), where have the same meaning as if used in FOL. (63): if a

³¹The above representations of lexical meanings of nouns, verbs and adjectives are simplifications, see the rest of the section and §5.2.1.

group of objects exists such that all of them are *As* then a single object that is *A* also exists; vice versa, if an object that is *A* exists, then a group of objects (in general, the size of the group is 1) exists such that all its members are *As*. (64): assume that is every group of objects at least one object is *A*; this is also true of all groups of cardinality 1, therefore every object is an *A*. Vice versa, if every object is an *A*, then in every group of objects all objects are *As*, so it's true that at least one of them is an *A*.

$$(63) \quad \exists x: A(x)$$

$$(64) \quad \forall x: A(x)$$

Next we illustrate how predicate $\#$ is used in the analysis of (65a). At first sight it seems that the truth conditions of this sentence can be represented as in (65b). However, (65b) is not an L^* formula. L^* does *not* include constants,³² i.e. symbols “naming” the elements of the domain of interpretation, therefore the usage of numeric constant 5 is illegal. In L^* , cardinal numerals will be represented using one-place predicates over numerical variables. Thus, the truth conditions of (65a) should be written as in (65c). (We shall nevertheless be using formulas like (65b), when clarity will be of greater importance than preciseness.)

(65) a. Five boys run.

b. $\exists x: \text{boy}(x) \wedge \#(5, x) \wedge \text{run}(x)$

There is an x such that: the members of x are boys; x has 5 members; the members of x run.

c. $\exists x: \text{boy}(x) \wedge (\exists n: 5(n) \wedge \#(n, x)) \wedge \text{run}(x)$

There is an x such that: the members of x are boys; there is a positive integer n such that n is 5 and that x has n members; the members of x run.

Note that, being precise, (65c) does not represent the exact truth conditions of (65a). Our linguistic intuition tells us that (65a) is about exactly five boys, whereas (65c) is true iff the numbers of running boys is at least five. (The formula asserts something about some five boys and tells nothing about the others.) The debate in the semantic literature on which meaning is more basic—*exactly* or *at least*—is an old one. The properties of L^* force me to join the (majority) view that the *at least* meaning is more basic (for discussion see Keenan and Stavi [1986], Ionin and Matushansky [2006]). I cannot see how the *exactly* meaning could be formalized in L^* in a simple way. Note that the *at least* has arisen although both cardinal numerals and predicate $\#$ are understood in the *exactly* meaning ($5(n)$ means that $n = 5$

³² L^* has no function symbols at all.

and $\text{quant}(n, x)$ means that the cardinality of x is exactly n .) I believe that the *exactly* meaning arises through interaction of the *at least* meaning and some other factors, perhaps focusing.

The usage of the overlap predicate $\text{\textcircled{X}}$ will be practically illustrated in the following subsections.

In mathematical logic, bracketing conventions are usually adopted for reasons of clarity. Usually the bracketing convention is such that quantifiers have a higher precedence than connectives. Thus under the *usual* convention the quantifier $\exists x$ in (65b) has scope over the atomic formula $\text{boy}(x)$. Consequently, (65b) is not a closed formula³³ and is logically equivalent to (66). In L^* we adopt the contrary convention, that (more-than-one-place) connectives have a higher priority than quantifiers. So, by the L^* convention, then quantifier $\exists x$ in (65b) scopes over the rest of the formula; thus, (65b) is logically equivalent to (67) and therefore closed.

$$(66) \quad (\exists x: \text{boy}(x)) \wedge \#(5, x) \wedge \text{run}(x)$$

$$(67) \quad \exists x: (\text{boy}(x) \wedge \#(5, x) \wedge \text{run}(x))$$

In L^* , the standard convention on the interpretation of free variables will also be modified. In logic formula ϕ containing free variables x_1, \dots, x_n is usually interpreted as being universally closed, $\forall x_1 \dots \forall x_n: \phi$. The new convention on interpretation of free variables will be motivated and introduced in §4.4. (The convention will allow us to represent all linguistically relevant formulas without explicitly using the quantifier symbols.) Until that section, only closed formulas will be used in the discussion.

Event semantics

Above we have illustrated L^* language using only one type of objectual variables: individual variables, which range over persons, animals, (abstract) objects, etc. In general we shall use more *types (sorts)* of objectual variables, all of them treated as plural. In particular, *event* variables (e, f , etc.) and *property* variables will be used.* In this section we shall illustrate the usage of event variables in so-called (neo)davidsonian event semantics [see Herburger 2000, Larson and Segal 1995]; the usage of property variables will be illustrated in chapter 5.

³³In formula $\forall x: \phi$ ($\exists x: \phi$), ϕ is the *scope* of the quantifier $\forall x$ ($\exists x$). An occurrence of the variable x is *bound* iff it is contained in within the scope of a quantifier $\forall x$ or $\exists x$; otherwise it is free. The variable x is *free* in a formula ϕ if it has at least one free occurrence in ϕ . Formula ϕ is *closed* if it contains no free variables.

*As far as I know, the concept of property variables (as used in this dissertation) is novel.

(Neo)davidsonian approach to decomposition of the meaning of verbs assumes that sentences describe *events* (the term event is to be interpreted in a wide sense which also includes states; Herburger [cf. 2000]). Instead of representing the (simplified) truth conditions of (68a) by using a two-place predicate *imitate*, we break down the meaning of this predicate into three components and say that (68a) describes an event of imitation which is performed by Možek [možek] and whose theme is a mouflon. Thus, the meaning of a lexical predicate has been decomposed by using theta-roles (agent, theme, experiencer, etc.).

- (68) a. Možek is imitating a mouflon.
 b. $\exists x: \text{možek}(x) \wedge \exists y: \text{mouflon}(y) \wedge \text{imitate}(x, y)$
 c. $\exists x: \text{možek}(x) \wedge \exists y: \text{mouflon}(y) \wedge \exists e: \text{imitation}(e) \wedge \text{agent}(e, x) \wedge \text{theme}(e, y)$

When event semantics will not be crucial for the discussion, we shall nevertheless use the shorter representation (68b) using more-place predicates. Furthermore, the representation will often be simplified by using predicates instead of variables in argument positions: (68b) and (68c) will be shortened to (69a) and (69b), respectively.

- (69) a. $\text{imitate}(\text{možek}, \text{mouflon})$
 b. $\exists e: \text{imitation}(e) \wedge \text{agent}(e, \text{možek}) \wedge \text{theme}(e, \text{mouflon})$

I also follow Herburger [2000] in treating adverbial modification (as in (70)) using a predicate over events, (70) (example from Herburger [2000]). On this view, adverbial modification is also assigned a theta-role (in a wide sense; following Starke [2001] we will call the classical theta-role, subsuming only the arguments of a verb, an argumental theta-role.)

- (70) a. Brutus stabbed Caesar in the back with a knife.
 b. $\exists x: \text{brutus}(x) \wedge \exists y: \text{caesar}(y) \wedge \exists e: \text{stabbing}(e) \wedge \text{agent}(e, x) \wedge \text{theme}(e, y) \wedge \text{in-the-back}(e) \wedge \text{with-a-knife}(e)$

2.2.2 Definite determiner

Following Ludlow [1995], we take Russell's [1905] analysis of DDs as a starting point for representing the (universal) meaning of DDs in L^* . Russell claims that (71a) is interpreted as in (71b), which translates to FOL as (71c). The generic Russellian schema³⁴ for the sentences of the type (71) is given in (72).

³⁴In schemata, the following mnemonics will be used: S for the subject, V for the verb, O for the object. These mnemonics will be used as words in the sentence-schemas. Typical

- (71) a. The father of Charles II was executed.
 b. »It is not always false of x that x begat Charles II and that x was executed and that “if y begat Charles II, y is identical with x ” is always true of y .« [Russell 1905]
 c. $\exists x: \text{begat-charles-II}(x) \wedge \text{was-executed}(x) \wedge$
 $(\forall y: \text{begat-charles-II}(y) \Rightarrow y = x)$ (in FOL)
- (72) a. The S Vs.
 b. $\exists x: S(x) \wedge V(x) \wedge (\forall y: S(y) \Rightarrow y = x)$ (in FOL)
 There is an x , such that the following is true. x is an S, x Vs and for every y it is the case that if y is an S then y equals x .

(73) gives two logically equivalent L^* versions of the Russellian DD scheme. (73a) is closer to the original wording; this is also the formula that will be used in chapter 5. (73b) will be used in §2.2.5, since I believe that it makes it easier to understand.

- (73) a. $\exists x: S(x) \wedge V(x) \wedge (\forall y: S(y) \Rightarrow y \checkmark x)$
 There is a group of individuals x such that the following is true. Every member of x is an S. Every member of x Vs. Every group of individuals y has a member, such that: if this member is an S, it overlaps with x .
- b. $\exists x: S(x) \wedge V(x) \wedge \neg(\exists y: S(y) \wedge y \asymp x)$
 There is a group of individuals x such that the following is true. Every member of x is an S. Every member of x Vs. It is not the case that there is a group of individuals y , such that: all members of y are Ss and y and x have no common members.

The meanings of the formulas in (73) are not exactly the same as the meaning of (72b). (72b) represents the truth conditions of a sentence where the complement of the DD *the* is singular, whereas the formulas in (73) are unspecified with respect for number: they can be true regardless of how many Ss exist in a given context (x must be the group of all Ss). The difference between the definite DPs with complements of various number will not be dealt with in the thesis.

2.2.3 Majority superlative determiners

An important empirical motivation for adopting L^* as a level of semantic representation is that using L^* it is possible to represent the meanings of English sentences containing the SD *most*. In FOL, this is impossible [Barwise and Cooper 1981].

examples are: *Ss Vs an O* and *Ss V an O*. Focusing will be marked by underlining the focused predicate.

The representation is given in (74). Note that it is crucial that the same numeric variable (n) is used in both atomic formulas of $\#$, $\#(n, x)$ and $\#(n, y)$. Both occurrences of n are bound by a single quantifier, $\exists n$.

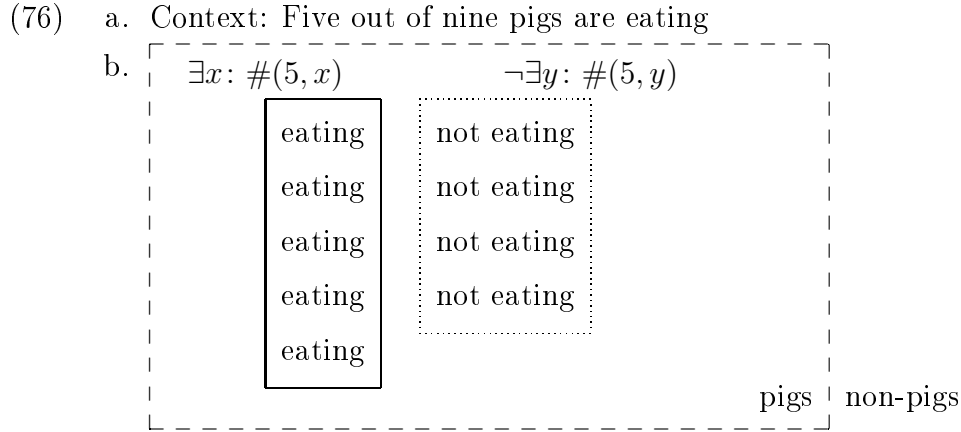
- (74) a. Most pigs are eating.
 b. $\exists n: \exists x: \text{pig}(x) \wedge \#(n, x) \wedge \text{eat}(x) \wedge$
 $\neg(\exists y: \text{pig}(y) \wedge \#(n, y) \wedge y \asymp x)$

There is a positive integer n , such that the following is true. There is a group of individuals x such that the following is true. Every member of x is a pig; x has n members; every member of x is eating; it is not the case that there is a group of individuals y such that: every member of y is a pig, y has n members and y and x have no common members.

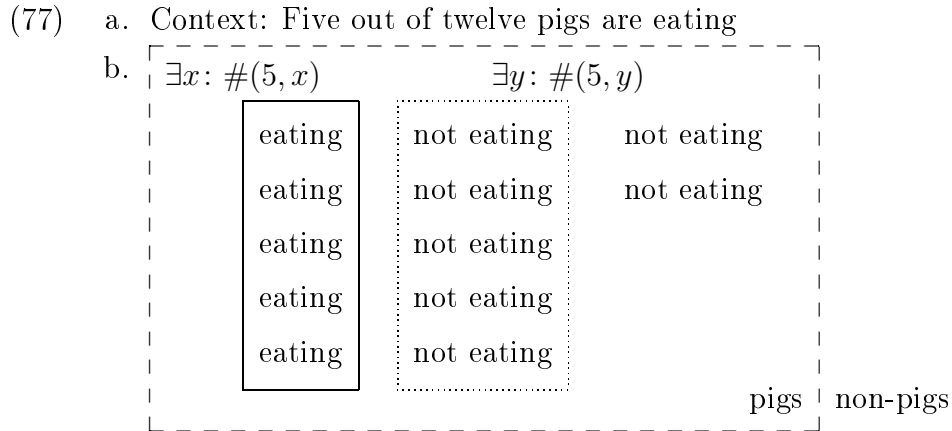
Let us show that (74b) really describes the truth conditions of (74a) by using the context given by (76). Formula (74b) will be true if we can find a positive integer n such that the (74b)'s subformula (75) (where $\exists n$ is removed) is true. For (75) to be true, a group of individuals x of size n must exist such that the following three conditions are satisfied. First, every member of x must be a pig. Second, every member of x must be eating. Third, it must be impossible to find a group of pigs y of size n , disjoint with x . In a context illustrated in figure (76b) such a positive integer n can be found, a good choice being the number of pigs that are eating, i.e. 5. The first two conditions for the truth of (75) are thereby automatically satisfied. The third condition is also satisfied: we have chosen an n greater than half the number of the pigs, so a group of pigs y of size n disjoint with x cannot exist. In the context of figure (76b) the variable x takes five values, so there are only four value remaining for y . It is thus impossible to find five pigs different from the pigs in x , so the third condition on the truth of (75) is satisfied, making (75) and consequently (74b) true.

- (75) $\exists x: \text{pig}(x) \wedge \#(n, x) \wedge \text{eat}(x) \wedge$
 $\neg(\exists y: \text{pig}(y) \wedge \#(n, y) \wedge y \asymp x)$

Next let us show why (74b) is false in the context given in (77). We have to show that for every choice of n , (75) is false. If n greater than the number of the pigs that are eating is chosen, (75) is false since no group x of size n can be found such that all its members are pigs that are eating. If n is less than or equal to the number of the pigs that are eating, we hit another problem. Since the number of pigs that are eating is less than or equal to the number of pigs that are not eating, then we can find another n pigs for any such n . (It is also true that the entire group can be chosen among the pigs that are not eating.) The third condition on the truth of



(75) is therefore not satisfied, since this its requirement is exactly opposite. We have therefore shown that an appropriate n cannot be chosen: if x is greater than the number of the eating pigs, the first two conditions are not met, otherwise the third one. Since an appropriate n cannot be chosen (74b) is false in (77).



The MSD schema we shall use for comparison in §2.2.5 is given in (78b).³⁶ The discussion in chapter 5 will be based on the logically equivalent formula (78c).

³⁶If we had included $\neg V(y)$ into the scope of $\exists y$, as in (i), we would get the same truth conditions. The choice of (78b) over (i) is based on two factors: (i) it makes the formulas for DD *the* and MSD *most* similar, see §2.2.5; (ii) the syntactic derivation of the formula, see chapter 5.

(i) $\exists n: \exists x: S(x) \wedge \#(n, x) \wedge V(x) \wedge$
 $\neg(\exists y: S(y) \wedge \#(n, y) \wedge \neg V(y) \wedge \wedge y \asymp x)$

(78) a. Most Ss V.

b. $\exists n: \exists x: S(x) \wedge \#(n, x) \wedge V(x) \wedge$
 $\neg(\exists y: S(y) \wedge \#(n, y) \wedge y \asymp x)$

There is a positive integer n such that the following is true. There is a group of individuals such that the following is true. Every member of x is an S; x has n members; every member of x Vs; it is not the case that there is a group of individuals y such that: every member of y is an S, y has n members and y and x are disjoint.

c. $\exists n: \exists x: S(x) \wedge \#(n, x) \wedge V(x) \wedge$
 $(\forall y: \neg(S(y) \wedge \#(n, y)) \vee y \not\asymp x)$

There is a positive integer n such that the following is true. There is a group of individuals such that the following is true. Every member of x is an S; x has n members; every member of x Vs; for every group of individuals y the following is true: if every member of y is an S and y has n members, then y and x overlap.

2.2.4 Plurality superlative determiner

In §2.1 the meaning of Slovenian sentences containing the SD *največ* has been described informally. We have shown that such sentences cannot have the majority reading, but only the plurality reading. Thus, the meaning of the sentence *največ Sjev Vja* ‘the plurality of Ss V’ cannot be represented using the formula (78b) that was used for English MSD *most*.

All Slovenian sentences with the SD *največ* contain focus. In this section the meanings of these sentences will be represented without trying to figure out, which part of the meaning stems from the SD and which part from the focus. This will suffice for the purpose of this chapter: the prediction we shall deduce in §2.2.5 will be based on the comparison of the truth conditions only, not on the internal analysis of the sentences.

We shall deal with focus in detail in §4.5. For this chapter the only important aspect of focusing is that it evokes the alternatives to the focused constituent. This will be formalized using second-order quantification, as illustrated in (79b) and schematized in (80b).

It is crucial in (79b) and (80b) that the same numeric variable (n) bound by a single existential quantifier ($\exists n$) occurs in both atomic formulas with predicate $\#$, $\#(n, x)$ and $\#(n, x')$.

(79) a. Največ fantkov se je igralo z avtomobilčki.
 most boys REFL is play with toy-cars
 ‘The plurality of boys was playing with toy-cars.’

- b. $\exists n: \exists x: \text{boy}(x) \wedge \#(n, x) \wedge$
 $\exists y: \text{toy-car}(y) \wedge \text{play-with}(x, y) \wedge$
 $\neg(\exists P: \text{Alternative}(\text{toy-car}, P) \wedge$
 $\exists x': \text{boy}(x') \wedge \#(n, x') \wedge$
 $\exists y': P(y') \wedge \text{play-with}(x', y'))$

There is a positive integer n such that the following is true. There is a group of boys x of size n such that there is a group of toy-cars y such that the members of x play with the members of y . And it is not the case that there exists an alternative (toy) P to toy-cars such that: there is a group x' of boys of size n such that there is a group y of P s such that the members of x' play with the members of y' .

- (80) a. Največ Sjev Vja O.

most Ss V an O.

‘The plurality of Ss V an O.’

- b. $\exists n: \exists x: S(x) \wedge \#(n, x) \wedge \exists y: O(y) \wedge V(x, y) \wedge$
 $\neg(\exists P: \text{Alternative}(O, P) \wedge$
 $\exists x': S(x') \wedge \#(n, x') \wedge \exists y': P(y') \wedge V(x', y'))$

There is a positive integer n such that the following is true. There is a group of Ss x of size n such that there is a group of Os y such that the members of x V the members of ys . And it is not the case that there exists an alternative P to O such that: there is a group x' of Ss of size n such that there is a group y of P s such that the members of x' V the members of y' .

In the above formulas the second-order predicate Alternative was used. Its first argument is the focused predicate, the other one a predicate variable. Let the atomic formula $\text{Alternative}(Z, P)$ be true iff P is some contextually determined alternative to predicate Z ; let the predicate Alternative be ir-reflexive. So $\text{Alternative}(\text{toy-car}, P)$ is true iff P is e.g. some other toy: a toy-house, a doll, etc.

From what we’ve said above it seems that in order to represent the meaning of a sentence containing a PSD, L^* language has to be extended into some variety of second-order logic. However, this is not the case: in §4.5 focus constructions will be analyzed without using second-order logic. In this chapter the details of the analysis are not important. The only thing that will be crucial is the fact that the truth conditions of Slovenian sentences with the SD *največ* are different from the truth conditions of English sentences with the SD *most*, since the cross-linguistic prediction of §2.3 will be based upon this difference.

2.2.5 Comparison of the representations

In previous subsections the schemata for DDs, MSDs and PSDs had been written in L^* language. The final versions of representations are repeated in (81)–(83).

- (81) a. The S Vs. / The Ss V. (DD)
 b. $\exists x: S(x) \wedge V(x) \wedge \neg(\exists y: S(y) \wedge y \asymp x)$
- (82) a. Most Ss V. (MSD)
 b. $\exists n: \exists x: S(x) \wedge \#(n, x) \wedge V(x) \wedge \neg(\exists y: S(y) \wedge \#(n, y) \wedge y \asymp x)$
- (83) a. Največ Sjev Vja O. (PSD)
 most Ss V an O
 b. $\exists n: \exists x: S(x) \wedge \#(n, x) \wedge \exists y: O(y) \wedge V(x, y) \wedge$
 $\neg(\exists P: \text{Alternative}(O, P) \wedge$
 $\exists x': S(x') \wedge \#(n, x') \wedge \exists y': P(y') \wedge V(x', y'))$

The odd one out is the formula (83) for PSDs. (i) It uses second-order logic (it contains a second-order variable P , a second-order quantifier $\exists P$ and a second-order predicate Alternative). (ii) It does not use the disjointness predicate \asymp . (iii) All lexical predicates occur twice in the formula. (In (81) and (82), only the predicate corresponding to the determiner's complement occurs twice; the predicate corresponding to the VP occurs only once.)

Let us call the pattern in (84) a *definiteness pattern*. (An empty sequence of symbols can correspond to the dots in a concrete formula.) Formulas for the DD (81b) and the MSD (82b) conform to the definiteness pattern, while the formula for the PSD (83b) does not.

$$(84) \quad \dots \exists x: S(x) \wedge \dots \wedge \neg(\exists y: S(y) \wedge \dots \wedge y \asymp x)$$

(82b) differs from (81b) in constraining the cardinality of x and y , namely the cardinality of both has to be n . (So, x and y “have the same size” in (82b).) The cardinality of x and y in (81b) is not explicitly constrained. (So, x and y can “have different sizes”.)

It follows that the structure of MSD *most* is more complex than the structure of DD *the*: both formulas conform to the definiteness pattern; additionally, the formula for *most* contains the predicate $\#$, occurring twice, with the same numeric argument.

The conclusion that the structure of *most* is more complex than the structure of *the* is valid even if the difference between (81) and (82) is interpreted a bit differently. The meaning of (81b) is the same to the meaning of (85): if the size of the individual variable is constrained by an “undetermined” numeric variable n (undetermined in the sense that no predicate constrains

its value), no additional conditions on the truth of the formula are given; for the proof see §4.1.1. In (85) the size of x and y is formally constrained, but with independent undetermined numeric variables, thus x and y can still have arbitrary different sizes. Therefore the difference between the formulas for DD and MSD can be seen as whether the size of x and y is constrained by different numeric variables (DDs) or the same variable (MSDs).

$$(85) \quad \exists x: S(x) \wedge (\exists m: \#(m, x)) \wedge V(x) \wedge \\ \neg(\exists y: S(y) \wedge (\exists n: \#(n, y)) \wedge y \asymp x)$$

2.3 The cross-linguistic prediction

In §2.2.5 the representations of the truth conditions for DDs and SDs were compared. We have seen that DDs and MSDs, but not PSDs, conform to the definiteness pattern.

English has both a DD (*the*) and an MSD (*most*). Slovenian has neither. Could this be merely a coincidence? Suppose that it is not and that the absence of both in Slovenian is a consequence of a single factor. Specifically, suppose that in English the definiteness pattern is legitimate, while in Slovenian it is not. It seems reasonable to view the legitimacy of the definiteness pattern as a cross-linguistic parameter: it is allowed in some languages and disallowed in the others. Based on this parameter the following can be predicted.

In languages where the definiteness pattern is not allowed, neither DDs nor MSDs can be found. In languages where the definiteness pattern is allowed both DDs and MSDs can be found.

The problem is that the above prediction is not falsifiable. With respect to the languages which allow the definiteness pattern it only claims that DDs and MSDs *can* be found. Thus it allows a state of affairs where a language allowing the definiteness pattern has no DDs or MSDs. In general, I believe that it is impossible to distinguish a language allowing some structure but not grammaticalizing it from a language where the structure is not available at all.

It is important to note that the existence of DDs and existence of MSDs in the lexicon are not independent. In §2.2.5 we have seen that *most* is more complex than *the*, in the sense that both conform to the definiteness pattern, but that additionally, the representation of *most* guarantees the sameness of the numerical arguments of both occurrences of the predicate $\#$.

I believe it is reasonable to assume that the existence of a structure (in the lexicon) implies the existence of any simpler structure which is a part

of the complex one [cf. Moren 2007]. Thus, if a language has an MSD it necessarily has a DD. The opposite does not hold: if a language has a DD nothing can be said about the existence of an MSD.

We therefore predict the existence of languages of the types (0), (D) and (DM), and the non-existence of languages of the type (M):

(86)	type	DD	MSD
	✓ (0)	no	no
	✓ (D)	yes	no
	* (M)	no	yes
	✓ (DM)	yes	yes

This prediction is falsifiable. It can be falsified by finding a language of the type (M), i.e. a language having an MSD but no DD.

A language with a DD cannot be used to falsify the prediction, since nothing follows from the existence of a DD in a language: neither that the language has an MSD nor that it does not have it. Similarly, the prediction cannot be falsified by a language without an MSD.

We should therefore seek for a counterexample of the prediction (86) (i) in languages without a DD: it is predicted that these will not have an MSD and this can be verified; (ii) in languages with an MSD: it is predicted that these will have a DD and this can also be verified.

Another, diachronic prediction can be derived from the above analysis of DDs and SDs: a language cannot develop an MSD if it does not (first) develop a DD. Slavic languages are an ideal testbed for this prediction. The only Slavic languages with a DD are Macedonian and Bulgarian. Therefore these are also the only ones where an MSD could have developed. As data in §2.3.1 shows, this actually happened in Macedonian,³⁷ which has two SDs, a PSD *najmnogu* and an MSD *poveќе*. (The latter can also be used as a CD.)

Bošković [2007] claims that the (non-)existence of a DD in a language is connected to a number of other syntactic phenomena, see §6.1.2.

In previous sections PSDs (like Slovenian *največ*) have also been discussed. I emphasize that the prediction (86) has nothing to say about them. The plurality reading of SDs is not based upon the definiteness pattern, so the existence of an PSD does not imply the existence of a DD or an MSD; and vice versa, the existence of a DD or an MSD does not imply the existence of a PSD.

This is confirmed by empirical data given in §2.3.1, where all four possible combinations of (non-)existence of MSDs and PSDs can be found. Slovenian

³⁷As far as I know, the same is true for Bulgarian, but I cannot present any Bulgarian data in the thesis.

has only a PSD, (Standard) English only an MSD. In §2.1.5 we have noted that German has both. Hebrew has none, since it has no SDs at all.

2.3.1 The data

The prediction (86) has been so far verified in the following languages: Catalan, Czech, Dutch, English, German (Standard, Austrian and Swiss), Hebrew, Hindi, Hungarian, Japanese, Kannada, Macedonian, Mandarin Chinese, Norwegian, Polish, Punjabi, Romanian, Serbian, Slovenian, Tamil and Turkish. All these languages confirm the prediction.³⁸

One should be careful when trying to verify the cross-linguistic prediction (86), since we have seen in §2.1 that the universal definition of DDs and SDs is slippery. When I was determining the lexical items corresponding to English *the* and *most* and Slovenian *največ* in other languages, I have tried to apply the results of discussion in §2.1.

In this section, not only data on DDs and MSD, but also data on PSD will be presented.

All examples of this section, where the source is not explicitly mentioned, were collected by fieldwork. This is especially true for all judgments about the meaning and acceptability of sentences containing an SD, which were all collected with direct fieldwork with native speakers. In some cases the speakers were bilingual. Their second native tongue was usually English, which was usually also the interview language. On the other hand I have mainly relied on descriptive grammars to find out whether a language has a DD, mainly because of the great cross-linguistic variability in realization of DDs.

Providing the appropriate context was crucial for collecting the data. Sometimes the context was presented orally, however, in the most cases pie-charts were used, usually the pie-charts (51) on page 37 and (52) on page 38 from §2.1.5.

In the rest of this section I present the collected data, alphabetically ordered by the name of the language. Next to the language's name its type is given: D stands for the **DD**, M for the **MSD** and P for the **PSD**. (0) marks the type of languages having no DDs, MSDs or PSDs.

Catalan (D)

In Catalan, the DD is realized as an article. The forms are given below.

³⁸In the dissertation, I limit the empirical data to sentences containing the SD in the subject. Work on SDs in the other positions is left for further research.

2.3 THE CROSS-LINGUISTIC PREDICTION

(87)		masc.	fem.
	sing.	el, l'	la, l'
	pl.	els	les

Catalan has no SDs. The majority is expressed using the noun *majoria* ‘majority’, which can also be used for expressing plurality.

(88) La majoria de la gent beu cervesa.
 the majority of the people drink beer
 ‘Most people are drinking beer.’

(89) La majoria de la gent beu CERVESA.
 the majority of the people drink beer_{focus}
 ‘The plurality of people is drinking beer.’

Catalan has the comparative adverb *més*, which can be used either alone (90) [Juarros-Daussà 1998], in adjective gradation (91), adverb gradation (92) [Batzarov 2006] or as a determiner (93).

(90) Ha
 has rained more in these three days which not has made sun in Barcelona
 plugut més en aquests tres dies que no ha fet
 than not in all the month
 sol a Barcelona que no en tot el mes.

‘It rained more in these three days that have not been sunny in Barcelona than in the v

(91) bonic, més bonic, el més bonic
 beautiful, more beautiful, the most beautiful

(92) lentament, més lentament, el més lentament
 slowly, more slowly, the most slowly

(93) Hi ha més gent jugant a volei que a ping-pong.
 PART has more people play on volleyball that on table-tennis
 ‘More people are playing volleyball than table tennis.’

The CD *més* cannot function as a superlative. If the comparison class (*que...*) is left out of (94), *més* behaves like Slovenian *več*, i.e. it gets the *several* reading.

(94) Hi ha més gent jugant a volei.
 PART has more people play on volleyball
 ‘Several people are playing volleyball.’
 not: ‘Most people are playing volleyball.’

Czech (P)

There is no DD in Czech [Janda and Townsend 2002].

In Czech, comparative adjectives are usually formed from the positive using suffix *-ější/-ejší*; superlative adjectives are formed from the comparative ones using the prefix *nej-*. Rarely graded adjectives are often graded analytically, using adverbs *více* ‘more’ and *nejvíce* ‘most’.

- (95) a. chytrý, chytřejší, nejchytřejší
 smart, smarter, the smartest
 b. dřevěný, více dřevěný, nejvíce dřevěný
 wooden, more wooden, the most wooden

The Czech SD is *nejvíc*. As shown below, it can only be used associated to focus, and it can only have the plurality reading. The majority is expressed using the noun *většina* ‘majority’.

- (96) a. Nejvíc lidí pije pivo.
 most people drink beer_{focus}
 ‘The plurality of people is drinking beer.’
 b. *Nejvíc lidí pije pivo.
 most people drink beer
 ‘Most people are drinking beer.’
- (97) Většina lidí pije pivo.
 majority people drink beer
 ‘Most people are drinking beer.’

Dutch (DMP)

In Dutch the DD is realized as an article. It agrees with the noun in gender, case and number. Its forms are given in (98). (Actually, only nominative is still used, and archaically also genitive. The other cases can only be found in set phrases and after certain prepositions, usually unverbized with the article.)

(98)

	sing.			pl.
	masc.	fem.	neut.	
nom.	de	de	het	de
gen.	des	der	des	der
dat.	den	der	den	den ³⁹
acc.	den	de	het	de

The Dutch SD is *meest*, cf. the adjective gradation. Adjectives are graded using suffixes *-er* and *-st*, (99). When the positive ends in *-st* or *-sch*, the adjective is graded analytically, *meest logisch* ‘the most logical’. Furthermore *meest* is a part of (irregular) paradigm *veel–meer–meest* ‘many–more–most’.

- (99) leuk, leuker, leukst
nice, nicer, the nicest

A translation of *majority* is the noun *meerderheid*, (100).

- (100) De meerderheid drinkt bier.
the majority drink beer
‘The majority is drinking beer.’

(101) and (102) show the majority and the plurality reading of *meest*, respectively.

- (101) De meeste mensen drinken bier.
the most-NOM.PL. people-NOM.PL. drink beer
‘Most people are drinking beer.’
- (102) De meeste mensen drinken BIER.
the most-NOM.PL. people-NOM.PL. drink beer_{focus}
‘The plurality of people is drinking beer.’

English (DM, DMP)

We know that English has the definite article *the* and the SD *most*, which has the majority reading. In Standard English *most* cannot have the plurality reading. However, for some speakers this can happen: they can use *the most* as a PSD (103) and as an adverb with the plurality reading (104).⁴⁰

- (103) The most people are drinking beer.
‘The plurality of people are drinking beer.’
- (104) Beer was drunk the most.
‘The largest group of drinkers was drinking beer.’

³⁹The alternative form of the definite article for dat. pl. fem. is *der*.

⁴⁰I thank an anonymous reviewer of my abstract for FDSL 6.5 for telling me about this fact. I have double-checked the information with one of my informants; Google search also confirms it, search string “the most men”.

German (DMP, DM)

In German the DD is realized as an article. It agrees with the noun in gender, case and number. Its forms are given in (105).

(105)	sing.			pl.
	masc.	fem.	neut.	
nom.	der	das	die	die
gen.	des	des	der	der
dat.	dem	dem	der	den
acc.	den	das	die	die

The German SD is *die meisten*. This is confirmed by morphosyntactic similarity to adjective gradation. (Actually, morphologically *meisten* behaves like an adjective.)

The adjective gradation in German uses suffixes *-er* and *-st*, see (106). Following the definite article, the weak declination of adjectives is used: in nom. pl. this means the suffix *-en*, see (107). In German, *meisten* is always used following the definite article. Its morphological structure is therefore expected (assuming it contains the superlative morpheme, of course), *meist-en*.

(106) schön, schöner, der schönste
beautiful, more beautiful, the most beautiful

(107) die **schönsten** Lieder ‘the most beautiful songs’

Majority is translated as the noun *die Mehrheit* (also *die Mehrzahl* and *der Grossteil*).

Die meisten has both the majority (108) and the plurality (109) reading.

(108) Die meisten Leute trinken Bier.
the most people drink beer
‘Most people are drinking beer.’

(109) Die meisten Leute trinken BIER.
the most people drink beer_{focus}
‘The plurality of people is drinking beer.’

The above data is valid for both Standard and (Vienna) Austrian German. The Swiss German is more restrictive: it disallows the plurality reading⁴¹ regardless of whether the sentence contains a focus or not—see (110).

⁴¹My informant feels that the sentences with *meischt-* sound somewhat formal and that they are the most acceptable when the speaker is a part of the majority under discussion.

- (110) a. Di meischte vo üs trinket pier.
 the most of us drink beer
 ‘Most people are drinking beer.’
 b. Di meischte vo üs trinket PIER.
 the most of us drink beer_{focus}
 ‘Most people are drinking beer.’

Hebrew (D)

In Hebrew the DD is realized as an article *ha*; (111).

Hebrew has no SD (neither with the majority nor with the plurality reading).⁴² (The same is true for Biblical Hebrew.) The majority is expressed using the noun *rov* ‘majority’, (111).

- (111) Rov ha-anašim šotim bira.
 majority the-men drink beer
 ‘The majority of men drink beer.’

The comparative adjectives are formed analytically in Hebrew, using *haxi*,⁴³ which can also be used as an adverb [Heller 1999]. However, morpheme *haxi* is not a part of any determiner.⁴⁴

- (112) ha- baxura haxi cefira
 the girl most- young
 ‘the youngest girl’

The simplest way of expressing the majority in Swiss German is using the paraphrase *more than half*, as can be seen from (i).

- (i) Me als d hälfti vo de lüt trink(e)t bier.
 more than the half of the people drink beer
 ‘Most people are drinking beer.’

These constraints of the usage of the SD do not influence the correctness of the prediction, since the use of an MSD requires the legitimacy of the definiteness pattern.

⁴²Also, Hebrew has no CD, i.e. a determiner corresponding to the English *more*.

⁴³In Biblical Hebrew superlative adjectives were formed with a zero morpheme. Only the definite article was present at the surface, (i), [Matushansky 2007].

- (i) ha- gadol ba- olam
 the big in+the world
 ‘the biggest in the world’

⁴⁴It is conceivable that *haxi* consists of the definiteness morpheme *ha* and superlative morpheme *xi*. However, it is again the case that *xi* is not a part of any determiner.

- (113) Rut haxi ohevet et acma
 Ruth most loves ACC self
 ‘Ruth loves herself the most.’

Hindi (MP?)

Hindi has no DD. [Wikipedia 2006b]

(114) shows the usage of the determiner *zyādā* ‘many, more’. We can see this is not a noun, since it cannot be used on its own, (115).

- (114) bans se zyādā log bir pirhete
 five of more people beer drink
 ‘More than five people drink beer.’
- (115) * zyādā bir pirhete
 more beer drink

Using the suffix *-tar* the superlative determiner/adverb *zyādātar* ‘most’ is formed. *zyādātar* has the plurality reading, (116a)–(116c). Surprisingly, however, it can also have the majority reading, (117).⁴⁵

- (116) a. log zyādātar bir pirhete
 people most beer drank
 ‘The plurality of people were drinking beer.’
- b. zyādātar log BIR pirhete
 most people beer drank
 ‘The plurality of people were drinking beer.’
- c. zyādātar bir pijagaja
 most beer was-drunk
 ‘Beer was drunk the most.’
- (117) zyādātar log bir pirhete
 most people beer drank
 ‘Most people were drinking beer.’

It is not entirely clear what is a superlative morpheme in Hindi. One of the means of adjective gradation is using *zyādā*: the comparative is formed using *zyādā* and the superlative using *sabsē zyādā* ‘more than every’ [prim. Wikipedia 2006b]. The meanings of the above examples and the comparison to adjective gradation seem to imply that the superlative morpheme is contained in *zyādā*, which can function both as CD and SD.

Majority translates to Hindi as noun *bahumad*.

⁴⁵For discussion see §2.3.2.

Hungarian (DMP)

In Hungarian the DD is realized as an article: as *a* in front of words beginning in a consonant and as *az* in front of words beginning in a vowel.

The CD is *több*; using the prefix *leg-* the SD *legtöbb* is derived. It is simple to provide a morphological argument for the two claims: *leg-* is also used to form the superlative adjectives from the comparative ones, see (118).

- (118) nagy, nagyobb, legnagyobb
big, bigger, the biggest

The conclusion that *több* is a CD is additionally backed up by its morphological similarity to suffix *-Vbb* (containing appropriate vowel, with respect to the vowel harmony) used to form comparative adjectives.

The SD has both the majority and the plurality reading. It is difficult to determine exact conditions on accessibility of both readings in examples (119)–(122)—it seems to change on speaker-to-speaker basis—so I leave it to further research.⁴⁶

- (119) A legtöbb diák tévét néz.
the most student TV watch-INDEF
'Most/[the plurality of] students are/is watching TV.'

- (120) A legtöbb diák néz tévét.
the most student watch-INDEF TV
'Most/[the plurality of] students are/is watching TV.'

- (121) A legtöbb diák nézi a tévét.
the most student watch-DEF TV
DOL največ študent gleda-DOL DOL televizijo

'Most/[the plurality of] students are/is watching TV.'

- (122) A legtöbb diák a tévét nézi.
the most student TV watch-DEF
'Most/[the plurality of] students are/is watching TV.'

Japanese (0)

Japanese has no DD. [Wikipedia 2006a]

⁴⁶Agreement by definiteness is active in Hungarian: the verb agrees with its direct object.

Japanese has no SD. The majority is expressed using the noun *hotondo*, (123)–(124). Both examples have the majority reading; the plurality reading seems impossible to express straightforwardly in Japanese.

- (123) Hotondo no hito ga tabeteiru.
majority of people NOM eat
‘Most people are eating.’
- (124) Hotondo no hito ga biiru wo nondeiru.
majority of people NOM beer ACC drink
‘Most people are drinking beer.’

We argue that *hotondo* is not a determiner based on the following: (i) it can be used on its own, i.e. without a complement introduced with *no*, (125); (ii) adjectives gradation uses adverbs *motto* and *ichiban*, see (126) [Wikipedia 2007], but there is no morphological similarity between these adverbs and *hotondo*.

- (125) Hotondo ga tabeteiru.
majority NOM eat
‘The majority is eating.’
- (126) utsukushii, motto utsukushii, ichiban utsukushii
beautiful, more beautiful, the most beautiful

The fact that Japanese has another word (*kahansu*; its morphological structure is transparent, *ka* ‘over’ + *hansu* ‘half’, but unproductive) translating as ‘majority’ might argue against the hypothesis that *hotondo* is noun. However, the counter-example cannot be valid, since the syntactic behaviour of *hotondo* and *kahansu* is the same.

The existence of a CD is unclear. My informant put forth (127) as the translation of the corresponding English sentence, but used an unexpectedly large amount of time to do this, which might point to a rare usage of the construction. Anyway, the comparison class cannot be omitted, therefore the CD, if it actually exists, cannot function as SD as well.

- (127) Onnanoko jori otokonoko no hoo ga biiru wo nondeiru.
girl as boy of more NOM beer ACC drink
‘More boys than girls are drinking beer.’

Kannada (0)

Kannada has no DD.

Kannada has no SDs (and CDs). It only seems to have comparative adjectives.

- (128) ivolu Nina-ge inta sundervage idale
 she nina-of than beautiful is
 ‘Ona je lepša od Nine.’
- (129) ivolu jellar-ge inta-nu sundervage idale
 she every-of than-? beautiful is
 ‘Ona je najlepša.’

Macedonian (DMP)

In Macedonian the DD is realized as a nominal suffix. Its form depends on the form of the noun, its gender and number. In singular, masculine nouns ending in a consonant use *-ot*; feminine nouns and all nouns ending in *-a* use *-ta*; the other nouns use *-to*.⁴⁷ In plural, nouns ending in *-a* use *-ta*, the others use *-te*. [Friedman 2001]

I claim that Macedonian has two SDs, *poveće* and *najmnogu*. (130) shows that *poveće* is used both as CD and SD. If the comparison class is explicitly given using *odkolku*, it functions as a comparative, otherwise as a superlative in the majority reading. The other SD, *najmnogu*, cannot be used as a comparative. As (131) shows, it only has the plurality reading.

- (130) a. Poveće maški pijat pivo odkolku ženski.
 more men drink beer than women
 ‘More men than women are drinking beer.’
- b. Poveće luđe pijat pivo.
 more people drink beer
 ‘Most people are drinking beer.’
- (131) Najmnogu od lugeto vo Slovenija se belci.
 most of people-the in Slovenia are white-people.
 ‘The plurality of people in Slovenia is white.’

In Macedonian, adjectives are graded using prefixes *po-* for comparative and *naj-* for superlative, (132). This confirms the analysis of *poveće* and *najmnogu* as comparative and superlative, respectively. It is only unusual that the base forms of the CD and SD are different.

- (132) nov, ponov, najnov
 new, newer, the newest
- (133) mnogu, poveće, najmnogu
 many, more, most

⁴⁷Symbols ġ and k̄ stand for voiced and voiceless palatal stop, respectively.

2.3 THE CROSS-LINGUISTIC PREDICTION

- a. *veke, poveke, *najveke
- b. mnogu, *pomnogu, najmnogu

Majority translates as noun *mnozinstvo*.

(130) illustrates the usage of *poveke* with an indefinite complement. It can, however, also take a definite complement, (134), but its definite form *poveketo* must be used.

- (134) a. Poveketo od lugeto pijat pivo odkolku vino.
more-the of people-the drink beer than wine
'More people are drinking beer than wine.'
- b. Poveketo od lugeto pijat pivo.
more-the of people-the drink beer
'Most people are drinking beer.'

Similarly, *najmnogu* can also be used both with definite (131) and indefinite (135) complement.

- (135) Maglata predizvikuva najmnogu soobračajni nesreki.
fog causes most traffic accidents

'The plurality of traffic accidents is caused by the fog.'

In a single sentence, *poveke*, but not *najmnogu*, can be used twice, (136).

- (136) a. *Najmnogu od lugeto vo najmnogu zemji se
most of people in most countries are
belci.
white-people
- b. Poveketo od lugeto vo poveketo zemji se belci.
most of people in most countries are white-people
'Most people in most countries are white-people.'
- c. Najmnogu od lugeto vo poveketo zemji se belci.
most of people in most countries are white-people
'The plurality of people in most countries are white-people.'

Mandarin Chinese (0)

Chinese has no DD.

The majority can only be expressed using the noun *da-duo-shu* 'majority'. The plurality reading is expressed using the construction in (138). The position of *zui-duo* seems to imply it is not a determiner but an adverb.

2.3 THE CROSS-LINGUISTIC PREDICTION

- (137) Da-duo-shu ren dou he pijiu.
 majority people all drink beer
 ‘Most people are drinking beer.’
- (138) He pijiu de ren zui-duo.
 drink beer PART people most
 ‘The plurality of people is drinking beer.’

Norwegian (bokmål) (DMP)

In Norwegian, the DD is realized as an article or a suffix. It agrees with the noun in gender and number, see (139).

(139)		sing.		pl.
	masc.	fem.	neut.	
	den	den	det	de

Adjective gradation is either synthetic or analytic, see (140).

- (140) a. vakker, vakrere, vakrest
 beautiful, more beautiful, the most beautiful
- b. komplisert, mer komplisert, mest komplisert
 complicated, more complicated, the most complicated

The Norwegian SD is *flest*, as can be seen from its morphological similarity to the superlative morpheme used in adjective gradation. The CD *flere* also exhibits morphological similarity. The noun *majority* translates as *majoritet*.

- (141) Majoriteten stemte for Slovenias selvstendighet.
 majority-def voted for Slovenian independence
 ‘The majority voted for Slovenian independence.’

Flest can have both the majority (142) and the plurality (143) reading.

- (142) a. De fleste drikker.
 the most drink
 ‘Most of them are drinking.’
- b. De fleste studenter drikker.
 the most students drink
 ‘Most students are drinking.’
- (143) De fleste drikker ØL.
 the most drink beer_{focus}
 ‘The plurality of them is drinking beer.’

Polish (P)

Polish has no DD. [cf. Feldstein 2001]

The comparative adjectives are formed from positives synthetically using suffix *-(ej)sz*, or analytically using adverb *bardziej*. The superlative adjectives are formed synthetically from comparatives with prefix *naj-*, or analytically from positives using adverb *najbardziej*.

- (144) a. prosty, prostszy, najprostszy
simple, more simple, the most simple
b. interesujący, bardziej interesujący, najbardziej interesujący
interesting, more interesting, the most interesting

The comparison with the adjective gradation makes it clear that *najwięcej* is the Polish SD. The examples below show that it is grammatical only when used in association with focus, having the plurality reading. It cannot have the majority reading, which is expressed using the noun *większość* ‘majority’.

- (145) a. Najwięcej ludzi piło piwo.
most people drank beer_{focus}
‘The plurality of people was drinking beer.’
b. *Najwięcej ludzi piło piwo.
most people drank beer
‘Most people were drinking beer.’
- (146) Większość ludzi piła piwo.
majority people drank beer
‘Most people were drinking beer.’

Punjabi (P)

Punjabi has no DD. [cf. Bhatia 1993:218–9]

There is no special morphological form for superlative adjectives in Punjabi. [Bhatia 1993:273]

It seems that the CD and the SD are the same, *ziaadaa*. The sentence with *ziaadaa* has the superlative reading when the comparison class is not explicitly given. The resulting reading can only be the plurality reading.

- (147) VAALAA aadmii nüü ziaadaa kette milii.
this man to more votes got
‘This man got the plurality of the votes.’

Romanian (DMP)

In Romanian, the DD is realized as a suffix, for realization see (148).

(148)	masc. (and neut.)		fem.	
	sing.	pl.	sing.	pl.
nom./acc.	-(u)l	-i	-a	-le
gen./dat.	-lui	-lor	-ei	-lor

Comparative adjectives are formed using the adverb *mai* in front of the positive; superlative adjectives are formed by putting (the appropriate form of, with respect to gender and number) *cel/cea/cei/cele* in front of the comparative.

- (149) frumos, mai frumos, cel mai frumos
 beautiful, more beautiful, the most beautiful

The comparison with adjective gradation leaves no doubt that *cei mai multi* in (150) is an SD. It can have both the majority and the plurality reading. The noun *majoritatea* ‘majority’ also exists, (151).

- (150) Cei mai multi oameni beau bere.
 most people drink beer
 ‘Most people are drinking beer. / The plurality of people is drinking beer.’
- (151) Majoritatea oamenilor beau bere.
 majority people-GEN drink beer
 ‘Most people are drinking beer.’

Serbian (P)

Serbian has no DD. [Brown and Alt 2004]

The comparison with adjective gradation makes it clear that *najviše* is the SD. It can only be used in association with focus, and can only have the plurality reading. In Serbian, the majority is expressed using the noun *većina* ‘majority’.

- (152) loš, lošiji, najlošiji
 bad, worse, the worst
- (153) a. Najviše ljudi pije PIVO.
 most people drink beer_{focus}
 ‘The plurality of people is drinking beer.’

- b. *Najviše ljudi pije pivo.
most people drink beer
'Most people are drinking beer.'
- (154) Većina ljudi pije pivo.
majority people drink beer
'Most people are drinking beer.'

Tamil (0)

Tamil has no DDs. [Wikipedia 2006a].

Tamil has no comparatives and superlatives at all (as a special morphological form).

Turkish (P)

Despite popular opinion⁴⁸ it is not the case that in Turkish the definiteness is an active syntactic category. It is true, however, that specificity is active in Turkish, and specificity is often confused with definiteness [cf. also Lyons 1999: 50].

The object introduced by the indefinite article *bir* with nominal complement marked by the accusative suffix *-u* is interpreted as specific. Whereas in (155a), the speaker seeks any doctor (i.e. he has no specific doctor in mind), in (155b) the speaker seeks a specific doctor (which the hearer might not know, or whose identity the speaker does not want to reveal).

Similarly as in Slovenian, a sentence without an indefinite article, (155c), is used to translate the English sentence with the definite article—however, not because definiteness is a syntactic category in Turkish, but since definite DPs are often interpreted as specific in English. Sentences containing a bare nominal object (*doktor*), with no indefinite article or accusative suffix, are analyzed as noun incorporation [Aygen-Tosun 1999].

- (155) a. Bir doktor ar-ıy-or-um.
some doctor seek-PROG-1SG
'I seek a doctor (non-specific).'
- b. Bir doktor-u ar-ıy-or-um.
some doctor-ACC seek-PROG-1SG
'I seek a doctor (specific).'

⁴⁸Most internet sources for learning Turkish claim that in Turkish definiteness is a active syntactic category, which can be realized on the object (not subject) using the so-called definite-accusative case [Wikipedia 2006e].

- c. Doktor-u ar-iyor-um.
 doctor-ACC seek-PROG-1SG
 ‘I seek the doctor.’

Adjective gradation used *daha* to form the comparative and *en* to form the superlative, (156).

- (156) güzel, daha güzel, en güzel
 beautiful, more beautiful, the most beautiful

Daha and *en* can be merged with noun phrases using *çok* ‘many’. So, the CD and the SD are *daha çok* and *en çok*, respectively. The sentence containing the SD, (157), has only the plurality reading.

- (157) İnsan-lar en çok bira iç-iyor-ø.
 man-PL SUPERLATIVE a-lot beer drink-PROG-3PL
 ‘The plurality of people is drinking beer.’

The majority is expressed using the noun *çok* ‘majority’. I argue that in (158) *çok* is a noun, by observing that it is marked with a possessive suffix.

- (158) İnsan-lar-ın çoğ-u bira iç-iyor-ø.
 man-PL-GEN a-lot-POSS beer drink-PROG-3PL
 ‘Most people are drinking beer.’

2.3.2 The discussion

The data from the previous subsection is summarized in table (159) on the next page.⁴⁹ Our cross-linguistic claims that languages of the types (M) and (MP) do not exist.

The only language that I have investigated and does not conform to the prediction is Hindi. I was able to consult only one speaker of Hindi, that was trilingual (Kannada–English–Hindi). Besides being able to use the SD in the majority reading in Hindi, that has no DD, he is among those speakers who can use *the most* as a PSD in English (see subsection on English). Therefore I guess that this is a case of interference between his native tongues. Unfortunately, I was unable to get the Hindi data from another source.

Table (159) reveals another, non-predicted generalization: there are no languages of the type (DP), i.e. a language cannot have a DD and a PSD without also having an MSD. This generalization will be predicted by the syntactic and semantic analysis in chapter 5.

⁴⁹D stands for the definite determiner (DD), M for majority superlative determiner (MSD) and P for plurality superlative determiner (PSD).

(159) language			
Catalan	D	-	-
Czech	-	-	P
Dutch	D	M	P
English	D(D)	M(SD)	P(SD)
German	D	M	(P)
Hebrew	D	-	-
Hindi	-	M?	P
Hungarian	D	M	P
Japanese	-	-	-
Kannada	-	-	-
Macedonian	D	M	P
Mandarin Chinese	-	-	-
Norwegian	D	M	P
Polish	-	-	P
Punjabi	-	-	P
Romanian	D	M	P
Serbian	-	-	P
Slovenian	-	-	P
Tamil	-	-	-
Turkish	-	-	P

2.4 The Slovenian corpus data

I have verified the usage of the Slovenian SD *največ* using corpus ELAN [Erjavec 2002]. *Največ* is always used in the plurality reading; *večina* ‘majority’ is used to express majority.

The only counter-example seems to be presented by (160g), where the (clearly) focused predicate *avstrijsko* ‘Austrian’ has only one alternative, *velikonemško*; the sentence, however, contains *največ* as an adverb. I assume that the counter-example is due to the repetition-avoidance strategy. Close to the adverb *največ*, a manner adverbial phrase *z neznatno večino* ‘by slight majority’ is used. It seems that the author of the text wanted to avoid the repetition of *večina* and rather used the adverb *največ* in a context where only one alternative to the focus is available. It is important to note that this alternative is explicitly given, which is uncommon with the majority reading and therefore hints that this is actually the plurality reading. In a nutshell, in (160g) *največ* has the plurality reading and therefore does not falsify the prediction; the sentence is nevertheless unusual, since the requirement that the focus has more than one alternative had to be loosened.

- (160) a. Največ površinskih vodotokov je prekomerno onesnaženih (29% v 3. in 4. razredu), pri čemer se onesnaževanje širi v povirja rek. (ekol.sl.183)
- b. K emisiji SO₂ največ prispeva elektroenergetika (81%), k emisiji NO_x pa promet (66%). (ekol.sl.203)
- c. V preteklosti je bila v Sloveniji ena največjih težav onesnaženost zraka, ki je ogrožala nekaj nad 40% prebivalcev in močno pripomogla k obsežnemu propadanju gozdov. (ekol.sl.428)
- č. Znotraj posameznih industrijskih panog potekajo različni programi varnosti pred nevarnimi kemijskimi snovmi, največ na področju kemične, farmacevtske in gumarske industrije.
- d. “Seveda odpravljamo največ glagole in pridevnike, pa tudi samostalnikov se lahko znebiš na stotine.” (Osl.1.6.24.2)
- e. Največ težav sestavljali novoreškega slovarja niso imeli z izumljanjem novih besed, temveč s tem, da so se, potem ko so jih izumili, prepričali, kaj pomenijo; se pravi, da so preverili, kolikšen obseg izrazov so s svojim obstojem razveljavile. (Osl.4.14.9)
- f. Največ (99%) ga je v kosteh in zobeh, kjer zagotavlja njihovo trdnost (oporni kalcij), preostali kalcij pa je v celicah mehkih tkiv (mišičje, živčevje, druge celice) in krvi. (vade.sl.883)
- g. ? dva volilna okraja poslancev sploh nista izvolila, v nekaterih pa so bili z neznatno večino izvoljeni največ avstrijsko (ne pa velikonemško) usmerjeni poslanci. (parl.sl.332)
- ‘two districts have not elected the members of the parliament at all, and in some districts Austrian (and not German) oriented members were elected by slight majority’
- (161) a. V občinah se večinoma (60% občin) z varstvom okolja ukvarja nekdo, ki ima hkrati še druge naloge, enega ali več zaposlenih izključno za področje okolja pa ima le 14% občin. (ekol.sl.1511)
- b. Pravice enega, skupine, dela ali celo večine družbe, ne da bi upoštevali in spoštovali pravice in svoboščine drugih, tudi manjšin, etničnih ali drugačnih, lahko ogrozijo pravice vseh in svobodo samo. (kuca.sl.375)
- c. za potrebe priprave primerjalnih analiz in usklajevanja obveznosti Slovenije do tretjih držav z obveznostmi, ki jih ima do tretjih držav EU, bo treba prevesti slovenske predpise (sporazume, dogovore, izjave, deklaracije, zakone, podzakonske akte) v enega od jezikov Skupnosti (večinoma v angleški jezik). (ekon.sl.175)

- č. V veliki večini primerov ni bilo ne procesov ne poročil o aretaciji. (Osl.1.2.42.3)
- d. Večina gradiva, s katerim si se ukvarjal, ni bila v nobeni zvezi s stvarnim svetom, niti toliko ne, kot je z resnico povezana neposredna laž. (Osl.1.5.10.3)
- e. Zakon je sprejet z večino opredeljenih glasov navzočih poslancev, kadar ni z ustavo ali z zakonom predpisana drugačna (npr. dvotretjinska) večina za sprejem zakona. (parl.sl.183)
- f. Predlog je na referendumu sprejet, če zanj glasuje večina volivcev, ki so glasovali. (parl.sl.234)
- g. Razsodniki odločajo z večino glasov. (spor.sl.888)
- h. Državni zbor sprejema zakone in druge odločitve ter ratificira mednarodne pogodbe z večino opredeljenih glasov navzočih poslancev, kadar ni z ustavo ali z zakonom določena drugačna večina. (usta.sl.382)
- i. Sprememba ustave je na referendumu sprejeta, če zanjo glasuje večina volilcev, ki so glasovali, pod pogojem, da se glasovanja udeleži večina vseh volilcev. (usta.sl.800)
- j. Svet lahko s kvalificirano večino sklep Komisije potrди, spremeni ali razveljavi. (vino.sl.345)

2.5 Conclusion

This chapter has illustrated two readings that superlative determiners (SDs) can have: the majority reading (more than half) and the plurality reading (the largest group, where focusing directs the partitioning). (Also, SDs have the non-superlative reading in some languages.) Based on the semantic analysis of definite determiners (DDs) and SDs the cross-linguistic prediction (162) was given. The cross-linguistic data in §2.3.1 and Slovenian corpus data in §2.4 confirm the prediction.

(162) If a language has an MSD it also has a DD.

Chapter 3

Syntax and semantics

This chapter provides a theoretical motivation of some properties of the syntax–semantics interface. The motivation is based upon the finding of modern cognitive science that the mind is a modular system.

This thesis belongs to the framework of generative linguistics. The birth of generative grammar is usually taken to be marked by the publication of Chomsky [1957]. The theory went through a lot of changes in the fifty years of its existence, main milestones being the *Government and Binding Theory* in the 80s and the *Minimalist Program (minimalism)* in the 90s,⁵⁰ to which this dissertation tries to contribute.

The Minimalist Program is primarily a theory of syntax. However, this dissertation deals mainly with semantics, or, more specifically, formal semantics. In this chapter I will illustrate the kind of challenges are met when trying to combine contemporary theories of formal semantics with the Minimalist Program. (As far as I can see, most semanticists are not aware of these problems, or ignore them.)

The structure of the chapter is as follows. §3.1 provides some basics of the standard minimalism. §3.2 makes explicit the adjustments to the architecture of the standard minimalism that have to be made if it is to be combined with the contemporary theories of formal semantics. §3.3 argues that the modified architecture is untenable, since it is incompatible with certain results of cognitive science. Specifically, it is incompatible with the view that the mind is a modular system. §3.4 concludes the chapter.

⁵⁰For a detailed view on historical development of the generative grammar see e.g. Belletti and Rizzi [2002].

3.1 Standard minimalism

§3.1.1 introduces the basic philosophy of the Minimalist Program, a philosophy I do not wish to steer away from in the thesis. §3.1.2 introduces the architecture of the standard minimalism, which regulates the distribution of the linguistic processing between the components of the mind's computational system. §3.1.3 describes the standard minimalism's X-bar theory. §3.1.4 introduces the so-called cartography of syntactic structures.

3.1.1 The substantive minimalism

The essence of the Minimalist Program are two kinds of minimalism: methodological and substantive. The methodological minimalism, more commonly known as Ockham's razor, is common to all sciences; it is methodologically important, since it is derivable from falsifiability [Popper 1998]. Being minimalist in the methodological sense means to try explaining as much as possible using the smallest theoretical apparatus possible. In the generative grammar this was manifested as a (radical) reformulation of the Government and Binding Theory. The methodological minimalism should not be mistaken for the *substantive minimalism* which is a hypothesis about the nature of the language faculty, explained below, following Chomsky [2002].

In the generative linguistics it is assumed that there is a part of the human mind, called the *language faculty (FL)*, dedicated to forming and parsing natural language expressions. The FL of every individual is, to a certain extent, genetically determined. The generative linguists assume that genetically determined aspects of the FL of healthy individuals are the same, and call their abstraction the *universal grammar (UG)*.

The main arguments for the existence of UG come from language acquisition. A child acquires the language of his or her social environment regardless of which language that is or what race or nation the child belongs to. The only input to the biological language acquisition program is language data that the child receives from the social environment. Specifically, the acquisition program has no access to negative data [Uriagereka 1998].⁵¹ If children were *tabula rasa* when they start acquiring language, it would be impossible to explain why some sentences are judged to be ungrammatical. For example, the question-formation rule (roughly, for an object: change the object to

⁵¹The positive data provides information that some linguistic expression is acceptable. Typically, an utterance is a piece of positive data. The opposite of positive data is negative data, which is provided by some (but few) parents trying to correct their children's grammatical mistakes. Research of language acquisition shows quite clearly that children do not use negative data when they acquire language.

the question word *kaj* ‘what’, and move it to the beginning of the sentence) cannot target the object in the relative clause, see (163)–(165). How can a child learn this pattern if he or she had no access to negative data? The only possibility seems to be that the relevant knowledge is innate, i.e. that the principle(s) responsible for the ungrammaticality of (165b) is a part of the UG. (Of course, the principles involved are abstract and its principles can be detected in many places. Specifically, a crucial principle involved in (165b) is probably Relativized Minimality [Rizzi 1990].)

- (163) a. Herman je nekaj vprašal.
Herman is something asked
‘Herman asked something.’
b. Kaj je vprašal Herman?
what is asked Herman
‘What did Herman ask?’
- (164) a. Misliš, da je Herman nekaj vprašal.
think that is Herman something asked
‘You think that Herman asked something.’
b. Kaj misliš, da je Herman vprašal?
what think that is Herman asked
‘What do you think Herman asked?’
- (165) a. Vidiš človeka, ki ga je Herman nekaj vprašal.
see man who him is Herman something asked
‘You see the man who Herman asked something.’
b. *Kaj vidiš človeka, ki ga je Herman vprašal?
what see men who him is Herman asked
‘What do you see the man who did Herman ask?’

The FL is a specialized system⁵² of the mind, and it’s obviously connected to other systems of the mind. The connection is only possible if there is a way for different systems to communicate. In the standard minimalism, the traditional observation that language is a pairing of sound and meaning is paraphrased as the claim that the FL is connected to two systems of the mind: the conceptual–intentional system (CI), and the articulatory–perceptual system (AP). The FL communicates with CI and AP through the *logical form*

⁵²I use the term system in its common sense, not in a technical vocabulary of some theory of the mind. The same goes for the term component, which is use when I wish to emphasize that some system is a part of some larger system.

(*LF*) and *phonetic form (PF)*, often called the interface levels.⁵³ The weakest possible condition on an interface level is the legibility of the expressions at the level, i.e. the two interfacing systems must be able to “read” and “understand” the expressions at the level; thus, these conditions are usually called *legibility conditions*.

We are now ready to formalize the main question of the substantive minimalism. We want to know, to what extent the FL is a “good solution” to the legibility conditions. Chomsky emphasizes that this question, which until very recently we have not even been able to ask, might have a surprising answer. The minimalist research indicates that the FL might be optimal in this way. Specifically, it is quite probable that the FL is a natural consequence of the legibility conditions.

Let me give an old Chomsky’s comparison. A flying fish jumping out of the water needs no special internal mechanism to get back. Similarly, the mind needs no special mechanism to solve the legibility conditions. Both are helped by the nature: the gravity makes the flying fish fall back into the water; the legibility conditions are satisfied by virtue of interaction of various natural laws in the complex environment of the human brain. So the flying fish’s “ability” to fall back into the water is not a direct consequence of the natural selection: when the flying fish developed the ability to jump out of the water, it also automatically got the “ability” to fall back into it. Similarly, the FL is not a direct consequence of natural selection, the idea being that something⁵⁴ had developed by natural selection, which caused the “automatic creation of the missing pieces of the FL”. As a consequence, we expect FL to be a “clean” system, having no “unnecessary luggage” characteristic for the development by means of natural selection.⁵⁵

⁵³I understand the term level to be basically synonymous to the mathematical term space. A level is defined by determining the kind of (cognitive) objects can be its members. While I consider systems to be psychologically real, i.e. a part of the mind, I do not claim this for levels: these are simply linguistic constructs. So, the term level does not imply processing: nothing is “happening” in a level, since it is only a set of conditions on some form. Cf. to the (*mental*) *lexicon*, which is a part of the mind, but (as a level) static. There is nothing happening in the lexicon—by definition, since it’s only storage of information. (The theories claiming the opposite, actually implicitly assume the existence of some other system of the mind.)

⁵⁴In Živanović [2004] I argue that the final major step in the development of language by means of natural selection was the development of (some part of) the phonological system (maybe autosegmentality).

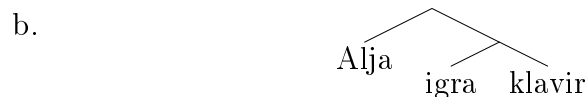
⁵⁵Natural selection builds on currently present material; it selects for mutations having immediate reproductive advantage. Metaphorically speaking, the development by natural selection cannot start shaping an organ with its final function in mind, so the morphological structure of an organ is by necessity a collection of phenotypical expressions of random mutations causing reproductive advantages in different stages of the species’ development.

3.1.2 The architecture

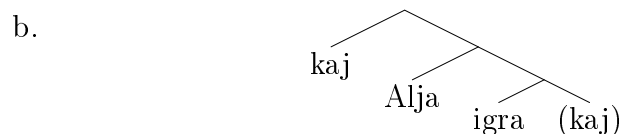
Standard minimalism [Chomsky 1995] assumes that the FL is *derivational*.⁵⁶ the construction of a linguistic expression from lexical items is a step-by-step process.

Let us introduce some details in generating a linguistic expression (based on Chomsky [1995] and Ilc [2004]). The generation of a linguistic expression starts by a one-time selection of lexical items to an *enumeration*. The mission of the FL is to map the enumeration to a pair of expressions (π, λ) , where π and λ are an PF and an LF expression. To achieve the mission, the linguistic computational system recursively builds new syntactic expressions from the lexical items in the enumeration and previously built syntactic expressions. It does this using three operations: *Select*, which transfers a lexical item from the enumeration to the set of the built syntactic expressions; *Merge*, which combines two syntactic expressions; and *Move*, which move a part of a syntactic expression to a hierarchically higher position.⁵⁷ These operations are illustrated by building the sentences in (166)–(167).

- (166) a. Alja igra klavir.
Alja plays piano
'Alja is playing the piano.'



- (167) a. Kaj Alja igra?
what Alja plays
'What is Alja playing?'



Simplified, when the linguistic computational system builds (166a), it first selects lexical items *igra* and *klavir* from the enumeration, and merges

Example: the structure of wings. Wings had been developed at least four independent times: at insects, pterodactyls, birds and bats. The details of their morphological structure are different, although their primary function is the same. [Wikipedia 2006f]

⁵⁶The opposite to derivational is *representational*. In derivational theories the generative procedure may be constrained, in representational theories only the resulting expression can be constrained.

⁵⁷Move can be thought of as a subspecies of Merge, i.e. internal Merge [Chomsky 2001, Starke 2001, Kracht 2001]. The operation of internal Merge operates (again) on some syntactic expression α embedded in some larger expression. Specifically, α can be remerged to the root of this larger expression.

them into a VP *igra klavir*. Next, it selects lexical item *Alja* and forms the sentence *Alja igra klavir* by merging this lexical item and previously build VP. The derivation of the question (167a) is the same up to the point of building the constituent *Alja igra kaj* ‘Alja plays what’, but the derivation is not finished at this point. The object *kaj* is moved to a hierarchically higher position in the sentence causing a change in the word order (*Kaj Alja igra* ‘what Alja plays’).

The operations Select, Merge and Move are repeated until the enumeration is empty and all built syntactic expressions are combined in a single expression. The part of the linguistic computational system doing this work is called the *syntactic component*. At a certain point in the operation of the syntactic component a *Spell-Out* occurs. Suppose that when Spell-Out occurs, the expression Σ has been built. Spell-Out creates Σ_L from Σ by removing from Σ all elements which are relevant only for formation of π . The syntactic component continues its work, but using Σ_L instead of Σ . The final product of the syntactic component, i.e. an LF expression, is called λ . The original expression arriving to the Spell-Out, Σ , is mapped into a PF expression π by the *phonological component* of the linguistic computational system. It is important to note that the phonological component radically differs from the syntactic component. The parts of the syntactic component leading from the enumeration to the Spell-Out, and from Spell-Out to LF are often called *overt syntax* and *covert syntax*, respectively.⁵⁸ It λ and π are of an appropriate form, i.e. if the CI and AP can interpret them, we say that the derivation *converges*; otherwise, it *crashes*.

The architecture of the minimalist program is shown in figure 3.1. (The interface points of the FL with CI and AP are also shown.)

The arthitecture of the standard minimalist program is similar to the architecture of its predecessor, the Government and Binding theory (GB), shown in figure 3.2. The two-part road leading from *Deep Structure* (DS) through *Surface Structure* (SS) to the Logical Form (LF) was replaced by a uniform computational system, where Spell-Out occurs at a certain point. The main difference between both architectures is not in the way how the linguistic expressions are generated, but in the fact that in minimalism, one cannot set constraints to the expressions in the enumeration and at Spell-Out. In GB there were requirements on expressions holding at DS and SS.

⁵⁸While overt syntax includes Select, Merge and Move, only Move is a part of covert syntax. The other two operations cannot apply, because using them would add phonological information in the expression intended to be interpreted by CI, violating the legibility condition at the LF. Consequently, since meaning interpretation can be performed only on a single expression, the Spell-Out can occur only after all syntactic expressions are combined into a single one.

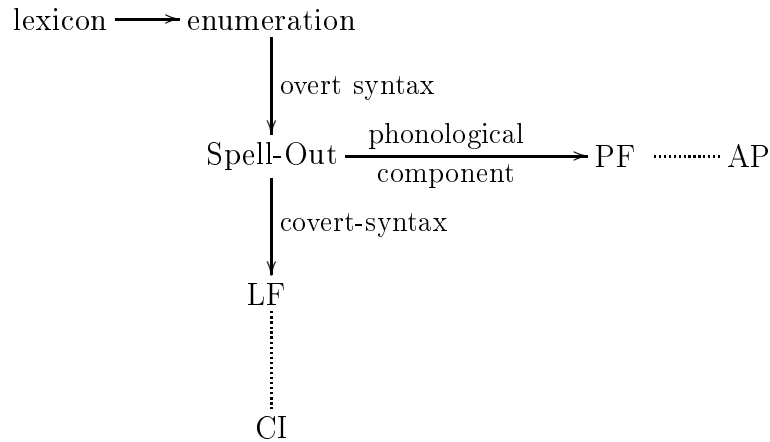


Figure 3.1: The architecture of the minimalist program

For example, expressions at DS had to conform to the theta-theory, and at SS the Case Filter applied. In the Minimalist Program, for reasons of substantive minimalism, only conditions on expressions appearing at LF and PF may be set.

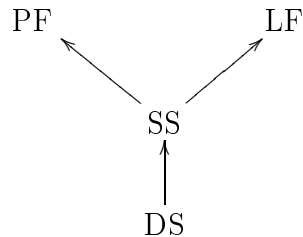


Figure 3.2: The architecture of the Government and Binding Theory

3.1.3 X-bar theory

The most basic syntactic operation is *Merge*. X-bar theory determines its properties, thus prescribing the form of syntactic expressions. I introduce the X-bar theory of the Standard Minimalism roughly following Chomsky [1995:241–9].

Merge creates a new syntactic expression by combining two existing ones. A crucial insight of the generative grammar is that the complex expressions are *endocentric*: the properties of the complex are the same as the properties of one of its constituents, called the *head* of the complex expression.

The formal definition follows. Every syntactic expression α has the *head* $H(\alpha)$ and the *label*. Its label equals its head. The head of α in the enumeration is α itself, i.e. $H(\alpha) = \alpha$.

From syntactic expressions α and β , Merge forms the expression $K = \{\gamma, \{\alpha, \beta\}\}$, where γ is the label of K . γ equals the label of one of the constituents α and β : the one that is the head of K . It is also said that this constituent *projects*; K is called the *projection* of the head. The other, non-projecting constituent is called the *complement*.⁵⁹ If α is the head, then $K = \{\alpha, \{\alpha, \beta\}\}$, α projects an object labeled α , β is the complement. K is graphically represented in (168).

$$(168) \quad \begin{array}{c} \alpha \\ \wedge \\ \alpha \quad \beta \end{array}$$

Assume that K is further merged to δ and that α is the head, as in (169). δ is then called a *specifier*.^{60,61}

$$(169) \quad \begin{array}{c} \alpha \\ \wedge \\ \delta \quad \alpha \\ \quad \wedge \\ \quad \alpha \quad \beta \end{array}$$

Every syntactic expression belongs to a certain syntactic *category* (noun (N), verb (V), adjective (A), preposition (P), complementizer (C), etc.). It is a part of the GB's heritage that, in graphical representation, nodes are not labeled with the head but with the category. In (168), if α 's category is V, and β 's category is N, then (168) is informally represented as (170).

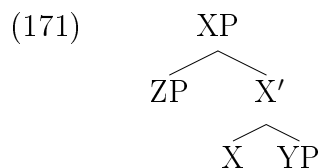
$$(170) \quad \begin{array}{c} V \\ \wedge \\ V \quad N \end{array}$$

An expression X labeled α that is not a projection of an expression having the same label, is called a *minimal projection*, X^0 . An expression X labeled α that does not project an expression having the same label, is called a *maximal projection*, XP (also a *(word) phrase*). An expression X, which is neither minimal nor maximal projection, is called an *intermediate projection*, X' . See (171).

⁵⁹We will use the terms the complement of the head and the complement of the projection as synonymous.

⁶⁰We will use the terms the specifier of the head and the specifier of the projection as synonymous.

⁶¹In this thesis, the adjunction is not used and therefore won't be formally defined. Also, we shall not define the distinction between X^{\min} and X^0 , since it is based on the head adjunction.



We shall skip further technical details of the Standard Minimalism.⁶² For further information see e.g. Adger [2003], Radford [1997], Chomsky [1995].

3.1.4 The cartography of syntactic expressions

Generative grammar distinguishes two types of syntactic categories: heads belonging to *lexical* categories, such as verb, noun or adjective, have substantive meaning; heads belonging to *functional* categories don't have substantive meaning [Golden 2001]. The generative view of syntactic structure of linguistic expressions differs from the traditional view. The latter claim that lexical categories are the heads of phrases, e.g. verb is the head of a sentence: a sentence is formed by »words surrounding a finite verb« [Toporišič 2000:555]. On contrary, the Minimalism claims that, universally, a head of a typical sentence is a complementizer (C), which is a functional category.⁶³

So, a sentence is a complementizer phrase (CP), whose head is a complementizer (C). Is its complement a verb phrase VP? Generative grammar argues that this is not the case: between CP and VP, inflectional phrase (IP) can be found. Therefore, a more detailed description of sentence's structure is that a sentence is a CP having an IP complement having a VP complement, (172) [Chomsky 1995:55]. The sequence CP–IP–VP shall be called the *extended verbal projection*. (Heads C, I and V can also have specifiers.)



Some of the main results of the generative grammar in the past twenty years are the following.

⁶²Specifically, we shall not deal with the linearisation of constituents. Languages such as Slovenian were described as *head-first* in GB [prim. Golden 2001], meaning that the complement always follows the head, while the specifier precedes it, as graphically shown in (171).

⁶³The traditional view is not wrong, but imprecise: the verb is not a syntactic, but a “semantic” head of the sentence. Since the generative grammar can distinguish between the two types of headship, it can assert that all syntactic expressions are endocentric.

(i) Not only sentence structure conforms to a universal pattern. Other types of phrases do so as well, e.g. noun phrase and adjective phrase with the corresponding *nominal* and *adjectival extended projection*. The seminal work in the nominal sphere is Abney [1987], who argues that noun phrases are actually determiner phrases (DPs), consisting of a determiner (D) and a noun phrase (NP), (173).



(ii) Extended projections are much more complex than (172) and (173) imply. Each of CP, IP, VP, DP and NP must be broken apart, into several semantically specialized functional projections. The seminal work is Pollock [1989], breaking apart IP; recent works include Rizzi [1997], Cinque [1999, 2002], Rizzi [2004]. The branch of Minimalist Program investigating the details of the structure of extended projections is called the *cartography* of syntactic structures.⁶⁴

fseq

Let us sum up and add to the terminology introduced so far in this subsection. Let F_1P be the root node of some sentence's syntactic representation. Let F_2P be the complement of F_1 , and so forth: let $F_{i+1}P$ be the complement of the head F_i . F_iP are so-called *functional projections*. The sequence of all functional projections in a sentence, $\langle F_1P, F_2P, \dots, F_nP \rangle$, will be called the *extended verbal projection*. Analogously, extended nominal and adjectival projection are defined.

We shall follow Starke [2004] and assume the validity of the *fseq generalization*, given in (174).⁶⁵

(174) For every lexical category, there is a universal sequence of functional projections, called *fseq*, so that the following is true.

Let FP and GP be functional projection in the extended (verbal, nominal, adjectival, etc.) projection. If GP is the complement of FP, $[_{FP} F GP]$, then $FP > GP$ (i.e. in the relevant fseq, FP precedes

⁶⁴Some of the better known works in this area include Cinque [1999, 2002], Rizzi [1990, 2004], Belletti [2004].

⁶⁵Some linguists [e.g. Nilsen 2003, Starke 2004] believe that fseq is semantically motivated.

GP)⁶⁶ or F=G.⁶⁷

(175) fseq

- a. Verbal: CP > TP > NralP > BgP > AgentP⁶⁸ > VP > ThemeP
- b. Nominal: DP > SpecificP > NumP > DefP > NralP > NP
- c. Adjectival: DegP > AP

(175) does not present the entire fseq, but only the part relevant for the thesis. This is usual practice: authors working on cartography usually don't deal with entire fseq at once, but focus on the relationships among a small number of heads. This is the reason why it is virtually impossible to find some article presenting the entire part of the fseq we shall need in the thesis. Thus, (175) was formed by combining partial fseqs put forth by various authors, and therefore actually represent noone's view on fseq (but mine). Note also that combining different authors' fseqs can be difficult, since their view on the content of specific functional heads sometimes differ.

The verbal fseq in (175a) consist of widely assumed functional projections CP, TP, AgentP and VP [see e.g. Adger 2003], and some functional projections, which are at least partly my own inventions: ThemeP (for discussion see §4.3.3), N(ume)ralP (the existence of NralP in the verbal extended projection is my own assumption, see §5.2), and B(ack)g(round)P (BgP is my own invention replacing the more common FocusP, for discussion see §4.5 and chapter 5).

Nominal fseq in (175b) is more controversial in the literature. Aboh [2004] assumes DP > NumP > DemP > NralP > AP > NP. Ihsane and Puskás [2001] add SpecificP > DP⁶⁹ and SpecificP > DefP,⁷⁰ but do not discuss the relative ordering of DefP with respect to NumP and NralP. What follows is the ordering SpecificP > NumP > NralP, that I assume in the thesis. I argue

⁶⁶Some authors believe that every extended projection must contain all members of the relevant fseq [Cinque 1999]. The others argue that, in principle, a projection can be absent from the extended projection [Starke 2004]. In the thesis I adopt the latter view; specifically, I assume that the functional projection can be absent whenever its presence/absence makes no change to the meaning; see also 6.3.

⁶⁷We must allow for a functional projection of some category to be the complement of another functional projection belonging to the same category, e.g. because of multiple-wh questions [Starke 2001].

⁶⁸I consider the small vP and AgentP to be one and the same functional projection. Since this thesis deals with theta roles and not with decomposition of verbal meaning, I will use the AgentP notation.

⁶⁹In Aboh [2004] D can be either [+specific] or [-specific].

⁷⁰Ihsane and Puskás [2001: 41] claim that DefP is »heads the lowest projection of the left periphery«, so in their system, SpecificP > DP > DefP probably holds.

for $\text{DefP} > \text{NralP}$ in §5.1.2.^{71,72}

(175c) is a commonly assumed ordering [Adger 2003:347].

It is also widely agreed that lexical categories belong to the final position in their fseq. I also believe that it is undesirable to use CP and DP in the cartographic approach, that is breaking up the “old” functional projections. The formal meaning of CP and DP is not well defined—they are merely remains of the historical development of the generative grammar and therefore only useful pretheoretically, as “cover categories”, synonymous to the traditional terms sentence and noun phrase.

Exceptions to fseq

The traditional generative view on negation [Pollock 1989] holds that sentential negation is introduced by a specialized functional projection NegP. As other functional projections, NegP is a part of the verbal extended projection. However, NegP is different from the other functional projections, which have a fixed position in fseq. So Cinque [1999:126] claims that »the evidence points to the possibility of generating a NegP on top of every adverb-related functional projection, even simultaneously, up to a certain height (which is likely determined by semantic reasons).« Next, Starke [2004] notes that negation and ϕ -features (gender, number, person) exhibit parallel behaviour: the functional projections corresponding to these features (let us call them ϕ P) can be generated on top of virtually every functional projection, too.⁷³

To sum up, functional projections NegP and ϕ P can be generated on top of many functional projections. As such they form an exception to the fseq generalization. However, we shall not reject the fseq generalization; we shall rather follow Starke [2004] and allow the exception, keeping in mind the need for an explanation. We shall therefore assume that the extended projections must conform to the universally given, fixed pattern fseq, with exception of NegP and ϕ P, which can in principle be generated on top of any other functional projection, with the list of actual functional projections allowing this possibly being specified on language-specific basis.⁷⁴

⁷¹See Lyons [1999] for a different view on syntactic decomposition of definite phrases.

⁷²In §5.4.1 the functional projection Def_{AP} is used: I assume that this projection is connected to the “adjectival” definite article *ta* in colloquial Slovenian. Its precise position in the nominal fseq will not be important: Marušič and Žaucer [2005] argue that it is connected to relative clauses. (Of course we have $\text{Def}_{\text{AP}} > \text{NP}$.)

⁷³For examples on possible positions of negative marker (for NegP) and subjects and objects (for ϕ P) see Cinque [1999: §5].

⁷⁴Nilsen [2003] views the situation differently and argues that the fseq can be derived if we assume that (some) adverbs are polarity items.

The exceptional status of NegP and ϕ P will be used in the thesis (in some appropriate formulation). The analysis in §4.5.5 will assume free distribution of ϕ P with respect to the other functional projections in fseq. For discussion on NegP see §4.4.2 and §5.7.

3.2 Semantic Form

In §3.1.2 the architecture of the Standard Minimalism has been introduced. The architecture is widely accepted both in generative syntactic theories⁷⁵ and in generative semantic theories [Larson and Segal 1995]. I find the latter surprising, since I believe that the contemporary theories of formal semantics are incompatible to the architecture shown in figure 3.1.

Of course, such a bold claim must be argued for. For reasons of space, I cannot discuss all the theories in the thesis; it seems, however, that, in order to compute the truth conditions, all of them introduce a special linguistic level, that I shall call *Semantic Form (SF)*. The problem is that—as far as I know—in no formal semantic theory SF equals the Minimalist LF. The expressions of LF are syntactic objects, whereas the expressions of SF are formulas of some other formal language. The choice of the formal language differs from theory to theory, but none of them adopts the language of LF as the language of SF.⁷⁶ No matter which formal language a particular semantic theory employs—some version of predicate logic, generalized quantifiers, etc.—the syntax of this formal language and the syntax of the natural language differ.

It follows that in generative theories of formal semantics LF cannot be the interface level between FL and CI. Only SF can be the interface level. LF and SF must be somehow connected, i.e. a *semantic component* of FL must exist, mapping the LF expression λ to the SF expression δ , called the *denotation*. It is worth noting that the difference between the syntactic structure of linguistic expressions and formulas of formal semantic languages implies that the syntactic and the semantic component of FL are different, i.e. the computational systems generating LF and SF expressions are different.

⁷⁵The theoretical toolbox of most syntacticians differs from Standard Minimalism in technical details, but its architecture is nevertheless widely accepted, the exceptions being e.g. Distributed Morphology [Halle and Marantz 1993], Elegant Syntax [Brody 2000, 2003], [Borer 2005a,b], and Nanosyntax [Starke 2006].

⁷⁶It must be emphasized that despite the fact that all semantic theories distinguish between LF and SF, the idea that these should be compatible to each other had driven the development of much semantics. (For a short historic overview see Partee [1996].) I only claim that no semantic theory has achieved the complete unification.

3.2 SEMANTIC FORM

Being precise, the architecture of standard contemporary linguistic theory that includes both syntax and formal semantics, is as shown in figure 3.3.

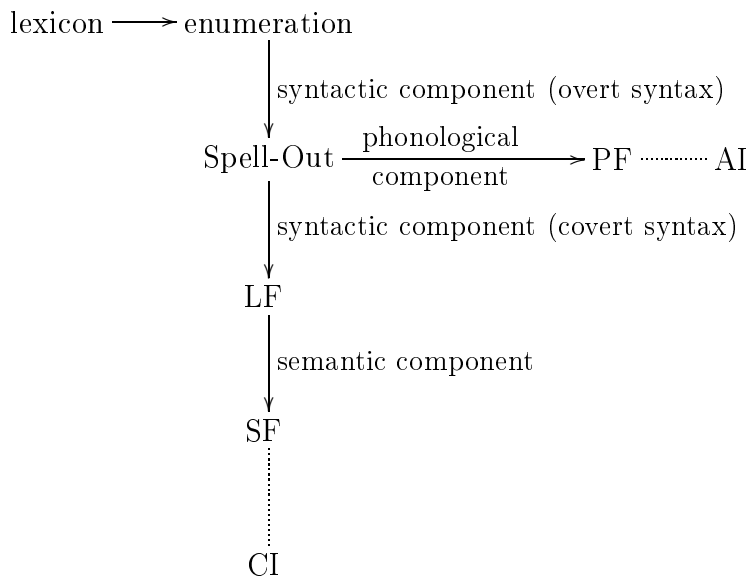


Figure 3.3: The architecture of Standard Minimalism with a special SF

The types of input of the syntactic, phonological and semantic component differ. The input of the syntactic component is enumeration, consisting of lexical items, standardly assumed to be *bundles of phonological, semantic and formal (syntactic) features*. The syntactic component uses the members of enumeration as terminal nodes of the resulting syntactic tree. To sum up, the input data of syntactic component are syntactic objects—more specifically, the smallest possible syntactic trees—and are thus of the same type as output data (the output of the syntactic component, LF expression λ , is a syntactic tree). On contrary, input data of the phonological and semantic component is not of the same type as these components’ output data. The input data of the phonological component is the syntactic “semi-product” Σ , a syntactic tree, which is, according to Chomsky [1995] transformed into phonetic transcription (some sort of mental IPA) by the phonological component. Similarly, input data of the semantic component is LF expression λ , again a syntactic tree, whereas its output is denotation δ , an expression of the formal language of SF.

Standard Minimalism assumes that syntactic component conforms to the *inclusiveness condition* [Chomsky 1995], requiring that during computation the computational system cannot introduce features not present in the input. The semantic theories assume that the computation of the denotation δ is

(strongly) compositional [Larson and Segal 1995]. Compositionality requires that the denotation of a complex expression is a function of the denotations of its constituents and the mode of composition; strong compositionality furthermore requires that only the denotations of the immediate constituents may be referred to. From the inclusiveness condition and strong compositionality, it follows that all features contained in the syntactic object's denotation at the SF must be present in the lexical items which were input to the generation of the syntactic object.

In the thesis, I distinguish two types of semantic features: logical and conceptual (also called substantive). *Logical features* are part and parcel of the semantic computational system. They do not stand for concepts, but contain directions for generation of SF expressions. In many semantic theories these features are expressions of the lambda calculus over some formal language (language of SF). For example, it is usually assumed that the lexical feature bundles of determiners contain logical features as in (176).⁷⁷ (Determiners have no conceptual features.) In semantic theories assuming the standard minimalist architecture, an SF expression (the denotation) is generated by interpretation of the LF expression λ .⁷⁸ λ is interpreted bottom-up. The denotation of the root node is computed recursively from the (lexically given) denotations of the terminal nodes. The denotation is an SF expression, and is available to CI.⁷⁹

- (176) a. every: $\lambda P \lambda Q \forall x: P(x) \Rightarrow Q(x)$
 The function having predicates P and Q for arguments, returning *true* iff every x that is P is also a Q .
- b. some: $\lambda P \lambda Q \exists x: P(x) \wedge Q(x)$
 The function having predicates P and Q for arguments, returning *true* iff some x which is a P is also a Q .
- c. no: $\lambda P \lambda Q \forall x: P(x) \Rightarrow \neg Q(x)$
 The function having predicates P and Q for arguments, returning *true* iff every x which is a P is not a Q .
- č. the: $\lambda P \lambda Q \exists x: P(x) \wedge (\forall y: P(y) \Rightarrow x = y) \wedge Q(x)$
 The function having predicates P and Q for arguments, returning *true* iff

⁷⁷For expository reasons I use the lambda calculus over FOL in this section. Actually, no contemporary theory of formal semantics uses FOL.

⁷⁸Semantic theories which do not adopt the minimalist architecture, assume the input to the semantic component to be some other syntactic level, e.g. surface syntax.

⁷⁹This is not entirely true for e.g. the theories of dynamic semantics, like Discourse Representation Theory (DRT) [Kamp 1981] and File Change Semantics (FCS) [Heim 1982]. In these theories logical features are not instructions for generating denotations: they are instructions for changing the context (in FCS, file change potential).

there is an x which (i) is a P , (ii) every y which is a P equals x , and (iii) x is a Q .

To satisfy the legibility conditions of CI, only features that CI can interpret may appear at SF. The other features must be eliminated.

Not much is known of CI and its mode of connection to FL; two things are fairly obvious, though. First, CI does not manipulate with phonological features. Second, it by definition manipulates with concepts, therefore the interface level (i.e. SF) must contain *conceptual features*: [pig], [dog], [to see], [to give], [red], etc.

Standard Minimalism distinguishes two types of formal features: *interpretable* formal features, which can be interpreted by CI (or at SF), and *non-interpretable* formal features, which CI does not understand. It is the task of syntax to eliminate all non-interpretable formal features from the syntactic expression. In Standard Minimalism, this is accomplished by *feature checking* mechanism.

The interpretable formal features are features for tense, aspect, mood, various modalities, negation, person, number, definiteness, etc. We know that syntax manipulates with these features: e.g. the difference between a finite and infinitival sentence, differing in the value of [tense], matters in the syntax; some languages have person, number and/or definiteness agreement; roughly put, Negative Polarity Items (NPIs)⁸⁰ can only be used within the scope of negation.

The status of interpretable formal features is unclear. Do they belong to the CI or to the semantic component. Is the answer to this question the same for all the interpretable formal features? Some of them are represented in the formal semantics as primitive operators/predicates: the semantic component simply transfers them to the CI. The others are analyzed as complex: the semantic component actually does some work using these features. Which features belong to one or the other class might also depend on the choice of a semantic theory. A detailed study of the status of interpretable formal features is not a subject of this dissertation. For us it only matters that the semantic component either does something with an interpretable formal feature or forwards it to the CI.

In the rest of the section we will argue that the introduction of a special SF (and, consequently, logical features) diminishes the explanatory power of the theory.

By analogy with logical features given in (176) we could argue that a determiner having logical feature given in (177) (we shall call this determiner

⁸⁰We shall discuss NPIs in §4.1.3

sone) must exist. The sentence (178a) should, by definition (177), have the meaning represented in (178b). Such a determiner cannot be found neither in English nor in any other natural language.

(177) *sone*: $\lambda P \lambda Q \exists x: P(x) \vee Q(x)$

The function having predicates P and Q for arguments, returning *true* iff some x is either P or Q (or both).

(178) a. *Sone dog is barking.*

b. $\exists x: \text{dog}(x) \vee \text{bark}(x)$

There is an x , such that x is a dog or that x is barking (or both).

If our theory does not predict that such a determiner cannot exist, it is not restrictive enough. This is not desirable: unrestrictive theories are methodologically dubious, since they cannot be falsified [Popper 1998]. It is impossible to get a piece of data falsifying an unrestrictive theory. A theory that is unrestricted enough can be used to describe just any state of affairs. The observation that not every prediction of the theory is confirmed empirically is often ignored as a (in the case of language, historical) coincidence. On the other hand, a theory that is too restrictive is easy to falsify, by finding a piece of data impossible to formalize in the theory. The process of falsification reveals the weak points of the theory and guides the research.

I believe that a theory of formal semantics introducing SF cannot predict the non-existence of determiner *sone*. In such a theory, the content of logical features can only be constrained by the expressive power of the formal language of SF employed by the theory. To predict the non-existence of the determiner *sone*, (the equivalent of) (177) should be impossible to generate in the lambda calculus over the language of SF. However, it is impossible to have an independent motivation for such restriction on expressive power. In other words, the prediction of the non-existence of determiner *sone* is circular.

Let us illustrate the above argument using the GQ theory. In GQ, the determiners correspond to a certain class of mappings, but, as it was immediately noticed by Keenan and Stavi [1986] and van Benthem [1983], not every mapping from this class corresponds to a determiner. The empirical generalization is that determiners must be (strongly) conservative.⁸¹ However, the condition on (strong) conservativity is only a formalization of the observation that determiners such as *sone* do not exist; it does not explain why this is so. As far as I know, §4.2 offers the first explanation of this observation.

How could not introducing a special SF increase the predictive power of the theory? Even if there is not special SF, some linguistic level must

⁸¹(Strong) conservativity will be defined in §4.2.2.

have its function of the interface, i.e. linguistic expressions must be given a semantic representation. In Standard Minimalism, whose architecture is shown in figure 3.1, the only candidate is LF. While formulas of a special formal language of SF were essentially independent of syntax, this is not the case with LF. On contrary, it is the syntactic component of FL generating the semantic representation. Therefore, to constrain the expressive power of the semantic representations, syntactic arguments can be used, which was impossible with a theory of formal semantics introducing a special SF.

3.3 The modularity of the language faculty

In §3.2 we have argued that introducing a special SF diminishes the explanatory power of a theory adopting the architecture of Standard Minimalism. Another, even greater problem of such a theory is its incompatibility with some results of cognitive science. Specifically, the theory violates the *modularity* condition.

There are two extreme views on the functional architecture of the mind. The first is the so-called horizontal view, claiming that there is no internal organization. The brain is a domain-general system. Mental activity is distributed across the brain. It cannot be decomposed into independent units, not even abstractly. (A prominent contemporary defender of this view is Uttal [2003].) [Wikipedia 2006c]

The opposite view is called the vertical view. The first defender of this view was the founder of phrenology Franz Joseph Gall in the nineteenth century, who claimed that mental processes could be put in a bijective correspondence to physical areas of the brain. The physical version of the vertical view is no longer believed in, of course. However, Fodor [1983] has revived a functional version of the vertical view, the so-called *modularity*. This view argues for existence of highly specialized computational systems called *modules*. (I emphasize that modules are not physically delimited areas of the brain. A modul is an organizational unit of the mind.) Modules solve highly specialized tasks (domain specificity), using limited information (informational encapsulation). They work fast and obligatorily (it is impossible to “switch them off”), they are innate and have a fixed neural architecture. [Wikipedia 2006c, Fodor 1983]

Among the above-mentioned properties of modules, the most important are domain specificity and informational encapsulation. (Adapted from Fodor [1983], Starke [2006].)

Domain specificity. Every module is specialized to work with a certain kind of input, i.e. it has its specific domain of operaton. In practice,

3.3 THE MODULARITY OF THE LANGUAGE FACULTY

the most certain way to recognize a module is by the elements (features) it manipulates.

Trivially, the visual and auditory system each has its own domain: we see with eyes, not ears; we hear with ears, not eyes.

Informational encapsulation. To operate, a module does not require information on the inner workings of the other cognitive systems.

Again, trivially, a person can be recognized by his/her looks, without hearing it; or by the color of his/her voice, without seeing him/her.

Actually, visual and auditory system consist of several modules each. The visual system, for example, consists of modules specialized for color perception, shape analysis, 3D spatial relation analysis, face recognition, etc. Informational encapsulation is also typically illustrated using an example in the visual domain. Figure 3.4 shows Müller-Lyer's optical illusion. The illusion that the horizontal lines have different lengths, based on the left part of the picture, remains regardless of the fact that we consciously know that their length is the same (based on the inspection of the right part of the picture). The visual system does not have access to the conscious data and reports its own, albeit wrong results.



Figure 3.4: Müller-Lyer's optical illusion

Fodor ascribes a modular structure to the input systems, i.e. systems receiving information from the environment, including the language faculty [Fodor 1983]. Jackendoff [1992] also claims that FL is a modular system (he also argues that output systems, e.g. motor systems, are modular). Many authors believe that mind is a *massively modular* system, i.e. it is entirely build of modules [among others see Jackendoff 1997, Sperber 2002, Carruthers 2006].⁸²

Generative grammar argues that syntax is autonomous [Golden 2001: 5]. It follows that generative grammar is compatible with the assumption that

⁸²Fodor believes that the *central system*—a sort of integrator of cognitive modules' results (consciousness)—is not modular; Chomsky's CI is also a component of the central system, and is therefore according to Fodor not modular.

FL is “outwardly” modular, i.e. that it is a module of a group of modules—at best, it might even require that this is so.⁸³ Next, we can inquire whether FL is “inwardly” modular, i.e. is the computational system that generates and parses linguistic expressions, build out of several modules? In the thesis I assume that this is the case, and evaluate linguistic theories with respect to their compatibility to this assumption.⁸⁴

I argue in §3.3.1 that Standard Minimalism (with a special SF) is not modular. In §3.3.2 a syntactic theory called Nanosyntax will be introduced, claiming that this theory is modular.

3.3.1 Standard Minimalism

In this section I argue that Standard Minimalism does not conform to the requirement of modularity. Specifically, I shall deal with Standard Minimalism with a special SF. All three components (phonological, syntactic and semantic) of FL, shown in figure 3.3 on page 87, will be checked to see if they conform to the modularity.

Standard Minimalism assumes that syntax is responsible to describe and explain not only syntactic, but also morphological data, i.e. that the computational system dealing with (inflectional) morphology is an integral part of the syntactic computational system. Besides the approach being empirically quite successful, it can be argued for on modularity basis. (i) Domain specificity. It is obvious that syntax and morphology use the same kinds of features: tense, verbal aspect, number, etc. (ii) Informational encapsulation. Baker’s mirror generalization claims that the word-internal order of morphemes is a mirror or the order of syntactic operations [Baker 1985]. To explain this if morphology and syntax were independent systems, syntax would have to “see” the inner workings of morphology or vice versa, violating informational encapsulation. (Arguing that Baker’s mirror generalization is a coincidence makes the theory unexplanatory.) [Starke 2006]

The semantic computational system works with logical features, by definition.

The semantic computational system also works with conceptual features, which function as predicates. However, formal semantics deals only with concepts’ extensions and does not try to subsume the intensional differences,

⁸³Outside the generative grammar, the autonomy of syntax is not always assumed, among others see Anderson [2006].

⁸⁴The question of modularity of systems of the mind other than FL is not important in the thesis. CI, that communicates with the syntax through LF, is certainly not a single module (according to the authors arguing for massive modularity, modules are much more finely specialized). We will therefore keep calling it a system.

which are in the domain of lexical semantics. No version of predicate logic is sensitive to differences such as the difference between a cat and a dog. The conceptual features are simply forwarded to CI.

If semantic component forwards conceptual features to CI, it follows they use the same features and therefore violate domain specificity. This view is, however open to objections that (i) mere forwarding of features (in contrast to manipulating them) does not constitute a violation of domain specificity, and that (ii) CI is not a module. I Despite my belief that these are feeble objections, I will not try to provide an answer to them. Rather, the non-modularity of Standard Minimalism with a special SF will be demonstrated using a more convincing case: I will argue that modularity is violated by the syntactic and semantic component.⁸⁵

Let us begin by providing a list of feature types, manipulated by the syntax. Neither phonological nor conceptual features influence the syntactic structure.⁸⁶ Formal features, both non-interpretable and interpretable, are syntactic features by definition. Next, let us show that the syntactic component, if we assume that it is informationally encapsulated, manipulates logical features and thereby violates domain specificity.

Unlike conceptual features, logical features heavily influence syntax.⁸⁷

⁸⁵Further discussion in this section is motivated by a class on nanosyntax given at the summer school of generative grammar EGG 2006 [Starke 2006]. The main topic of the class was the role of the mental lexicon as an interface between the modules of FL. However, it was explicitly mentioned, among other things, that the syntactic and semantic component cannot be separate modules, and that lambda calculus (the language of logical features) cannot be a part of the Minimalist Program.

⁸⁶We could try to provide to counter-examples to this claim, but both of them turn out to be illusory. First, the sentence (i), which is about pigs, is clearly different from the sentence (ii), which is about dogs. However, this is not a case of syntactic, but a case of phonological and substantive (conceptual) difference. Second, morphological properties of the verb can vary with respect to the subject. For example, in Slovenian the verb agrees with the subject in gender; it therefore makes a difference whether the subject is a masculine noun *pes* ‘dog’ or a feminine noun *mačka* ‘cat’. However, as implied by the above description, this is not a consequence of a change in conceptual meaning, but a consequence of a gender difference, i.e. a change in a formal feature. Independence of conceptual meaning and grammatical gender becomes obvious, if nouns *dekle* and *punca*, both meaning ‘girl’, are compared. Their substantive meaning is the same, but the former is a neuter, and the latter a feminine noun.

- (i) There is a pig on the road.
- (ii) There is a dog on the road.

⁸⁷We could escape this conclusion by doubling the logical features. For every logical feature, we could assume the existence of a syntactic feature with the “same” content. Then, logical features would influence the (formal) meaning of the lexical item, whereas

The distribution of DPs depends on its head: DPs headed by *vsak* ‘every’, *noben* ‘no’, *ali en* ‘a’ have different distributions, (179)–(181). (The sentences should be read using ordinary falling intonation.)

- (179) a. *Vsak pujs je kumaro.*
every pig eats cucumber
‘Every pig is eating a cucumber.’
b. **Vsak pujs ne je kumare.*
every pig not eats cucumber
- (180) a. **Noben pujs je kumaro.*
no pig eats cucumber
b. *Noben pujs ne je kumare.*
no pig not eats cucumber
‘No pig is eating a cucumber.’
- (181) a. *En pujs je kumaro.*
a pig eats cucumber
‘A pig is eating a cucumber.’
b. *En pujs ne je kumare.*
a pig not eats cucumber
‘Some pig is not eating a cucumber.’

Following the GQ theory [Barwise and Cooper 1981] we assume that determiners *vsak* ‘every’, *noben* ‘no’ and *en* ‘a’, differ in no formal feature, but only in logical features (and, trivially, in phonological features). It follows that the difference in acceptability of (179)–(181) can only be due to the differences in logical features of the determiners. Therefore, the differences in acceptability cannot be predicted without violating modularity. On one hand, if the syntactic component manipulates logical features, domain specificity is violated. On the other hand, if it does not do so, it must “find out” about the difference from the formal semantics, which violates informational encapsulation.

The modularity of the phonological component

So far we have realized that Standard Minimalism with a special SF is not compatible with the modularity hypothesis. However, it is clear that this

formal features would be responsible for its syntactic properties. (For illustration see §4.1.2, page 117.) However, such an approach is either (i) unexplanatory, since the feature doubling is not independently motivated, or (ii) informational encapsulation is violated instead of domain specificity, since any kind of motivation for the feature doubling must be aware of the inner workings of both modules, the syntactic and the semantic one.

is not the fault of Standard Minimalism; it is formal semantics that is to blame. The opposite is true in phonology: the phonological component of FL, as seen by Chomsky [1995], violates modularity. I believe Chomsky's view on the phonology–syntax interface is well illustrated by the following quotation.

[T]he whole phonological system looks like a huge imperfection, it has every bad property you can think of. Consider the way an item is represented in the lexicon, with no redundancy, including just what is not predictable by rule. So the lexical item does not include the phonetic form in every context, if that is predictable by rule; it just includes what the phonology must know in order to give the output, and it's a very abstract kind of representation, abstracted from phonetic form. Probably none of the elements that appear in the lexical representation are interpretable at the interface, that is, they are all uninterpretable features. The interface is some kind of very narrow phonetic representation, maybe not even that, maybe a syllabic representation or a prosodic representation. The prosody is not in the lexical item, therefore it is added along the way; what is in the lexical item couldn't be read at the interface, it has to be modified along the way. Probably the entire phonology is an imperfection. Furthermore the phonological system has, in a way, bad computational properties. For example, one reasonable computational optimality condition is the Inclusiveness Condition, which holds that the computation shouldn't add anything new; it just takes the features that it has and rearranges them; that is the best system, it doesn't add junk along the way. The phonology violates it, wildly. The whole narrow phonetics is new, metrics is new, everything is just added along the way. If you look at the phonetics it seems to violate every reasonable computational principle that you can think of. [Chomsky 2002: 118–9]

Phonological component of FL, as seen by Chomsky, is incompatible with modularity. Phonological component maps expression Σ from Spell-Out to the phonetic form. Σ contains all features of the constituent lexical items except the non-interpretable features that had been checked before Spell-Out. Thus, it is the phonological component that has to eliminate all these features (including semantic features), and to introduce (additional) phonetic features, non-occurring in lexical items. Thereby, domain specificity is violated, since phonological component manipulates phonological, (interpretable) formal, (logical and conceptual) semantic and phonetic features. In

the case of formal features it shares the domain of syntax, in the case of semantic features it overlaps with formal semantics, and in the case of phonetic features there is overlap with AI.

At first sight it might not be clear as to why the phonological component should be the one that eliminates formal and logical features from Σ (e.g. why this is not performed at Spell-Out?). This is a consequence of the view on the function of the phonological component from Chomsky [1995], where it is assumed that word-formational morphology belongs to the early stages of the phonological component's processing. For example, the formation of patterns such as *decide–decisive–decision* is part of this process (for arguments against this claim see Kaye [1995], Živanović [2006]). In order to derive these patterns, the phonological component must have access to morphosyntactic features. Thus, Spell-Out (see figure 3.1) should not eliminate them from Σ . Since morphosyntactic features must not arrive at PF, they must be eliminated by the phonological component.

The above makes it clear that the phonological component, as seen by Standard Minimalism, does not conform to the substantive minimalism. In Chomsky's opinion it belongs to the class of imperfections, which are consequences of conditions imposed by the interface levels.

A phonological theory, rejecting and falsifying the validity of the above-presented view (although very minimalistic itself) is *Government Phonology*. The discussion about it falls out of scope of this dissertation.⁸⁸ I would like to mention, however, that the theory seems to be compatible to the modularity thesis: the phonological component as seen by the Government Phonology, is a cognitive module.

⁸⁸The seminal work of Government Phonology is Kaye, Lowenstamm, and Vergnaud [1985]. The philosophy of the theory is best presented in Kaye [1989]. For standard theory see Kaye, Lowenstamm, and Vergnaud [1990], Harris [1994], Kaye [1995], for various CV versions Lowenstamm [1996], Ségéral and Scheer [1999], Szigetvári [1999], Scheer [2004]. The phonetics–phonology interface is discussed in Harris and Lindsey [1995], Harris [1996]. For discussion on syntax–phonology interface see Kaye [1995], Scheer [2001, 2006a,b]. Prosody is not discussed much in Government Phonology, with an partial exception of Scheer [2006a].

3.3.2 Nanosyntax

Unlike Standard Minimalism (with a special SF), Nanosyntax, which I sketch in this section, conforms to modularity.^{89,90}

The architecture of nanosyntax is graphically shown in 3.5. The theory assumes that three cognitive systems are important for linguistic processing, two of them being modules.

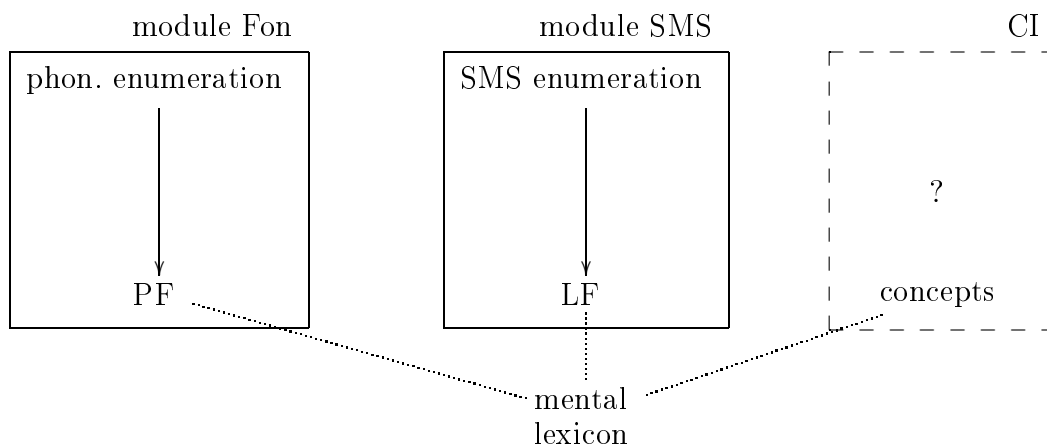


Figure 3.5: The architecture of nanosyntax

Module SMS generates syntactic expressions. These contain only formal features. Specifically, they contain no phonological or conceptual features. The module's name is derived from the fact that the module subsumes the traditional fields of **syntax**, **morphology** and **semantics**. The generated syntactic expressions contain all aspects of meaning, independent of concepts; i.e. all formal aspects of meaning. In the terminology of Standard Minimalism, this means that SMS module generates LF expressions.

Phonological *module Fon* generates phonological expressions. Contrary to Standard Minimalism, which assumes that the phonological component generates phonetic representations, I assume following Scheer [2006a] that module Fon generates phonological expressions, e.g. expressions of the kind proposed by the Government Phonology (see §3.3.1). The phonology–phonetics interface is not a part of nanosyntax.⁹¹

⁸⁹Nanosyntax is being developed at CASTL (Tromsø, Norway), project leader being Michal Starke. It is work in progress, and there were no written sources by time when I was writing (the Slovenian version) of the thesis. In the sketch I therefore follow the classes of Starke [2006].

⁹⁰I will refer to the architecture of nanosyntax in §4.5.1.

⁹¹One of the arguments supporting the view that the phonology–phonetics interface

Conceptual-intentional system (CI), understood as in Chomsky [1995], is the source of conceptual representations. As mentioned, it is probably a part of the central system, which Fodor [1983] does not take to be a module. The details of CI's workings are not important for the thesis. We shall only assume it to be the source of concepts.

The interface between the modules, i.e. the agent acting as a translator between different modules, is the mental lexicon. In nanosyntax, lexical items are triples (π, λ, γ) , where π is a phonological representation, generated by module Fon, λ is a syntactic-morphological-semantic (LF), representation generated by module SMS, and γ is a conceptual representation, generated by CI.

The crucial difference between nanosyntax and the other minimalist approaches is in the point where the mental lexicon is accessed. While practically all other theories begin the generation of a linguistic expression by accessing the mental lexicon,⁹² Nanosyntax assumes that the mental lexicon is accessed after the modules output their results.⁹³ Corresponding to Spell-Out of the Standard Minimalism is a recursive comparison of the generated LF expression to the lexical items: the LF expression is typically associated to several lexical items—naively, with as many as there are words/morphs in the sentence. (We shall say that a lexical item *realizes* certain features in the LF expression.) In this way, the syntactic expression is associated to the sound and meaning. We shall not discuss the details of this algorithm, presented in Starke [2006].⁹⁴

does not belong to narrow linguistic theory is the modality argument. Deaf-mute persons communitate using *sign languages*. Just as better know spoken languages, these are full natural human languages. The only difference lies in modality: spoken languages employ articulatory and auditory systems, while sign languages employ motor and visual systems. Due to different modality, the “phonetics” of sign languages differs widely from the phonetics of spoken languages. However, it does not necessarily follow that signed and spoken languages differ in their phonological representations. For information on sign languages see e.g. Brentari [1999], Emmorey [2002], Sandler and Lillo-Martin [2006].

⁹²This is also true for Distributed Morphology. Its mental lexicon consists of three parts: Lexicon, containing bundles of formal features; Vocabulary, containing associations between formal and phonological features; and Encyclopedia, associating PF and LF expressions to the conceptual meaning. Distributed Morphology starts the generation by accessing Lexicon (but not Voabulary or Encyclopedia). [Marvin 2002]

⁹³At this point, we ignore the potential complication dur to the phase theory [Chomsky 2001].

⁹⁴Likewise, we shall not discuss the synchronization problem, which is common to all cognitive science [Roskies 1999]. Essentially, the problem is to assure the synchronization of Fon–SMS and CI–SMS interfaces, otherwise any phonological string could have any meaning, if only both would be assigned the same syntactic structure. (E.g. a sentence *The dog is chasing the cat* could mean *The cat is watching the mouse*.)

The assumption that the mental lexicon is accessed only after the computation is what yields the modularity. Modules SMS and Fon manipulate exclusively their own features: module SMS manipulates (interpretable and non-interpretable) formal features, module Fon manipulates phonological features. In Standard Minimalism, the syntactic component forwards features it does not understand to the appropriate systems. In nanosyntax this is not necessary, since lexical access, connecting the syntactic structure to the phonological and conceptual representation, takes place only after the syntactic expression has been built.⁹⁵

Let us show that the following follows from the assumption that the mental lexicon is accessed only after the (syntactic) computation. (i) The heads of syntactic expressions are not feature bundles; rather, heads contain only one feature. Thus, there is no difference between a head and a feature.⁹⁶ (ii) Lexical items are not unstructured bundles of features. They are triples $\{\pi, \lambda, \gamma\}$, where π is a phonological (PF) representation, λ a syntactic (LF) representation and γ a conceptual representation.

(i) Standard Minimalism allows the heads to contain more than one feature. Thus, heads are feature bundles. Which feature bundles are allowed, is not universally determined, but language-specific: feature bundles are specified in the lexicon. Standard Minimalism starts the derivation with lexical items, so the mental lexicon must be accessed before the derivation. In nanosyntax, the mental lexicon is accessed after the derivation, therefore the syntactic generation cannot start with lexical items. Since the only possible source of feature bundles is the mental lexicon,⁹⁷ the syntactic derivation in nanosyntax must begin with the enumeration of independent features.⁹⁸ Every feature from the enumeration thus becomes a syntactic head.

(ii) Lexical items are not bundles of phonological, formal and conceptual features. What are lexical items then? The point of the mental lexicon is to associate “form” and “meaning”. The form is a phonological (PF) representation π , generated by module Fon. Next, there are two kinds of meaning: the formal meaning is given by the syntactic (LF) expression λ , generated

⁹⁵How come that mental lexicon can contain all three kinds of representations: phonological, syntactic and conceptual. Is this not a violation of domain specificity? No, since the mental lexicon is not a computational system—it is only a collection of data. Modularity applies only to computational systems.

⁹⁶This only applies to *simple* (non-complex) heads. The complex heads, which are foreign to Standard Minimalism, will be introduced in §4.3.2. The introduction of complex heads does not counter the conclusions of this section.

⁹⁷The assumption that feature bundles are universal, does not appear tenable.

⁹⁸Thus, in nanosyntax the enumeration is not an enumeration of lexical items, the an enumeration of features. Actually, it would be possible to formalize the algorithm of syntactic derivation without employing the construct of enumeration.

by module SMS; the conceptual representation γ is generated by CI. (The structure of π and γ is not discussed in the thesis.) The mental lexicon associates phonological, syntactic and conceptual representations: thus, the simplest assumption is that lexical items are triples $\{\pi, \lambda, \gamma\}$.⁹⁹

3.4 Conclusion

In this chapter we have argued that the theories of formal semantics introducing a special semantic form while adopting the architecture of Standard Minimalism, are not compatible to the modularity thesis (see §3.3). Contrary to Standard Minimalism, the architecture of Nanosyntax does not allow the introduction of a special computational system of formal semantics, and thus forces us to invent formal semantics that can do without it. Such a theory of formal semantics cannot use logical features, formulated in the lambda calculus over some formal language—all aspects of formal semantics must be syntactically transparent. The challenge of inventing such a theory, or at least its quantificational aspects, is the challenge accepted by this dissertation.

To sum up, the semantic component of FL does not exist. However, the hypothesis 1, which formalizes this conclusion and which will be referred to in the following chapters, does not directly claim this. Although it is my belief that there is no special semantic component or semantic form, I wish to keep talking about them for expository reasons. In this way, I can gradually present the *isomorphism* between SF (i.e. the appropriate form of L^* formulas) and LF.

Hypothesis 1 (Triviality of semantic component) *The semantic component of the language faculty is trivial. In other words, LF is isomorphic to SF, $LF \cong L^*$.*

By assuming the validity of this hypothesis, we effectively make LF and SF equal—the architecture in figure 3.3 on page 87 with a trivial semantic component is essentially the same as the architecture in figure 3.1 on page 80. Thus, it is claimed that there FL has no semantic component.

⁹⁹This is probably an oversimplification. A more detailed analysis should explain how irregular forms, idioms, allomorphs etc. are stored in the mental lexicon.

Chapter 4

L* theory

In chapter 2 we have provided an empirical motivation for L* as a language of SF. In chapter 3 we have concluded that the semantic component of FL must be trivial. It follows that LF expressions are only a notational variant of L*: LF expressions are isomorphic to L* formulas. L* theory, that will be developed in the present chapter, is an explication of this isomorphism.

The chapter is organized as follows. §4.1 deals with the formal language L*. The original version of the language was defined by Law and Ludlow [1985]; §4.1.1 formally defines the version used in the thesis. The further subsections give two Ludlow, Ludlow's [1995, 2002] results stemming from the semantic analysis of linguistic expressions using L*: §4.1.2 characterizes directionally entailing environments in L*; §4.1.3 presents Ludlow's hypothesis on characterization of NPI licensing environments.

Further sections deal with the LF–L* isomorphism, which is explicated in principles I shall call the *correspondence principles*.

§4.2 deals with basic features of the LF–L* isomorphism. §4.2.1 formulates the requirement that it is an isomorphism of hierarchical structure. §4.2.2 argues that this implies that all quantification in L* must be restricted. §4.2.3 presents the basic correspondence principles.

§4.3 explores how predication of arguments of L* is reflected in LF. In §4.3.1 we find out what elements of LF the variables and the predicates of L* correspond to. §4.3.2 presents the X-bar theory I believe we should employ if LF and L* are to be isomorphic. §4.3.3 presents the correspondence principle claiming that projection in LF and predication in L* are one and the same thing. §4.3.4 it is shown how predication would be reflected in LF if standard X-bar theory were employed.

§4.4 presents the correspondence principles that determine the position (§4.4.1) and type (§4.4.2) of quantifiers in L*, based on the information in LF. The type is determined with help of the correspondence principle dealing

with the negation, presented in the same subsection.

§4.5 explores how atomic formulas of L* are incorporated in the truth conditions of a whole sentence, using data on focus and cardinal numerals. §4.5.1 explores the reflection of SMS–CI interface in L* theory, thereby preparing the grounds for analysis of focus. §4.5.2 gives the truth conditions for focus in L*. §4.5.3 presents the correspondence principle used to compute such truth conditions. LF structure suggested for the analysis of focus is an elliptical structure: §4.5.4 provides a general principle for interpretation of elliptical structures. §4.5.5 deals with the numerical argument of predicate #, crucially using the observation of §3.1.4 that ϕ -phrases are exceptional with respect to the fseq generalization.

§4.6 concludes the chapter. (The correspondence principles are repeated in appendix A.)

4.1 Formal language L*

PLO does not have enough expressive power to represent the truth conditions of sentences containing English SD *most*. It is not very difficult to prove that it is impossible to represent the meaning of (182a) in PLO. This is proven by Barwise and Cooper [1981], who bridge the problem by introducing the theory of generalized quantifiers (GQ). In GQ theory, the meaning of *most* is defined using set theory; the meaning of (182a) is represented as in (182b).¹⁰¹

(182) a. Most people were eating noodles.

$$\text{b. } |\{x; \text{man}(x)\} \cap \{y; \text{eating noodles}(y)\}| > \\ > |\{x; \text{man}(x)\} - \{y; \text{eating noodles}(y)\}|$$

The number of individuals in the intersection of the set of people and the set of noodle-eaters is greater than the number of individuals in the set we get by subtracting the set of noodle-eaters from the set of all people.

¹⁰¹There are several equivalent notations used in GQ theory. Let E be the set of individuals. The *functional* notation, used by Barwise and Cooper [1981] and Keenan and Stavi [1986], the denotations of determiners are mappings $2^E \rightarrow 2^{2^E}$, i.e. mappings that map a predicate into a set of predicates. van Benthem [1983] uses a simpler *relational* notation, that is also used in this thesis. In this notation the denotations of determiners are relations on $E \times E$. In $D(X, Y)$ the first argument is the determiner's complement (an NP), and the second argument is its nuclear scope (a VP). Larson and Segal [1995] also use the relational notation. However, their version is more complicated than the one adopted in the thesis, since they want to explicate all the details required by the strong compositionality. For a detailed derivation of an example similar to (182b) see Larson and Segal [1995: 277–8].

(183) $\text{most}(X, Y)$ iff $|X \cap Y| > |X - Y|$

Sets X and Y are in a most-relation, if and only if the cardinality of their intersection $X \cap Y$ is greater than the cardinality of the difference $X - Y$.

However, GQ theory introduces a special SF. Therefore, I do not wish to use it in the thesis. Rather, I extend the PLO into a formal language L^* , which has enough expressive power to represent the truth conditions of sentences containing English SD *most*. L^* was informally described in §2.2.1. The present section provides the formal definition.

§4.1.1 formally defines the version of L^* , used in the thesis. §4.1.2 shows, how Ludlow [1995, 2002] use L^* to solve an old philosophical puzzle about directional entailment; §4.1.3 presents Ludlow's hypothesis on syntactic characterization of NPI licensing environments. Both results were developed using the original version of L^* , but remain valid using the current version.

4.1.1 The definition

In §2.2.1 formal language L^* was introduced. The list of symbols employed was given, and their meaning described informally. The interpretation rules will be formally defined in this section. The rules will be indirect: a procedure for translating L^* formulas into a language of infinitary logic $L_{\omega_1\omega}$ (read '1 [omega one] omega') will be given. Such course of action is chosen in order to keep the results of Živanović [2002].

The version of L^* used in the thesis is not the original implementation of the basic insight. The original version was defined in Law and Ludlow [1985], where an important aspect of the defined language is mentioned: it provides a way to syntactically characterize the directionally entailing environments (see §4.1.2). This aspect of L^* is further researched in Ludlow [1995, 2002], where it is also noted that L^* opens a path to syntactic characterization of NPI licensing environments. Next, Živanović [2002] observed that conservativity—a notion well known from the GQ literature—can be syntactically characterized in L^* , and proved (in the mathematical sense) Monotonicity and Conservativity theorems. The first theorem shows the validity of the hypothesis about the syntactic characterization of directionally entailing environments; the connection between conservativity and restricted quantification follows from the second one. I wish to keep both results valid in the thesis, although the original and current version of L^* differ in many respects. This can be done since the results proven in Živanović [2002] are general enough: the theorems were not proven directly for L^* , but for the language of infinitary logic $L_{\omega_1\omega}$, which the original version of L^* was translatable to. Thus, the plan is to provide a translation procedure from the current

version of L* into $L_{\omega_1\omega}$, and thereby keep the validity of both theorems.¹⁰²

I emphasize that I do not claim that the L*– $L_{\omega_1\omega}$ translation rules given in this section are used by the speakers when they interpret linguistic expressions. The rules are provided exclusively to (i) show, that L* has a consistent interpretation and (ii) to keep the validity of Monotonicity and Conservativity theorems. The discussion about the psychological processes used by the speakers to interpret the LF expressions are out of scope of this thesis. I believe them to be much closer to our informal understanding of L* formulas, given in 2.2.1, than its formal definition, that will be presented in this section.

Interpretation

In finitary logic (such as PLO) only a finite number of formulas may be combined in one step, and all formulas must be build in a finite number of steps. It is possible to define logical languages where these restrictions do not hold. They are called *infinitary* logics. Such languages in general allow, to conjoin an infinite number of arbitrary formulas using connectives \wedge and \vee (184)–(185), or to create a formula containing an infinite sequence of quantifiers (186).¹⁰³

$$(184) \quad \phi_1 \wedge \phi_2 \wedge \phi_3 \wedge \dots$$

$$(185) \quad \phi_1 \vee \phi_2 \vee \phi_3 \vee \dots$$

$$(186) \quad \exists x_1 \exists x_2 \exists x_3 \dots \phi'$$

We shall translate L* into an infinitary logical language $L_{\omega_1\omega}$. $L_{\omega_1\omega}$ allows conjunctions and disjunctions of countably infinite number of formulas, but does not allow infinite sequences of quantifiers.¹⁰⁴ The L*– $L_{\omega_1\omega}$ translation

¹⁰²The status of the hypothesis about NPI licensing environments is different. Unlike the results on directional entailment and conservativity, the NPI hypothesis is an empirical one, and its validity can only be checked after the LF–L* relation is defined. The establishing of this relation is the goal of the thesis; however, the NPI hypothesis is left to further research. §4.1.3, dealing with NPIs, will merely introduce the hypothesis from Ludlow [1995, 2002] and illustrate it using some prototypical examples.

¹⁰³The notation used in (184)–(186) is only adequate for cases of countable infinity.

¹⁰⁴Mathematicians use symbol ω to refer to countable infinity (there are countably many (positive) integers), and symbol ω_1 to refer to the first uncountable sort of infinity. The first index in $L_{\omega_1\omega}$ (ω_1) refers to the maximal conjunction/disjunction allowed. More precisely, it tells us that in an $L_{\omega_1\omega}$ formula, we can combine less than ω_1 formulas using conjunction or disjunction—so at most countably many formulas may be combined this way. The second index is about the longest sequence of quantifiers allowed. Concretely, we may use only sequences of less than countably many quantifiers—so only finite sequences may be created.

procedure may therefore use constructions like (184)–(185), but not constructions like (186). We shall use a more economical notation and replace the notation in (184)–(185) with (187)–(188).

$$(187) \quad \bigwedge_{i=1}^{\infty} \phi_i$$

$$(188) \quad \bigvee_{i=1}^{\infty} \phi_i$$

How do we do the translation? The main question is how to translate $\exists x: \phi$ where x is a plural variable. The idea (stemming from the first version of L*) is to use a sequence of quantifiers over singular variables, and assert that ϕ is true for each of these singular variables:

$$(189) \quad \exists x: \phi \stackrel{?}{\sim} \exists x_1 \exists x_2 \exists x_3 \dots : \bigwedge_{i=1}^{\infty} \phi(x/x_i)$$

($\phi(x/x')$ denotes a formula we get if all occurrences of x in ϕ are replaced by x' .) The problem is that we cannot use an infinite sequence of quantifiers in $L_{\omega_1\omega}$. On the other hand, no finite (n -long) sequence of quantifiers will do, since we cannot represent the meaning of the sentence $n + 1$ Ss V. The trick is to use the following idea from the original version of L*.

$$(190) \quad \exists x: \phi \stackrel{?}{\sim} \bigvee_{k=1}^{\infty} \exists x_1^k \dots \exists x_k^k : \bigwedge_{l=1}^k \phi(x/x_l^k)$$

$L_{\omega_1\omega}$ allows for infinite disjunctions, so $\exists x: \phi$ may be translated as an infinite disjunction of formulas having longer and longer sequences of quantifiers. In (190) no sequence of quantifiers is infinite; only the disjunction combining all the formulas containing longer and longer sequences of quantifiers has a countably infinite number of disjuncts. In every disjunct there is a (finite) conjunction following the quantifier sequence, asserting that ϕ is true for all singular variables introduced in the disjunct. (190) is therefore read roughly as ‘there is a number n such that there are n individuals such that ϕ is true for all of them’—actually, this was the form of formulas in the original version of L*.¹⁰⁵

¹⁰⁵More precisely, the formulas in the original version of L* also contained the condition that the values of singular variables appearing in a disjunct are different. In the current version of L* this condition is transferred into the definition of predicate #.

The translation based on formula (190) is valid only for countably infinite models. I believe this is sufficient for linguistic application.¹⁰⁶

There is one problem remaining with (190). Predicates # and \checkmark , described in §2.2.1, are not distributive. Thus, if the above procedure is used to replace the occurrences of plural variables in argument positions of these predicates, we will get wrong results.

The procedure will therefore be modified in such a way that the substitution of plural variables for singular ones will not apply to the arguments of predicates # and \checkmark . We therefore define $\phi(x/x')$ to be the formula resulting from substitution for x' of all occurrences of x but occurrences in argument positions of predicates # and \checkmark .

Obviously, the meaning of predicates # and \checkmark must be defined separately. The infinite disjunction arising from the translation of an existential quantifier “multiplies” atomic formulas, also atomic formulas of predicates # and \checkmark : there is one “copy” of the formula in every disjunct. k th “copy” is within the scope of k quantifiers over singular variables $(x_1^k, x_2^k, \dots, x_k^k)$, thus in the translation of existential quantification the predicates # and \checkmark must be relativized with respect to the disjunct they are contained in: for every plural variable that is an argument to # and \checkmark , the “copies” of these predicates must “know” in which disjunct (arising from the translation of the existential quantifier over the plural variable) they are contained. This will be formalized using the following notation.

Let Var_{PL} be the set of plural variables used in L^* . Let f be a partial mapping from Var_{PL} to the set of positive integers \mathbb{N} , i.e. $f: D(f) \rightarrow \mathbb{N}$, where $D(f)$ denotes the domain of mapping f and $D(f) \subset \text{Var}_{\text{PL}}$ holds. Let $x \in \text{Var}_{\text{PL}}$ and $k \in \mathbb{N}$. The extension of mapping f with an ordered pair (x, k) is defined by:

$$(191) \quad (f + (x, k))(D(f) \cup \{x\}) \rightarrow \mathbb{N}$$

$$(f + (x, k)): y \mapsto \begin{cases} f(y) & \text{if } y \in D(f) \\ k & \text{if } y = x \end{cases}$$

The final set of L^* - $L_{\omega_1\omega}$ translation rules is given in (192)–(197). (ϕ and ψ are arbitrary L^* formulas, x is an arbitrary objectual variable, f an arbitrary partial mapping $D(f) \subset \text{Var}_{\text{PL}} \rightarrow \mathbb{N}$, and n an arbitrary numerical variable.) Let us assume that the root node of every L^* formula is marked

¹⁰⁶I believe that understanding of uncountable sorts of infinity surpasses the linguistic intuition and that mathematical education is needed for that. The question how the “mathematical faculty” is associated to FL is an interesting one, but it is out of scope of the thesis. (I thank Philippe Schlenker for reminding me of the question.)

with an empty-domain mapping.

$$(192) \quad (\exists x: \phi)^f \stackrel{\text{def}}{\sim} \bigvee_{k=1}^{\infty} \exists x_1^k \dots \exists x_k^k: \bigwedge_{l=1}^k \phi(x/x_l^k)^{f+(x,k)}$$

$$(193) \quad (\phi \wedge \psi)^f \stackrel{\text{def}}{\sim} \phi^f \wedge \psi^f$$

$$(194) \quad (\neg \phi)^f \stackrel{\text{def}}{\sim} \neg \phi^f$$

$$(195) \quad (x \wr y)^f \stackrel{\text{def}}{\sim} \bigvee_{i=1}^{f(x)} \bigvee_{j=1}^{f(y)} x_i^{f(x)} = y_j^{f(y)}$$

$$(196) \quad (\exists n: \phi)^f \stackrel{\text{def}}{\sim} \bigvee_{n=1}^{\infty} \phi^f$$

$$(197) \quad (\#(n, x))^f \stackrel{\text{def}}{\sim} \exists v_1 \dots \exists v_n: \left(\bigwedge_{\substack{i,j=1 \\ i \neq j}}^{\infty} v_i \neq v_j \right) \wedge \left(\bigwedge_{i=1}^n \bigvee_{j=1}^{f(x)} v_i = x_j^{f(x)} \right) \wedge \left(\bigwedge_{j=1}^{f(x)} \bigvee_{i=1}^n v_i = x_j^{f(x)} \right)$$

In (196) all occurrences of n in the definiendum on the left-hand side of $\stackrel{\text{def}}{\sim}$ are numerical variables (ϕ can also contain some occurrences of symbol n), whereas all occurrences of n in the definiens on the right-hand side are positive integers. So, (196) translates $\exists n: \phi$ into an infinite disjunction of formulas that contain a positive integer n instead of the numerical variable n . Therefore, to be precise, there is substitution going on in (196): all occurrences of some numerical variable are replaced by concrete positive integers (but, the same symbol is used). Consequently, the first argument of predicate $\#$ is always a positive integer (remember (§2.2.1) that we require formulas of L* to be closed), so it is allowed to use the symbol n in the definiens in (197).

To keep the validity of above-mentioned Monotonicity and Conservativity theorems it is crucial that the translation rules preserve the polarity of individual predicates; specifically, after each translation step all predicates are within the scope of the same number of negation as before the translation.

Translation rules for standard notational abbreviations can be derived using the above rules ($\phi \vee \psi \stackrel{\text{def}}{\sim} \neg(\neg\phi \wedge \neg\psi)$, $\phi \Rightarrow \psi \stackrel{\text{def}}{\sim} \neg\phi \vee \psi$, $\forall x: \phi \stackrel{\text{def}}{\sim} \neg\exists x: \neg\phi$, $\forall n: \phi \stackrel{\text{def}}{\sim} \neg\exists n: \neg\phi$):

$$(198) \quad (\phi \vee \psi)^f \sim \phi^f \vee \psi^f$$

$$(199) \quad (\phi \Rightarrow \psi)^f \sim \phi^f \Rightarrow \psi^f$$

$$(200) \quad (\forall x: \phi)^f \sim (\neg \exists x: \neg \phi)^f \sim \neg \bigvee_{k=1}^{\infty} \exists x_1^k \dots \exists x_k^k: \bigwedge_{l=1}^k (\neg \phi(x/x_l^k))^{f+(x,k)} \sim$$

$$\sim \bigwedge_{k=1}^{\infty} \forall x_1^k \dots \forall x_k^k: \bigvee_{l=1}^k \phi(x/x_l^k)^{f+(x,k)}$$

$$(201) \quad (\forall n: \phi)^f \stackrel{\text{def}}{\sim} \bigwedge_{n=1}^{\infty} \phi^f$$

Restricted quantifiers are defined as usual.

(202) Restricted existential quantification:
 $\exists x [\phi] \psi$ is the abbreviation for $\exists x: \phi \wedge \psi$.
 ϕ is the *restrictor*, ψ the (*nuclear*) *scope*.

(203) Restricted universal quantification:
 $\forall x [\phi] \psi$ is the abbreviation for $\forall x: \neg \phi \vee \psi$.
 ϕ is the *restrictor*, ψ the (*nuclear*) *scope*.

Some useful results

Let us show that our informal understanding of L* formulas, presented in §2.2.1, is correct.

$\exists x: \phi$ where ϕ does not contain $\#$ or \checkmark , is read as ‘there is a group x such that ϕ is true for every member of x .’ Inspecting (192) on the preceding page, we can see this is ok: since ϕ does not contain $\#$ or \checkmark , the markings of formulas are irrelevant; thus, the definiens in (192) can be read as ‘there is a number n such that there is a group x of the size n such that ϕ is true for every member of x .’

Similarly for universal quantification, (200), which is read as ‘for every number n , in every group x of the size n , ϕ is true for some member of x .’

Existential restricted quantification $\exists x [\phi] \psi$ is read as ‘there is a group of individuals x such that ϕ is true for every member of x , and that ψ is also true for every member of x .’

$$(204) \quad \exists x [\phi] \psi \sim \exists x: \phi \wedge \psi \sim$$

$$\sim \bigvee_{k=1}^{\infty} \exists x_1^k \dots \exists x_k^k: \bigwedge_{l=1}^k (\phi \wedge \psi)(x/x_l^k)^{f+(x,k)}$$

$$\begin{aligned}
 & \sim \bigvee_{k=1}^{\infty} \exists x_1^k \dots \exists x_k^k : \bigwedge_{l=1}^k (\phi(x/x_l^k)^{f+(x,k)} \wedge \psi(x/x_l^k)^{f+(x,k)}) \\
 & \sim \bigvee_{k=1}^{\infty} \exists x_1^k \dots \exists x_k^k : \left(\bigwedge_{l=1}^k \phi(x/x_l^k)^{f+(x,k)} \right) \wedge \left(\bigwedge_{l=1}^k \psi(x/x_l^k)^{f+(x,k)} \right)
 \end{aligned}$$

Universal restricted quantification $\forall x [\phi] \psi$ is read as ‘in every group of individuals x such that ϕ is true for every member of x , ψ is true for at least one member of x .’

$$\begin{aligned}
 (205) \quad & \forall x [\phi] \psi \sim \forall x : \neg \phi \vee \psi \sim \\
 & \sim \bigwedge_{k=1}^{\infty} \forall x_1^k \dots \forall x_k^k : \bigvee_{l=1}^k (\neg \phi \vee \psi)(x/x_l^k)^{f+(x,k)} \\
 & \sim \bigwedge_{k=1}^{\infty} \forall x_1^k \dots \forall x_k^k : \bigvee_{l=1}^k \neg \phi(x/x_l^k)^{f+(x,k)} \vee \psi(x/x_l^k)^{f+(x,k)} \\
 & \sim \bigwedge_{k=1}^{\infty} \forall x_1^k \dots \forall x_k^k : \left(\bigvee_{l=1}^k \neg \phi(x/x_l^k)^{f+(x,k)} \right) \vee \left(\bigvee_{l=1}^k \psi(x/x_l^k)^{f+(x,k)} \right) \\
 & \sim \bigwedge_{k=1}^{\infty} \forall x_1^k \dots \forall x_k^k : \neg \left(\bigwedge_{l=1}^k \neg \phi(x/x_l^k)^{f+(x,k)} \right) \vee \left(\bigvee_{l=1}^k \psi(x/x_l^k)^{f+(x,k)} \right) \\
 & \sim \bigwedge_{k=1}^{\infty} \forall x_1^k \dots \forall x_k^k : \left(\bigwedge_{l=1}^k \phi(x/x_l^k)^{f+(x,k)} \right) \Rightarrow \left(\bigvee_{l=1}^k \psi(x/x_l^k)^{f+(x,k)} \right)
 \end{aligned}$$

The rules that “push” negation over restricted quantifiers are the same as in PLO. The following equivalences can easily be proven using definitions of universal quantifier, restricted quantifiers and connectives \vee and \Rightarrow .

$$(206) \quad \neg \exists x : \phi \sim \forall x : \neg \phi$$

$$(207) \quad \neg \forall x : \phi \sim \exists x : \neg \phi$$

$$(208) \quad \neg \exists x [\phi] \psi \sim \forall x [\phi] \neg \psi$$

$$(209) \quad \neg \forall x [\phi] \psi \sim \exists x [\phi] \neg \psi$$

Let us make sure, using the above definitions and equivalences, that we have ascribed correct truth conditions to sentences containing English determiners *the* and *most*. Formulas for *the* and *most* were given in (73a) on page 47 and (78c) on page 50; the derivations are given in (210) and (211),

respectively. The derivations begin with logically equivalent notations using restricted quantification.

(210) the

$$\begin{aligned}
 & \exists x [S(x) \wedge (\forall y [S(y)] y \checkmark x)] V(x) \sim \\
 & \sim \bigvee_{k=1}^{\infty} \exists x_1^k \dots \exists x_k^k : \left(\bigwedge_{l=1}^k S(x_l^k) \wedge (\forall y [S(y)] (y \checkmark x)^{(x,k)}) \right) \wedge \left(\bigwedge_{l=1}^k V(x_l^k) \right) \\
 & \sim \bigvee_{k=1}^{\infty} \exists x_1^k \dots \exists x_k^k : \left(\bigwedge_{l=1}^k S(x_l^k) \right) \wedge \left(\bigwedge_{l=1}^k V(x_l^k) \right) \wedge \\
 & \quad \left(\bigwedge_{l=1}^k \bigwedge_{k'=1}^{\infty} \forall y_1^{k'} \dots \forall y_{k'}^{k'} : \left(\bigwedge_{l'=1}^{k'} S(y_{l'}^{k'}) \right) \Rightarrow \left(\bigvee_{l'=1}^{k'} (y \checkmark x)^{(x,k)+(y,k')} \right) \right) \\
 & \sim \bigvee_{k=1}^{\infty} \exists x_1^k \dots \exists x_k^k : \left(\bigwedge_{l=1}^k S(x_l^k) \right) \wedge \left(\bigwedge_{l=1}^k V(x_l^k) \right) \wedge \\
 & \quad \left(\bigwedge_{k'=1}^{\infty} \forall y_1^{k'} \dots \forall y_{k'}^{k'} : \left(\bigwedge_{l'=1}^{k'} S(y_{l'}^{k'}) \right) \Rightarrow \left(\bigvee_{i=1}^k \bigvee_{j=1}^{k'} y_j^{k'} = x_i^k \right) \right)
 \end{aligned}$$

(211) most

$$\begin{aligned}
 & \exists n : \exists x [S(x) \wedge \#(n, x) (\forall y [S(y) \wedge \#(n, y)] y \checkmark x)] V(x) \sim \\
 & \sim \bigvee_{n=1}^{\infty} \left[\bigvee_{k=1}^{\infty} \exists x_1^k \dots \exists x_k^k : \left(\bigwedge_{l=1}^k S(x_l^k) \wedge \#(n, x)^{(x,k)} \wedge (\forall y [S(y)] (y \checkmark x)^{(x,k)}) \right) \wedge \right. \\
 & \quad \left. \left(\bigwedge_{l=1}^k V(x_l^k) \right) \right] \\
 & \sim \bigvee_{n=1}^{\infty} \left[\bigvee_{k=1}^{\infty} \exists x_1^k \dots \exists x_k^k : \left(\bigwedge_{l=1}^k S(x_l^k) \right) \wedge \#(n, x)^{(x,k)} \wedge \left(\bigwedge_{l=1}^k V(x_l^k) \right) \wedge \right. \\
 & \quad \left(\bigwedge_{l=1}^k \bigwedge_{k'=1}^{\infty} \forall y_1^{k'} \dots \forall y_{k'}^{k'} : \right. \\
 & \quad \left. \left(\left(\bigwedge_{l'=1}^{k'} S(y_{l'}^{k'}) \right) \wedge \#(n, y)^{(x,k)+(y,k')} \right) \Rightarrow \left(\bigvee_{l'=1}^{k'} (y \checkmark x)^{(x,k)+(y,k')} \right) \right) \left. \right] \\
 & \sim \bigvee_{n=1}^{\infty} \left[\bigvee_{k=1}^{\infty} \exists x_1^k \dots \exists x_k^k : \left(\bigwedge_{l=1}^k S(x_l^k) \right) \wedge \left(\bigwedge_{l=1}^k V(x_l^k) \right) \wedge \right.
 \end{aligned}$$

$$\begin{aligned}
 & \left(\exists v_1 \dots \exists v_n : \left(\bigwedge_{\substack{i,j=1 \\ i \neq j}}^{\infty} v_i \neq v_j \right) \wedge \left(\bigwedge_{i=1}^n \bigvee_{j=1}^k v_i = x_j^k \right) \wedge \left(\bigwedge_{j=1}^k \bigvee_{i=1}^n v_i = x_j^k \right) \right) \wedge \\
 & \left(\bigwedge_{k'=1}^{\infty} \forall y_1^{k'} \dots \forall y_{k'}^{k'} : \left(\bigwedge_{l'=1}^{k'} S(y_{l'}^{k'}) \right) \wedge \right. \\
 & \left. \left(\exists v_1 \dots \exists v_n : \left(\bigwedge_{\substack{i,j=1 \\ i \neq j}}^{\infty} v_i \neq v_j \right) \wedge \left(\bigwedge_{i=1}^n \bigvee_{j=1}^{k'} v_i = y_j^{k'} \right) \wedge \left(\bigwedge_{j=1}^{k'} \bigvee_{i=1}^n v_i = y_j^{k'} \right) \right) \wedge \right. \\
 & \left. \Rightarrow \left(\bigvee_{i=1}^k \bigvee_{j=1}^{k'} y_j^{k'} = x_i^k \right) \right) \Big]
 \end{aligned}$$

A part of discussion in §2.2.5 was based upon the assumption that adding condition $\exists n: \#(n, x)^f$ in a formula does not change the truth conditions. This assumption will be proved by proving that $\exists n: \#(n, x)^f$, appearing in the translation procedure, is a tautology for every f .

The algorithm of the translation guarantees that every expression of the form $\exists n: \#(n, x)^f$ occurs in within the scope of quantifiers over variables $x_1^{f(x)}, \dots, x_{f(x)}^{f(x)}$. The interpretation of this expression is therefore in principle dependent on the values taken by these variables, i.e. dependent upon the assignment g . Let A be the set of values of these variables and a the cardinality of this set.

$$A = \{g(x_1^{f(x)}), \dots, g(x_{f(x)}^{f(x)})\}$$

$$a = |A|$$

A is finite, so we may write $A = b_1, \dots, b_a$.

Let $g(v_i) = b_i$ for $i \in \{1, \dots, a\}$, so $b_i = g(v_i) \neq g(v_j) = b_j$, if only $i \neq j$ holds for $i, j \in \{1, \dots, a\}$.

For this choice of variables v_1, \dots, v_a it holds (by the definition of A) that for every $i \in \{1, \dots, a\}$ there is at least one $j \in \{1, \dots, f(x)\}$ such that $g(v_i) = g(x_j^{f(x)})$.

By the definition of A we can also find (for every $j \in \{1, \dots, f(x)\}$) an $i \in \{1, \dots, a\}$ such that $g(x_j^{f(x)}) = g(v_i)$.

Summarized, we have

$$\exists v_1 \dots \exists v_n : \left(\bigwedge_{\substack{i,j=1 \\ i \neq j}}^{\infty} v_i \neq v_j \right) \wedge \left(\bigwedge_{i=1}^a \bigvee_{j=1}^{f(x)} v_i = x_j^{f(x)} \right) \wedge \left(\bigwedge_{j=1}^{f(x)} \bigvee_{i=1}^a v_i = x_j^{f(x)} \right)$$

which is exactly $\#(a, x)^f$, by the definition of $\#$. The a th member of the disjunction

$$\bigvee_{n=1}^{\infty} \exists v_1 \dots \exists v_n : \left(\bigwedge_{\substack{i,j=1 \\ i \neq j}}^{\infty} v_i \neq v_j \right) \wedge \left(\bigwedge_{i=1}^n \bigvee_{j=1}^{f(x)} v_i = x_j^{f(x)} \right) \wedge \left(\bigwedge_{j=1}^{f(x)} \bigvee_{i=1}^n v_i = x_j^{f(x)} \right)$$

is therefore true, so the whole formula, which is exactly the translation of $\exists n: \#(n, x)^f$ to $L_{\omega_1\omega}$, is true.

On the (non-)exhaustive assignment of theta roles

Herburger [2000] follows Larson and Segal [1995:485–6] in assuming that theta roles are assigned *exhaustively*. This means that in example (212) the only agent in the event is Romeo and that Juliet is the only theme. The motivation behind this assumption is the cases of indirect agentivity. Our linguistic intuition tells us that sentence (212a) does not describe a scenario where Romeo pays Hamlet to kiss Juliet. It is possible to claim that both Romeo (who intentionally initiates the event of kissing) and Hamlet (who intentionally does the kissing) are agents in this event. Herburger and Larson and Segal claim that if the assignment of theta roles were not exhaustive, formula (212b) could be used to describe such situations.

- (212) a. Romeo kiss Juliet.
 b. $\exists e: \text{kiss}(e) \wedge \text{agent}(\text{Romeo}, e) \wedge \text{theme}(\text{Juliet}, e)$

In L* theory we cannot assume that the assignment of theta roles is exhaustive. Why? We assume that all the predicates of L* (but $\#$ and \checkmark) are distributive. More precisely, the meaning of a predicate whose arguments are plural variables, is defined using the meaning of the same predicate in PLO, i.e. with singular variables (see §4.1.1). Thus, the equivalence (213b) holds. If the assignment of theta roles was taken as exhaustive, the right hand formula would be contradictory.

- (213) a. Romeo in Hamlet kissed Juliet.
 b. $\text{agent}(\text{romeo and hamlet}, e) \sim \text{agent}(\text{romeo}, e) \wedge \text{agent}(\text{hamlet}, e)$

Rejecting the assumption that the assignment of theta roles is exhaustive, we are left with finding some other path towards the solution of the indirect agentivity. Actually, such a path is already shown by Larson and Segal, who argue that we should understand the scenario where Romeo pays Hamlet to kiss Juliet as a conjunction of two events: the event of paying and the event

of kissing. I believe that to solve the indirect agentivity problem, it suffices to simply make this consequence a stipulation and claim that the above scenario is impossible to describe using only one event: the scenario is “composed” of two events. We have to assume that in the above scenario, CI cannot assign to Romeo the agent role in the event of kissing, but only in the event of paying. Thus, the problem is transferred from formal semantics to the theory of CI, maybe theory of language use. Our current level of understanding CI might not be high enough to provide sufficient and required conditions on agenthood; however, as discussed in Larson and Segal [1995: 489], this is not a problem limited to theta theory and that it would be thus unreasonable to expect it to be solved by a theory of formal semantics.

4.1.2 Directional Entailingness

Aristotle’s syllogisms and Natural Logic

Current work on formal logical languages does not necessarily bear any relation to natural language. Modern logic is essentially a branch of mathematics. Traditionally, however, logicians have dealt with natural language a lot—beginning from Aristotle, whose theory of *syllogisms* is the subject of this section.

Syllogisms are composed of three statements: two *premises* and a *conclusion*. Premises and a conclusion form a syllogism if the conclusion is a consequence of the premises, i.e. if it is impossible that the premises are true but the conclusion false.¹⁰⁷ Aristotle’s statement consists of a subject and a predicate. The latter either asserts or denies that something is true of the former. Aristotle’s subjects and predicates are terms, which can be either particular (*Socrates*) or universal (*horse, white*). Of a great importance for our discussion, the assertion about the subject can also be universal or particular. This yields the following typology, the so-called *square of opposition*, (214). (Traditional abbreviations of the types are given in parenthesis. In the abbreviations, the predicate precedes the subject.)

(214)		affirmative	negation
	universal	Every a is b. (Aba)	No a is b. (Eba)
	particular	Some a is b. (Iba)	Some a is not b. (Oba)

The following terminology is usually introduced: *major term* (P) is the predicate of the conclusion; *minor term* (S) is the subject of the conclusion; *middle term* (M) is the term occurring in both premises; *major* and *minor*

¹⁰⁷Aristotle’s original definition uses a different wording, and is also somewhat more complex. However, our simplification does not influence the discussion in the thesis.

premise are the premises containing the major and the minor term, respectively. Based on where the middle term occurs, all potential syllogisms can be classified in four *figures*.

(215)		1. figure	2. figure	3. figure	4. figure
	major premise	M-P	P-M	M-P	P-M
	minor premise	S-M	S-M	M-S	M-S
	conclusion	S-P	S-P	S-P	S-P

Since any statement in any syllogism can be of any of the four types in the square of opposition, there are 256 potential syllogisms. Mostly, they are invalid, i.e. the conclusion is not a necessary consequence of the premises. The list of valid syllogisms is given in (216). (The names are mnemonic. The three vowels in the name mark the type of major premise, minor premise and conclusion, in this order. For the meaning of mnemonic letters a, e, i and o, see (214).) Some examples of syllogisms are given in (217)–(220).

(216)	1. figure	2. figure	3. figure	4. figure
	Barbara	Cesare	Darapti	Bramantip
	Celarent	Camestres	Disamis	Camenes
	Darii	Festino	Datisi	Dimaris
	Ferio	Baroco	Felapton	Fesapo
			Bocardo	Fresison
			Ferison	

- (217) Barbara
- All (guinea) pigs are rodents.
 - All rodents are animals.
 - \Rightarrow All (guinea) pigs are animals.

- (218) Celarent
- No mammal is a bird.
 - All whales are mammals.
 - \Rightarrow No whale is a bird.

- (219) Darii
- All swans are white.
 - Some birds are swans.
 - \Rightarrow Some birds are white.

- (220) Ferio
- No long thing is interesting.
 - Some book is long.

- c. \Rightarrow Some book is not interesting.

The Aristotle himself had already tried to characterise the set of valid syllogisms. At first sight, the sentences of valid syllogisms have no common syntactic properties to use in the characterization. Aristotle did provide certain generalization—for some of them, see (221)—about the form that premises and/or conclusion may take. His findings, however, are insufficient to uniquely determine the set of valid syllogisms—and even if they could, they remain unmotivated. Aristotle’s greatest achievement with respect to the characterization of valid syllogisms is the theorem in (222).

- (221) a. No syllogism contains two negated premises.
 b. No syllogism contains to particular premises.
 c. Syllogism having an affirmative conclusion must contain two affirmative premises.
 č. Syllogism having a negated conclusion must have one negated premise.
 d. Syllogism having a universal conclusion must have two universal premises.
- (222) All syllogisms can be reduced to the universal syllogisms in the first figure, i.e. syllogisms Barbara and Celarent.

Since Aristotle’s time, syllogistic logic was investigated mainly by medieval logicians, among them Willian of Ockam, famous for his razor blade. In this period, the logicians succeeded not only in extending the empirical domain of syllogistic logic, but also in simplifying the inference rules to a small number of principles. Ludlow [2002] calls this research program *Natural Logic*.

The idea of Natural Logic is that logical inferences follow two rules, each of them applicable in a certain environment. The environments were called *dictum de omni* and *dictum de nullo*. Today, however, they are better known as *upward monotonous* and *downward monotonous*. The rules are the following. In *dictum de omni* environment, an occurrence of predicate A may be substituted for by predicate B if $A \Rightarrow B$ holds. In *dictum de nullo* environment, an occurrence of predicate A may be substituted for by predicate B if $B \Rightarrow A$ holds.

Let us illustrate the usage of *dictum de omni et nullo* environments on the derivation of the validity of syllogisms (217)–(220). We get the correct results, if we assume the following distribution of *dictum de omni* and *dictum de nullo* environments.

(223)	statement type	subject	predicate
	A	<i>nullo</i>	<i>omni</i>
	E	<i>nullo</i>	<i>nullo</i>
	I	<i>omni</i>	<i>omni</i>
	O	<i>omni</i>	<i>nullo</i>

First let us remember that the Aristotle himself found out that every syllogism has at least one universal premise (see (221b)), either affirmative or negative. Thus every syllogism contains a premise which entails a formula of the form $A \Rightarrow B$ or $A \Rightarrow \neg B$, where either A or B is the middle term. The second premise is then modified into the conclusion using the inference rules for *dictum de omni et nullo* environments.

In Barbara (217) the minor premise gives us $\text{pig} \Rightarrow \text{rodent}$. In the major premise, subject is in *dictum de nullo* environment, so *rodent* may be replaced by *pig*.

In Celarent (218) the minor premise yields $\text{whale} \Rightarrow \text{mammal}$. In the major premise, the subject is in *dictum de nullo* environment, so *mammal* can be replaced by *whale*.

In Darii (219) the major premise yields $\text{swan} \Rightarrow \text{white}$. In the minor premise, the predicate is in *dictum de omni* environment, so *swan* can be replaced by *white*.

In Ferio (220) the major premise yields $\text{long} \Rightarrow \text{not interesting}$. In the minor premise, the predicate is in *dictum de omni* environment, so *long* can be replaced by *not interesting*.

The problem lies in the arbitrariness of table (223). True, it covers all logical possibilities of the distribution of both environments. However, it remains a puzzle why they are distributed the way they are. Why is the subject in particular statements in *dictum de omni* environment? Why is the predicate in negative sentences in *dictum de nullo* environment?

We could say that medieval logicians have (unsuccessfully) tried to define *dictum de omni et nullo* environments by syntactic means. This goal was also pursued by some generative linguists, among others Suppes [1979], Sánchez [1991], Dowty [1994]. However, noone succeeded in providing an algorithm for determining *dictum de omni et nullo* environments, which would take as input some independently motivated features. All the authors have introduced (otherwise unmotivated) monotonicity features and an algorithm which used them to compute the monotonicity properties of complex expressions. In a nutshell, until Ludlow [1995, 2002] there is no syntactic characterization of *dictum de omni et nullo* environments.

Directional entailingness in GQ theory

The above discussion might leave the impression that there is no known characterization of *dictum de omni et nullo*. This is certainly false. Until Ludlow, there is no *formal/syntactic* characterization of these environments; the semantic characterization is well-known. In GQ theory [Barwise and Cooper 1981, Keenan and Stavi 1986] the monotonicity properties of determiners follow directly from their set-theoretic definitions. (224) provides, following Larson and Segal [1995:275–6], the denotations of some determiners.¹⁰⁹

- (224) a. $\text{Val}(\langle X, Y \rangle, \text{every})$ iff $|Y - X| = 0$
 b. $\text{Val}(\langle X, Y \rangle, \text{some})$ iff $|Y \cap X| > 0$
 c. $\text{Val}(\langle X, Y \rangle, \text{no})$ iff $|Y \cap X| = 0$
 č. $\text{Val}(\langle X, Y \rangle, \text{two})$ iff $|Y \cap X| = 2$
 d. $\text{Val}(\langle X, Y \rangle, \text{most})$ iff $|Y \cap X| > |Y - X|$
 e. $\text{Val}(\langle X, Y \rangle, \text{the})$ iff $|Y - X| = 0$ and $|Y| = 1$
 f. $\text{Val}(\langle X, Y \rangle, \text{both})$ iff $|Y - X| = 0$ and $|Y| = 2$

The monotonicity properties of determiners are collected in (225). \uparrow and \downarrow mark upward and downward monotonicity; \times marks non-monotonicity. (Cf. to (223).)

(225)	determiner	Y	X
	every	\downarrow	\uparrow
	some	\uparrow	\uparrow
	no	\downarrow	\downarrow
	two ¹¹⁰	\times	\uparrow
	most	\times	\uparrow
	the	\times	\uparrow
	both	\times	\uparrow

In GQ theory, the monotonicity properties of determiners follow from the definitions of their meaning. For a mathematician, the proof of correctness

¹⁰⁹Larson and Segal [1995] use a valuation notation of the denotations. (224) presents semantic axioms in the form $\text{Val}(X, J, \sigma)$ where J is a linguistic expression, σ is a sequence and X the value of J with respect to σ . In (224), Y and X are the first and the second argument of a determiner, i.e. the subject and the predicate. (Sequences are a tool used in the analysis of deixis and binding of pronouns and traces. They are not important for our discussion and are therefore omitted for clarity.)

¹¹⁰The definition in Larson and Segal [1995] assumes that cardinals have the *exactly* meaning, and not the *at least* meaning. Only in the latter meaning, the subject is in an (upward) monotonous environment.

of table (225) is trivial.¹¹¹ However, to claim that our language faculty contains a theoretical apparatus needed for such a proof is not psychologically convincing. But if FL does not contain the required apparatus, it is unclear how the speakers know whether some environment is monotonous (and whether it is upward or downward monotonous) or not. If the theory aims to be psychologically real, it must replicate the monotonicity information as syntactic features (this is done by Sánchez [1991] and Dowty [1994], for example). However, the congruence of the syntactic features and the denotations of determiners could only be motivated by language acquisition argument, again assuming that some part of human cognition, i.e. language acquisition device, contains the above-mentioned set-theoretical apparatus.

Directional entailment in L*

In a nutshell, until Ludlow [1995, 2002] there is no formal (syntactic) characterization of the monotonicity properties of determiners on one hand, and on the other hand, explaining directional entailment in terms of GQ theory is not convincing from the psychologist's viewpoint. Encoding the quantificational aspects of meaning with L*, we get a theory which (formally) characterizes the relation between the meaning and monotonicity properties of determiners in a psychologically convincing manner.

Examples (226)–(233) provide the truth conditions of sentences containing various determiners. Let us compare them with the table of monotonicity properties of determiners given in (234).

- (226) a. A student suffers.
 b. $\exists x: \text{student}(x) \wedge \#(1, x) \wedge \text{suffer}(x)$
 There is a group of individuals x such that: the members of x are students, the size of group x is 1, and the members of x suffer.
- (227) a. (At least) five students suffer.

¹¹¹Of the rows in table (225), the row of *most* seems the most difficult to prove, so we include the proof below.

(i-a) If the subject (Y) was in an upward monotonous environment, we would be allowed to replace Y by any Z such that $Y \subset Z$. Let us set $X = \{1, 2\}$, $Y = \{1, 2, 3\}$ and $Z = \{1, 2, 3, 4, 5\}$. Then $2 = |Y \cap X| > |Y - X| = 1$, but $2 = |Z \cap X| \not> |Z - X| = 3$.

(i-b) If the subject (Y) was in a downward monotonous environment, we would be allowed to replace Y by any Z such that $Z \subset Y$. Let $X = \{1, 2\}$, $Y = \{1, 2, 3\}$ and $Z = \{3\}$. Then $2 = |Y \cap X| > |Y - X| = 1$, but $0 = |Z \cap X| \not> |Z - X| = 1$.

(ii) Let us prove that the predicate (X) is in an upward monotonous environment. Assume $|Y \cap X| > |Y - X|$ and $X \subset Z$. We have to show that $|Y \cap Z| > |Y - Z|$. This is true since: (a) $X \subset Z$ implies $\{Y \cap X\} \subset \{Y \cap Z\}$, and (b) $X \subset Z$, which is equivalent to $X' \supset Z'$ (X' is the complement of set X), implies $\{Y - X\} = \{Y \cap X'\} \supset \{Y \cap Z'\} = \{Y - Z\}$.

- b. $\exists x: \text{student}(x) \wedge \#(5, x) \wedge \text{suffer}(x)$
 There is a group of individuals x such that: the members of x are students, the size of group x is 5, and the members of x suffer.
- (228) a. Some students suffer.
 b. $\exists x: \text{student}(x) \wedge \text{suffer}(x)$
 There is a group of individuals x such that: the members of x are students, and the members of x suffer.
- (229) a. Every student suffers.
 b. $\forall x: \neg \text{student}(x) \vee \text{suffer}(x)$
 In every group of individuals x there is a member which is not a student or suffers.
- (230) a. No student suffers.
 b. $\neg \exists x: \text{student}(x) \wedge \text{suffer}(x)$ ali $\forall x: \neg \text{student}(x) \vee \neg \text{suffer}(x)$
 It is not the case that there is a group of individuals x such that: the members of x are students and they suffer; or: In every group of individuals x there is a member which is not a student or does not suffer.
- (231) a. The pig is eating. / The pigs are eating.
 b. $\exists x: \text{pig}(x) \wedge \text{eat}(x) \wedge \neg \exists x': \text{pig}(x') \wedge x' \neq x$
 There is a group of individuals x such that: the members of x are pigs, they eat and it is not the case that there is group of pigs x' disjoint from x .
- (232) a. The five pigs are eating.
 b. $\exists x: \text{pig}(x) \wedge \#(5, x) \wedge \text{eat}(x) \wedge \neg \exists x': \text{pig}(x') \wedge x' \neq x$
 There is a group of individuals x such that: the members of x are pigs, the size of x is 5, the members of x eat and it is not the case that there is group of pigs x' disjoint from x .
- (233) a. Most pigs are eating.
 b. $\exists n: \exists x: \text{pig}(x) \wedge \#(n, x) \wedge \text{eat}(x) \wedge \neg \exists x': \text{pig}(x') \wedge \#(n, x') \wedge x' \neq x$
 There is an integer n such that the following is true. There is a group of individuals x such that the following is true. The members of x are pigs, the size of x is n , the members of x are eating and it is not the case that there is a group of pigs x' of size n disjoint from x .

(234)	determiner	subject	verb
	a	↑	↑
	five	↑	↑
	some	↑	↑
	every	↓	↑
	no	↓	↓
	the	×	↑
	the five	×	↑
	the + PL.	×	↑
	most	×	↑

The generalization is obvious. The monotonicity properties of determiners depend on the distribution of their arguments (subject and verb) with respect to negation operator(s). If an argument is within the scope of a negation, it is in a downward monotonous (*dictum de nullo*) environment. If it is not within the scope of negation, it is within an upward monotonous (*dictum de omni*) environment. A more precise generalization, which takes into account the fact that an argument can occur more than once in the formula (this happens to the subject with *the* and *most*), and that the polarity of the occurrences might be different, is stated in (235).

- (235) Monotonicity properties of determiners
- a. If all occurrences of a predicate corresponding to some argument of a determiner are within the scope of a negation, the argument is in a downward monotonous environment.
 - b. If no occurrences of a predicate corresponding to some argument of a determiner are within the scope of a negation, the argument is in an upward monotonous environment.
 - c. If some occurrences of a predicate corresponding to some argument of a determiner are within the scope of a negation, while the others are not, the argument is in a non-monotonous environment.

The above generalization was stated based on a small number of examples. It becomes really interesting, however, once it is (mathematically) proven that there is indeed a connection between a syntactic property of ‘(not) being within the scope of a negation’ and a logical property of ‘being (non-)monotonous (upward/downward).’ Such proof was done by Živanović [2002],¹¹² the detailed formulation of the proven theorem being the following.

¹¹²The proof was based on a general method for proving interpolation theorems (for infinitary logic $L_{\omega_1\omega}$), developed by Makkai [1969]. In particular, the Monotonicity Theo-

Let formula ϕ be in a *polar canonic form* iff the set of logical connectives used in the course of generating ϕ is a subset of $\{\wedge, \vee, \neg\}$, and the set of quantifiers used in the course of generating ϕ is a subset of $\{\exists, \forall\}$, where \forall and \exists are unrestricted quantifiers.

- (236) Definition: The occurrence of a predicate in a formula in a polar canonic form is *positive* iff it is within the scope of an even (including 0) number of negations, and *negative* iff it is within the scope of an odd number of negations.¹¹³
- (237) *Monotonicity Theorem.* Let ϕ be an arbitrary polar canonic formula (of language $L_{\omega_1\omega}$). Let ψ be a formula constructed from ϕ by unrestricted application of the following substitution. Any positive occurrence of some predicate P can be replaced with any predicate Q such that $P \Rightarrow Q$ is true, and any negative occurrence of some predicate P can be replaced by any predicate Q such that $Q \Rightarrow P$. The theorem states that the truth of ϕ entails the truth of ψ .¹¹⁴

Generalization (235) follows from theorem (237): we simply substitute one and the same predicate for all occurrences of predicates corresponding to some argument of the determiner.

However, the Monotonicity Theorem is more general than our generalization in (235). First, it tells us what happens if some predicate is within the scope of more than one negation. (Examples (226)–(233) contained no such situation.) Second, it frees us from term ‘argument of a determiner’ (which we haven’t even defined, really). We can apply the substitution to any predicate corresponding to any constituent—mathematics ensures that all substitutions conforming to the Monotonicity Theorem will preserve the truth of the sentence. I provide some additional examples of directional entailing in (238).

rem is a generalization of Lopez-Escobar theorem [Lopez-Escobar 1965]; the proof imitates Makkai’s novel proof of this known result. The finitary version of the theorem is known as Lyndon’s theorem [Lyndon 1959].

¹¹³Terms positive occurrence and negative occurrence are defined only for formulas in a polar canonic form. Thus, any time we discuss polarity (of predicates), we assume that the formula is in polar canonic form.

¹¹⁴Actually, Živanović [2002] proves more, namely the reverse. If it is possible to replace (in some polar canonic formula ϕ) any subset of some set (S_1) of occurrences of predicates with their hypernyms, and any subset of some set (S_2) of occurrences of predicates with their hyponyms (yielding formula ψ), while preserving the truth (i.e. the truth of ϕ entails the truth of ψ), then there is some polar canonic formula θ logically equivalent to ϕ such that all occurrences of predicates from S_1 are positive and all occurrences of predicates in S_2 are negative. In other words, the reverse of the theorem guarantees that the algorithm described in (237) encompasses all valid directional entailments.

- (238) a. Yesterday I have bought a parrot.
 \Rightarrow Yesterday I have bought a pet.
 \Rightarrow In the past I have bought a parrot.
- b. No student knows every professor at the university.
 \Rightarrow No student knows every employee at the university.

Furthermore, Monotonicity Theorem licenses the following types of entailment, which might be called *delete* and *insert* entailment.

- (239) Delete entailment:
- a. Yesterday I have bought a parrot.
 \Rightarrow I have bought a parrot.
- b. No student knows every professor at the university.
 \Rightarrow No student knows every professor.¹¹⁵
- (240) Insert entailment:
- a. Yesterday I haven't bought a parrot.
 \Rightarrow Yesterday afternoon I haven't bought a parrot.
- b. No student knows every professor at the university.
 \Rightarrow No hard-working student knows every professor at the university.
 \Rightarrow No student knows every professor at the university well.

Let us represent *hard-working student* and *student* by $\text{hard-working}(x) \wedge \text{student}(x)$ and $1(x) \wedge \text{student}(x)$, where 1 is a predicate true for every member of the domain. Then we can use the Monotonicity Theorem to justify delete and insert entailment. Since 1 is a universal hypernym, we can substitute 1 for any predicate in an upward monotonous environment, while we can substitute any predicate for 1 in a downward monotonous environment. This means that upward and downward monotonous environments license delete and insert entailment, respectively.

The most general type of substitution licensed by Monotonicity Theorem is replacing a subformula (ϕ) with free variable x by some other formula (ψ) having the same free variable. The substitution is licensed if $\forall x: \phi \Rightarrow \psi$ and ϕ is within an upward monotonous environment, or if $\forall x: \psi \Rightarrow \phi$ and ϕ is in a downward monotonous environment.¹¹⁶ An example of such substitution is given in (241).

¹¹⁵Argument *professor at the university* in (239b) is within the scope of two negations and thus in an upward entailing environment.

¹¹⁶Intuitively it seems that subformula substitution could be made even more general by allowing for substitution of a subformula having any number of free variables. This would justify the entailment in the below example. Unfortunately, Monotonicity Theorem as formulated and proved in Živanović [2002] does not allow such generalization. While I

- (241) a. Albert Einstein understands everything.
 \Rightarrow Albert Einstein understands Relativity Theory.
 b. Everyone who understands Relativity Theory is a genius.
 Everyone who understands everything is a genius.

Last but not least, using L* and Monotonicity Theorem we can easily predict the monotonicity properties of comparative determiners. In (242), which a scheme for (243)–(245), we observe the following. (i) The only occurrence of predicate B is not within a scope of negation and is thus in an upward monotonous environment. (ii) The only occurrence of predicate C is within a scope of negation and is thus in an downward monotonous environment. (iii) Predicate A has two occurrences, one positive and one negative, and is thus in a non-monotonous environment.

- (242) a. More Bs than Cs are As.
 b. $\exists n: \exists x: B(x) \wedge \#(n, x) \wedge A(x) \wedge \neg(\exists y: C(y) \wedge \#(n, y) \wedge A(y))$
 There is an integer n such that the following is true. There is a group of individuals x such that the following is true. All members of x are Bs; the size of x is n ; all members of x are As; it is not the case that there is a group of individuals y such that the following is true: all ys are Cs, the size of y is n and all ys are As.
- (243) More promising beginners than dancers invited this tanguera.
 a. \Rightarrow More beginners than dancers invited this tanguera.
 b. $\not\Rightarrow$ More promising beginners from Ljubljana than dancers invited this tanguera.
- (244) More beginners than bad dancers invited this tanguera.
 a. $\not\Rightarrow$ More beginners than dancers invited this tanguera.
 b. \Rightarrow More beginners than bad Italian dancers invited this tanguera.
- (245) More beginners than dancers visited the milonga before midnight.
 a. $\not\Rightarrow$ More beginners than dancers visited the milonga.
 b. $\not\Rightarrow$ More beginners than dancers visited the milonga before midnight gladly.

In a nutshell, Monotonicity Theorem licenses (i) entailment by substitution for hypernyms and hyponyms, (ii) delete and insert entailment, and (iii) entailment by subformula substitution.

believe it could be generalized to cover such examples, this falls out of scope of this thesis.

- (i) John beats Mary.
 \Rightarrow John mistreats Mary.

Finally, an important aspect of our discussion on directional entailment is that it is relatively independent of which syntactic analysis we adopt. It is true that, if we adopt the hypothesis on the triviality of the semantic component, our discussion requires LF to have certain properties. However, its exact form is not determined, since LF could correspond to any of many logically equivalent formulas. Directional entailment does not care which of the two logically equivalent formulas in (230) on page 120 we use to represent the meaning of determiner *no*. Other arguments must be found to decide which LF is correct.

The only condition (besides valid truth conditions) that our discussion on directional entailment sets to a syntactician, is the following. If some argument is in a (upward or downward) monotonous environment, then our semantic (and thus syntactic) form should not contain occurrences of this predicate having different polarities. For example, truth conditions for sentence (246) should not be represented by (246a), although this formula is logically equivalent to (246b), since by using (246a) we cannot justify the usage of Monotonicity Theorem to license upward entailment for predicate student. An algorithm which would check whether a given formula is logically equivalent to some formula which satisfies the conditions given by Monotonicity Theorem is too complicated to be a part of faculty of language. We could criticize a theory which included it in its analytical apparatus by the same means as we have criticized GQ theory in §4.1.2. The above described condition is of course a welcome one, since it is a point of contact between syntax and directional entailment and thus increases the restrictiveness of the whole theory.

(246) Some student suffers.

- a. $\exists x: \text{student}(x) \wedge \#(1, x) \wedge \text{suffer}(x) \wedge (\text{student}(x) \vee \neg \text{student}(x))$
- b. $\exists x: \text{student}(x) \wedge \#(1, x) \wedge \text{suffer}(x)$

4.1.3 Negative Polarity Items

In this section we show how we can use L* in the analysis of NPIs. We show that we are able to simulate some of the main results on NPIs, while being more convincing from a psychologist's perspective.

Natural language has an interesting class of expression called Negative Polarity Items (NPIs). These include expressions as *anyone*, *anything*, *ever*, *budge an inch*, which have in common the property that they must be licensed by certain other elements in the sentence, which usually a negative feel—thus the name of NPIs.

Typically NPIs can occur in a negative, but not in an assertive sentence. Furthermore NPIs are licensed by certain verbs (*deny*, *doubt*), prepositions (*without*), adverbs (*rarely*, *only*) and complementizers (*before*). A fact that is very important for our discussion is that some determiners (*no*, *every*) can also function as NPI licensors. Determiners differ in their NPI licensing properties. Also, the licensing properties of a single determiner can differ with respect to its argument positions. For example, *no* licenses the use of NPIs in both its arguments, while *every* licenses NPIs only in the restrictor. See (247)–(256).¹¹⁷ (NPIs are printed in italics, licensors are underlined.)

- (247) a. * John saw *anything*.
 b. John didn't see *anything*.
- (248) a. * John claims that *anyone* was misbehaving.
 b. John denies that *anyone* was misbehaving.
- (249) a. * John believes that he *ever* visited Paris.
 b. John doubts that he *ever* visited Paris.
- (250) a. * With *anyone* signed up, we have no chance for a prize.
 b. Without *anyone* signed up, we have no chance for a prize.
- (251) a. * John visited Paris after *anyone* else did.
 b. John visited Paris before *anyone* else did.
- (252) a. * John often will *budge an inch* on such matters.
 b. John rarely will *budge an inch* on such matters.
- (253) a. No person who has *ever* visited Boston has returned to it.
 b. No person who has visited Boston has *ever* returned to it.
- (254) a. * Some person who has *ever* visited Boston has returned to it.
 b. * Some person who has visited Boston has *ever* returned to it.
- (255) a. Every person who has *ever* visited Boston has returned to it.
 b. * Every person who has visited Boston has *ever* returned to it.
- (256) Only JOHN *ever* ate any kale for breakfast.

Despite a long history of research on NPIs the essence of the phenomenon is still badly understood. We don't really know *why* certain environments license NPIs and even less *why* NPIs exist at all (see, however, Chierchia [2004]). We are most successful when it comes to characterize the environments licensing NPIs. Here, the basic result is Ladusaw's hypothesis that

¹¹⁷Examples (247)–(255) are taken from Ludlow [1995] and Larson and Segal [1995]. (256) is taken from von Stechow [1999].

NPIs are licensed precisely in downward monotonous environments [Ladusaw 1979].

Let us check Ladusaw's hypothesis on the above examples. We have learned in §4.1.2 that *no* is downward monotonous in both its arguments; *some* is upward monotonous in both its arguments; *every* is downward monotonous in its first argument, but upward monotonous in the second one. Thus, examples (253)–(255) confirm Ladusaw's hypothesis.¹¹⁸

What is problematic for Ladusaw's hypothesis are examples (256) and (248)–(252), since in these examples NPIs occur in an environment which is not downward monotonous. Let us take a detailed look at the example containing *only*. We shall follow von Fintel [1999], who also suggest how to solve the puzzle.

Downward entailment in the scope of *only* is impossible, since we can easily conceive of a situation where the premise is true but the conclusion is false. Assume that John had kale for breakfast and that noone else had vegetables for breakfast. If we are told that only John ate vegetables (and provides no other information), we surely won't conclude that John ate kale.

- (257) a. Only John ate vegetables for breakfast.
 b. $\not\Rightarrow$ Only John ate kale for breakfast.

Von Fintel [1999] argues that Ladusaw's approach can overcome such difficulties if we adjust the definition of downward monotonicity: he calls the adjusted version *Strawson downward entailingness*. Informally, when checking whether an environment is Strawson downward entailing, we want to know whether a substitution for a hyponym preserves truth under the condition that all conventional implicatures and presuppositions of the premise and the conclusion are satisfied. Strawson hypothesis is then that NPIs are licensed precisely in Strawson downward entailing environments.

Let us demonstrate why the verb phrase in (256) is in Strawson downward entailing environment. The truth of (257a) must entail the truth of (257b) under the condition that all presuppositions (and conventional implicatures) of both sentences are satisfied. Crucially, one of the presuppositions of (257b) is that John had kale for breakfast. We thus have to verify whether it follows from premises (i) that only John had vegetables for breakfast and (ii) that John had kale for breakfast, that John only John had kale for breakfast. Such a conclusion is valid, therefore the scope of *only* is a Strawson downward entailing environment. Strawson hypothesis thus correctly predicts that NPIs are licensed in the scope of *only*.

¹¹⁸Trivially, (247) also confirms Ladusaw's hypothesis. Complementation is a downward monotonous function, as exemplified by the validity of the following entailment: *John didn't see the bicycle.* \Rightarrow *John didn't see the red bicycle.*

Descriptively, approaches based on Strawson downward entailingness are becoming more and more adequate. However, they are impossible to integrate within a modular architecture of language faculty (see §3.3). The basic criterion used in determining the NPI licensing properties of an environment is semantic and pragmatic in nature, and not syntactic, although the type of ungrammaticality arising from wrong usage of NPIs seems to be comparable to ungrammaticality due to syntactic reasons.¹¹⁹

L* offers a way out of the modularity puzzle, since it makes it possible to determine the monotonicity properties of an environment based on inspection of syntactic structure alone. By Monotonicity Theorem, an argument is in an downward entailing environment iff all its occurrences are negative, i.e. within the scope of an odd number of negations. Ladusaw's original hypothesis is thus translatable into the L* framework, and can be therefore made syntactic.

However, L* theory can do better than Ladusaw's original hypothesis. Ludlow [1995] states the hypothesis that an environment licenses NPIs iff *at least one* occurrence of an argument (predicate, subformula) is negative. This formulation explains why NPIs are licensed in the first argument of a definite (258a) and superlative (258b) determiner and in the verbal phrase in a sentence containing a comparative determiner (258c), although these environments are not downward monotonous, (259)–(261).¹²⁰ In L* representation of truth conditions of these sentences one occurrence of the relevant predicate is within the scope of (one) negation, while the other is not. (See (231b), (233b) and (242) for truth conditions of sentences with *the*, *most* and *more*, respectively.)

- (258) a. The one man with *any* money left after the trip is here.¹²¹
 b. Most people who know *anything* about politics hate it.
 c. More cats than dogs have *ever* eaten a mouse.
- (259) a. The boy kicked the ball.

¹¹⁹In literature this is usually reflected by using a star (*) or a question-mark (?) to mark the unacceptability of the sentence, as contrasted by hash-mark (#) used for unacceptability due to pragmatic/contextual reasons.

¹²⁰Examples (258a) and (258b)–(258c) are taken from Rothschild [2007] and Ludlow [1995], respectively.

¹²¹Data on licensing NPIs in the definite determiner's complement is complicated and will not be dealt with in the thesis. For example, *the* with cardinal numeral *one*, (258a), licenses NPI in its complement, while *the* without the cardinal, (i), does not. Furthermore, NPIs are generally licensed in a plural complement of *the*, (ii). [cf. Rothschild 2007]

- (i) * The man with *any* money left after the trip is here.
 (ii) The pianists with any sense of self-respect played rugby.

- b. $\not\Rightarrow$ The red-haired boy kicked the ball.
- (260) a. Most people hate politics.
b. $\not\Rightarrow$ Most politicians hate politics.
- (261) a. More boys than girls want to build a house.
b. $\not\Rightarrow$ More boys than girls want to build a Barbie-house.

Ludlow’s characterization of NPI licensing environments correctly predicts that *only* licenses NPIs. The prediction is borne out if such sentences are analyzed following Herburger [2000]. The essence of her analysis is that *only* is a universal quantifier over events, which however also has some existential impact. In L*, the relevant truth conditions are (somewhat simplified) represented by formula (262b).

- (262) a. Only John ate vegetables.
b. $\exists e [C(e) \wedge \text{Past}(e) \wedge \text{eat-vegetables}(e)]$
 $\forall f [C(f) \wedge \text{Past}(f) \wedge \text{eat-vegetables}(f)]$
 $\text{Past}(f) \wedge \text{eat-vegetables}(f) \wedge \text{Agent}(f, \textit{john})$

In (262b), predicate eat-vegetables has more than one occurrence. Crucially, one of the occurrences is negative. Specifically, the occurrence within the restrictor of the event quantifier $\forall f$ is within a scope of one negation—remember that, when restricted quantification is translated into the corresponding unrestricted format, the restrictor of a universal quantifier is within the scope of a negation. Ludlow’s characterization of NPI licensing environments thus correctly predicts that NPIs are licensed in the verb phrase in (262a).

Furthermore, Ludlow’s hypothesis opens a path towards the analysis of (248)–(252). Let us consider *dvomiti* ‘doubt’ in more detail. The Dictionary of Standard Slovene [Bajec 1994] states that *dvomiti* means ‘assume that something is not as it seems to be’. If we denote by p the proposition of the embedded clause (‘Marie will learn to dance tango’) then (264) means that it seems that p and Jon believes that $\neg p$. Thus, in formula (263), which states the meaning of verb *dvomiti* ‘to doubt’, symbol p occurs twice: one of its occurrences is positive and the other negative. L* theory thus correctly predicts that NPIs are licensed in the embedded clause in (264), although the environment is not monotonous (neither upward nor downward).¹²²

- (263) $\textit{dvomiti}(d, p) := \textit{zdeti}(p) \wedge \neg \textit{meniti}(d, p)$ $\textit{doubt}(d, p) := \textit{seem}(p) \wedge \neg \textit{believe}(d, p)$

¹²²I assume, without discussion, that *kdaj* ‘ever’ is an NPI. Also see a more reliable English example in (249).

- (264) Jon dvomi, da se bo Marie *kdaj* naučila plesat tango.
 ‘Jon doubts that Marie will *ever* learn to dance tango.’

The problematic aspect of the above analysis is the fact that it is not a priori necessary that formula (263) is a part of (266)’ LF. It is possible that it represents the *lexical* meaning of verb *dvomiti* and not its syntactic decomposition. In the latter case, the application of L* theory is not legitimate since it only deals with LF.¹²³ The below examples show that the difference between verbs *meniti* ‘believe’ and *dvomiti* ‘doubt’ (or, between *biti prepričan* ‘to be certain’ and *dvomiti* ‘doubt’) is not only lexical but also syntactic—the meaning of the verb *dvomiti* interacts with the sentential negation—and thus justify the above application of L* theory.

- (265) Jon ne meni, da je pogovorna slovenščina nepomembna.
 ‘Jon doesn’t believe that colloquial Slovenian is unimportant.’
- a. \neq Jon dvomi, da je pogovorna slovenščina nepomembna.
 ‘Jon doubts that colloquial Slovenian is unimportant.’
- b. = Ni res, da Jon meni, da je pogovorna slovenščina nepomembna.
 ‘It is not the case that Jon believes that colloquial Slovenian is unimportant.’
- c. ... Prav nasprotno, meni, da je znanje pogovornega jezika pomembnejše od znanja knjižnega.
 ‘Quite on contrary, he believes that the knowledge of colloquial language is more important than the knowledge of standard language.’
- (266) Jon ne dvomi, da se bo naučil slovensko.*
 ‘Jon doesn’t doubt that he will learn Slovenian.’
- a. = Jon je prepričan, da se bo naučil slovensko.
 ‘Jon is certain that he will learn Slovenian.’
- b. = Ni res, da Jon dvomi, da se bo naučil slovensko.
 ‘It is not the case that Jon doubts that he will learn Slovenian.’

¹²³Actually, Ludlow’s characterization of NPI licensing environments can be adopted without buying the whole L* theory. Lexical meaning must be represented somehow, using some formal language, as well. Thus, Ludlow’s hypothesis can be understood as a hypothesis within the level of this formal language. Similarly, it is possible to argue for a special semantic component and still adopt Ludlow’s hypothesis.

*Indeed, Jon now speaks Slovenian very well, while my Norwegian is still limited to a couple of juicy swearwords.

- c. ... On dvomi, da se bom jaz naučil norveško.
'He doubts that I will learn Norwegian.'

The negation of the sentence with *meniti* 'believe' is not surprising. (265) is synonymous to (265b) and not to (265a). On contrary, the meaning of the negation of sentence containing *dvomiti* 'doubt' has an unexpected meaning. (266) is not necessarily synonymous to (266b). It has another meaning, which can be paraphrased as (266a). ((266b) is more salient if we continue by (266c).)

It seems sensible to assume that the source of this phenomenon has something to do with the negation in formula (263), which represents the (lexical) meaning of verb *dvomiti* 'doubt'. (We will not attempt a detailed analysis of the phenomenon.) The operator is thus syntactically active. As such, it can influence the usage of NPIs.

4.2 Basic aspects of LF–L* correspondence

In this section we begin to develop the LF–L* isomorphism, which will be explicated in the *correspondence principles*.

The theory of LF–L* correspondence is a theory of the semantic component of FL. In §3.4 we have concluded that, since FL is modular, its semantic component must be trivial. The optimistic expectation therefore states that the correspondence principles will turn out to be simple (stating e.g. what is a syntactic correspondent to a logical connective \wedge , a variable or a quantifier) and that they form a part of the theory only because the terminology of syntactic (LF) and semantic (L*) theory differ. We shall see that these expectations are partially fulfilled.

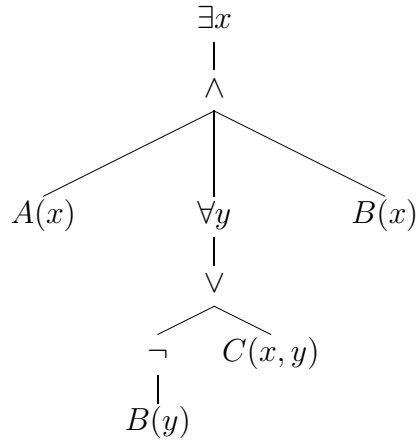
4.2.1 The preservation of hierarchical structure

One of the basic findings of generative grammar is that linguistic expressions are not just linear strings of words; they have hierarchical structure [Pinker 1994]. The same is true for expressions of formal logical languages, although they are usually written as formulas, i.e. in linear form. (The tree-like representation of formula (267a) is given in (267b).)

The semantic component of FL is a computational system transforming LF expressions into L* expressions. The most basic requirement it should fulfill if it is to be trivial is that the shapes of tree-like representations of both expressions are the same.

(267) a. $\exists x: A(x) \wedge (\forall y: \neg B(y) \vee C(x, y)) \wedge B(x)$

b.



Correspondence Principle 1 *The semantic component of FL preserves hierarchical structure.*

A consequence of correspondence principle 1 is that L* expressions we may use for representation of truth conditions must be binary branching. In the minimalism every non-terminal node of a syntactic tree is binary branching, see 3.1.3 and 4.3.2.¹²⁴ Since we require that hierarchical structure be preserved, all non-terminal nodes in a syntactic tree of an L* formula must also be binary branching.

Specifically, expression (267) cannot be a semantic representation of some linguistic expression, since nodes $\exists x$, \wedge , $\forall y$ and \neg have a wrong number of arguments. The only branching node having an appropriate form is node \vee , since it has exactly two syntactic dependents: nodes $\neg B(y)$ and $C(x, y)$.

The binary branching requirement presents no problem in the case of connectives \wedge and \vee . Restricting the argument structure of these connectives to two arguments does not diminish the expressive power of the formal language, since their many-argument version is defined based the two-argument version. (Definition is standard and hasn't been provided in the thesis. Coherency follows from the associativity of the two-place operation.) So in the case of (267) $A(x) \wedge (\forall y: \dots) \wedge B(x)$ can be replaced with binary branching $A(x) \wedge (\forall y: \dots) \wedge B(x)$ without change of meaning.

On the other hand, negation and quantifiers (both existential and universal) seem problematic. All these elements of L* were defined as unary operators: if ϕ is a formula, $\neg\phi$, $\exists x: \phi$ and $\forall x: \phi$ are also formulas (x is a objectual variable). At first sight, it is not clear how they could be viewed

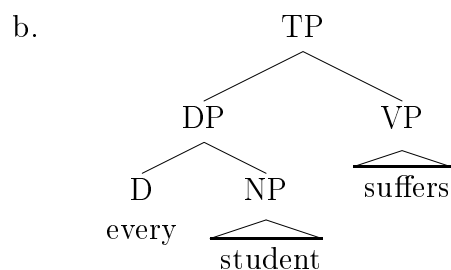
¹²⁴In §4.3 we show that an exception to this generalization exists, but this does not bear on the discussion in this section.

as binary operators. We shall see, however, that this can be done and even presents advantages for the theory. (We shall deal with the argument structure of quantifiers and negation in §4.2.2 and §4.4.2, respectively.)

To illustrate the preservation of hierarchical structure, the result of §4.2.2 is needed. In the present section we therefore cannot illustrate it; we will do so in §4.2.3. In the remainder of the section it will be shown that in GQ theory, hierarchical structure of LF is *not* preserved.

Superficially, natural language contains *quantificational words*, such as determiners *a, every, five, more, most* and adverbs *always, often, everywhere, somewhere*. For example, (268b) contains determiner *every* in the terminal node D. The GQ theory assumes that terminal node D contains a quantificational element at LF as well. More precisely (but ignoring strong compositionality), D contains a logical feature denoting the mapping $\llbracket \text{vsak} \rrbracket$ having two arguments, *internal* and *external*. The internal and external argument are defined as c-command domain of D and DP, respectively. Thus, in (268b), the internal and external argument of D are NP and VP, respectively. The (surface) syntactic structure and the content of the logical feature, which is formulated in the lambda calculus over GQ, are compatible. The content of the logical feature is a mapping, whose arguments are determined by the syntax.

(268) a. Every student suffers.



(269) $\llbracket \text{every} \rrbracket (N, V)$ iff $V \supset N$.

This does not mean that in GQ theory the semantic component of FL preserves hierarchical structure, but only that logical features are compatible to the (surface) syntactic structure. (In §3.3 we have argued that the technical implementation of this compatibility violates modularity. How does the syntax know, what kind of LF expression to generate, if it is to be compatible to a logical feature, whose content the syntax cannot see? From the other perspective, how does the formal semantics know what kind of logical features may be generated to be compatible with syntactic structures generated by the syntax?) Of course, denotations of sentences generated in the GQ theory

the nodes in both trees is incompatible, too: in LF there are no features for numbers (0), cardinality predicate and the set-subtraction operation.

In contemporary semantic theories the requirement of (*strong*) *compositionality* plays an important role. It is thus necessary to clarify its role in L* theory; more precisely, to explain why it plays no role in this theory.

A theory of formal semantics is compositional, if the meaning (i.e. denotation) of every syntactic expression is computed from the denotations of its constituents (and general principles prescribing the mode of composition).¹²⁶

The denotations are computed by the semantic component of FL (see §3.2)—the denotations are expressions of SF, computed from the information in LF expressions. Compositionality is thus a condition on the semantic component of FL. In L* theory it is assumed that there is no semantic component, therefore the condition is vacuous. Put a bit differently, L* theory assumes the semantic component is trivial, making LF and SF expressions isomorphic, and therefore automatically satisfies compositionality.¹²⁷

4.2.2 Conservativity and restricted quantification

On page 89 in §3.2 a hypothetical determiner *some* has been defined; no determiner of any language has its meaning, represented by formula (271b) (using PLO).

- (271) a. Some dog is barking.
 b. $\exists x: \text{dog}(x) \vee \text{bark}(x)$
 There is an x such that x is a dog or x is barking.

The GQ theory claims that *some* cannot be a determiner of any language since it is not *conservative*.

- (272) Determiner D is *conservative*, $D(A, B) \Leftrightarrow D(A, B \cap A)$ holds for every sets A, B . [van Benthem 1983, see also Keenan and Stavi 1986]

The idea of conservativity is that, in order to check the truth of a sentence in some situation, it suffices to consider the set of individuals determined by the determiner's complement. Intuitively we can check the conservativity of determiners by checking that the sentences in the following sentence pairs are

¹²⁶Strong compositionality requires that the denotation of a complex expression is computed from the denotations of its *immediate* constituents.

¹²⁷On the other hand, it is reasonable to ask whether the formal definition of L* is compositional. The definitions of formal languages have two parts: the syntax and the interpretation must be defined. L* is compositional in this sense: the interpretation rules were given in §4.1.1.

consequences of each other. These sentences illustrate that it really suffices to consider students and pigs when checking truth conditions.

- (273) a. Some student suffers.
 b. Some student is a student who suffers.
- (274) a. Every student suffers.
 b. Every student is a student who suffers.
- (275) a. Most pigs are eating.
 b. Most pigs are pigs that are eating.

The hypothetical determiner *some* is not conservative, since sentences in (276) are not consequences of each other. By definition (271b), sentence (276a) should mean ‘there is something, which is a dog or it is barking (or both).’ The sentence is true in a situation containing no dogs but some barking individual. Contrary, (276b) is false in this situation: there must be an individual x that is a dog or a barking dog; however, in both cases, a dog.

- (276) a. i. Some dog is barking.
 ii. $\exists x: \text{dog}(x) \vee \text{bark}(x)$
 There is an x , which is a dog or is barking.
- b. i. Some dog is a dog that is barking.
 ii. $\exists x: \text{dog}(x) \vee (\text{dog}(x) \wedge \text{bark}(x))$
 There is an x , which is a dog or a dog that is barking.

All ordinary¹²⁸ determiners are conservative, or, as is argued by van Benthem [1983], satisfy an even stronger requirement: *strong conservativity*, which is equivalent to the conjunction of the above-defined conservativity and *extension* [van Benthem 1983], (277).

(277) Extension: $A, B \subset E \subset E' \Rightarrow (D_E(A, B) \Leftrightarrow D_{E'}(A, B))$

(278) Strong conservativity: $D_E(A, B) \Leftrightarrow D_A(A, B \cap A)$

In (272) we have been somewhat vague. We haven’t explicitly mentioned the *domain* of the model, i.e. the set of individuals.¹²⁹ In (277)–(278) the domain is explicated as an index of D , i.e. E , E' and A are domains.

¹²⁸The exception mentioned by van Benthem [1983] is *many* in the relative frequency reading, but see Herburger [2000].

¹²⁹The semantics of formal languages is investigated in the *model theory*. A model is an interpretation of a formal language, where true statements correspond to the axioms of the theory. For our purposes it is important to note that to define a model one must (among other things) define its *domain*, i.e. the set of individuals usually denoted by E .

In general, it is possible to define e.g. a determiner which has the meaning of *some* in some models and the meaning of *every* in the others. Extension forbids such determiners, and allows us to drop omit mentioning the model explicitly.

An example of a conservative L* formula which does not satisfy extension, is given using another hypothetical determiner *soke* in (279).

- (279) a. Soke dog is barking.
 b. $\exists x: \neg \text{dog}(x) \vee \text{bark}(x)$
 There is an x , such that x is not a dog or x barks.

(279b) is conservative, since it is equivalent to $\exists x: \neg \text{dog}(x) \vee (\text{dog}(x) \wedge \text{bark}(x))$ (as in (273)–(275)), but it does not satisfy extension. Let us construct a model where (279b) is false. In such a model every individual must be a dog, but noone may be barking. Extension requires that the truth is preserved if an individual is added which is neither a dog nor it is barking. However, if such an individual is added to the domain of our model, formula (279b) becomes false.

Is it possible to provide a syntactic (i.e. formal) characterizatoin of strong conservativity. It turns out that this is not only possible but also extremely simple. The semantic (model-theoretic) notion of strong conservativity corresponds to syntactic (formal) notion of *restricted quantification*.

Until now, we have used unrestricted L* notation. In unrestricted existential (universal) quantificational structure $\exists x: \phi$ ($\forall x: \phi$) variable x may (must) “take” every value of the domain. Oppositely, when using restricted existential (universal) quantification, we have to explicitly determine, within the formula, which values the variable may (must) take. The restricted existential (universal) quantification was formally defined as an abbreviation of certain unrestricted existential (universal) quantificational structure, see (202) to (203) on page 109. The examples of restricted quantification are given in (280).

- (280) a. Restricted existential quantification:
 $\exists x [\text{dog}(x)] \text{bark}(x)$
 Something, which is a dog, is barking.
 b. Restricted universal quantification:
 $\forall x [\text{dog}(x)] \text{bark}(x)$
 Everything, which is a dog, is barking.

Conservativity is satisfied, since (280a) and (280b) are equivalent to $\exists x [\text{dog}(x)] \text{dog}(x) \wedge \text{bark}(x)$ ‘something, which is a dog, is a dog and is barking’ and $\forall x [\text{dog}(x)] \text{dog}(x) \wedge \text{bark}(x)$ ‘everything, which is a dog, is a dog and is barking’, respectively.

Extension is satisfied, since it suffices, in both cases, to consider the set of dogs when checking the truth conditions. Thus extending the domain of a model with an individual that is not a dog (and is not barking) does not influence the truth conditions. In (280a) it cannot be chosen as an individual satisfying the condition in square brackets; in (280b) it cannot act as a counterexample.

The claim that strong conservativity corresponds to restricted quantification is proven by Živanović [2002] in the following *Conservativity Theorem*.

Theorem 1 (Conservativity)

Let A be a unary predicate. $L_{\omega_1\omega}$ formula ϕ is A -restricted, if it is build using only the following means of composition.

- *Atomic formulas are A -restricted.*
- *If ϕ and ψ are A -restricted $L_{\omega_1\omega}$ formulas, $\neg\phi$, $\phi \wedge \psi$ and $\phi \vee \psi$ are A -restricted as well.*
- *If ψ is an A -restricted $L_{\omega_1\omega}$ formula, $\exists x [A(x)]\psi$ and $\forall x [A(x)]\psi$ are A -restricted as well.*

*Let us use lambda calculus over $L_{\omega_1\omega}$ to represent the denotations of determiners. Then the following holds.*¹³⁰

- *Let $\|D\| := \lambda A\lambda B\phi$, where ϕ is a A -restricted $L_{\omega_1\omega}$ formula. Then mapping $\|D\|$ is strongly conservative.*
- *Let $\|D\|$ be a strongly conservative mapping. Then an A -restricted $L_{\omega_1\omega}$ formula ϕ exists such that $\|D\| := \lambda A\lambda B\phi$.*

Since the theorem is proven for a general case of infinitary logic $L_{\omega_1\omega}$, it can be used both for the original version of L* [Law and Ludlow 1985] and for the current version, used in the thesis.*

¹³⁰Let $\|X\|$ be the denotation of a syntactic expression X.

* During the preparation of the English version of the thesis I have discovered that this is not entirely true. The Conservativity Theorem (for $L_{\omega_1\omega}$) is valid for (both the original and the current version) of L* only in one direction: restrictive formulas of L* denote strongly conservative functions, but not all strongly conservative functions can be written in L* (not even using unrestricted quantification)—the latter is not true on infinite domains. For example, an $L_{\omega_1\omega}$ formula

$$\exists x [A(x)] B(x) \wedge \bigvee_{i=1}^{\infty} \exists x_i [A(x_i)] E_i(x)$$

The above theorem is limited to the denotations of determiners. Since it is assumed in GQ theory that these denotations are conservative, the theorem implies that the meaning of any determiner can be written in L^* . However, since we assumed that LF and SF are isomorphic, this means that we are adopting a principle stating that the “part” of LF representing the meaning of determiners may use only restricted quantification. Limiting the principle to some “part” of LF—which is, additionally, only vaguely defined, see §2.1.1—is of course unreasonably. I thus adopt the assumption that the principle applies in general, i.e. for the “whole” LF.

Hypothesis 2 (Restricted quantification) *The L^* expressions generated by the semantic component of FL use only restricted quantification, i.e. unrestricted quantification is not used.*

The conservativity generalization of GQ theory is limited to determiners. We have argued in 2.1.1 that a syntactic definition of determinerhood is slippery. Therefore, syntacticians conclude that determiners are not a uniform syntactic category (see the conclusion of §2.1.1); semanticists take conservativity to be the defining property of determiners, an assumption leading to circularity.

Contrary to the conservativity generalization of GQ theory the above hypothesis about restricted quantification is falsifiable. It claims that the (literal) meaning of any linguistic expression can be represented without using unrestricted quantification (in L^*). The hypothesis can be falsified by a single example of a sentence whose truth conditions are impossible to represent without using unrestricted quantifiers.¹³¹

The monotonicity theorem from §4.1.2 holds only for polarity canonical formulas, where restricted quantifiers cannot be used. This seems incompatible to the above hypothesis about restricted quantification, since it seems that the monotonicity theorem is unusable for formal semantic decompositions of linguistic expressions. The same holds for the discussion on NPIs in §4.1.3.

¹³¹Of course, a question, what exactly the truth conditions are, become immediately relevant. . .

where E_i are arbitrary predicates, is restricted and therefore denotes conservative function, but is not expressible in L^* . However, I cannot think of a linguistic expression (let alone a single (complex) determiner), which would denote this function. So, somewhat surprisingly, it turns out that the failure to fully apply Conservativity theorem to L^* has welcome consequences for the theory developed in the thesis. For further details see Ludlow and Živanović [prep].

However, the restricted quantification hypothesis is *not* incompatible to the monotonicity theorem and NPI licensing assumption. These are dependent upon the notation: the formula must be in polarity canonical form. Oppositely, the restricted quantification hypothesis is not dependent on a particular notation, and remains valid, if restricted quantification is notated by unrestricted quantifiers, using the translation rules in (202) to (203) on page 109. (When we have introduced restricted quantifiers, we have said that $\exists x[\phi]\psi$ and $\forall x[\phi]\psi$ are only *abbreviations* of the unrestricted notations; they have no independent definition. The same is true for connectives \Rightarrow and \Leftrightarrow , or any connective we wanted to use.)

4.2.3 The basic correspondence principles

In this section the workings of the semantic component will be demonstrated on sentence (281), inducing the basic correspondence on the way.

Correspondence principle 1 requires LF and L* expressions to have the same shape. Ignoring the internal structure of NP and VP, the L* expression corresponding to the LF of (281), has the shape shown in (284a).

We clearly want that atomic formulas $\text{student}(x)$ and $\text{suffer}(x)$ correspond to NP and VP, respectively, as shown in (284b). In general, the semantic component maps conceptual features to predicates.

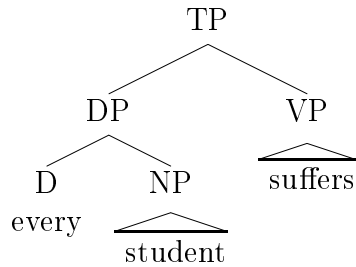
We want to assign to sentence (281) truth conditions given by L* formula (283). Based on the results of §4.2.2 this formula does not contain an unrestricted, but a restricted universal quantifier. This quantifier has two arguments, the restrictor $\text{student}(x)$ and the nuclear scope $\text{suffer}(x)$. We must therefore place $\forall x$ in a node which branches into nodes containing $\text{student}(x)$ and $\text{suffer}(x)$. Considering the positions of these in (284b), we must place $\forall x$ in the root node (TP), as shown in (284c).

So far we have concluded that the content of the L* expression is as shown in (284c). This tree must have the same meaning as formula (283), so the subformula rooted in the higher question mark, must be logically equivalent to $\text{student}(x)$. This can be achieved by assuming that the higher and the lower question mark correspond to connective \wedge and truth value 1, respectively. The former assumption is consistent with the assumption of Davidsonian semantics that atomic formulas are combined using conjunction (see §2.2.1). The adoption of the latter assumption is then inevitable, since formula $? \wedge P$ is logically equivalent to P , for every P , only if $?$ is the truth value 1.¹³² Thus, \wedge corresponds to DP, and 1 corresponds to D , (284č).

¹³²We can prove this by choosing predicate 1 for P in $? \wedge P \Leftrightarrow P$.

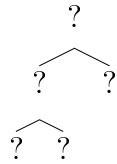
(281) Every student suffers.

(282)

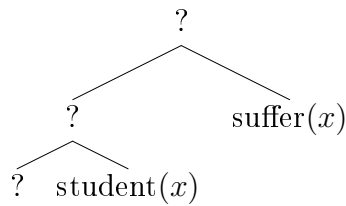


(283) $\forall x [\text{student}(x)] \text{suffer}(x)$

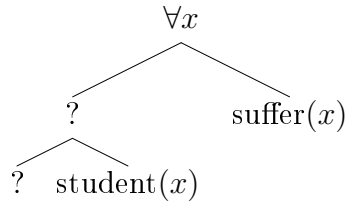
(284) a.



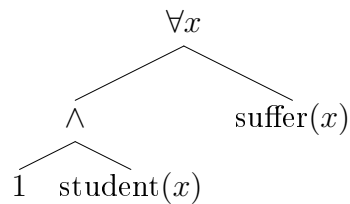
b.



c.



č.



We state the results of the above argument in the following correspondence principles. (The word *default* in the following principles should be read as ‘if some other correspondence principle does not override this.’)

Correspondence Principle 2 *Individual predicates (in L^*) correspond to conceptual features (in LF).*

Correspondence Principle 3 *Logical connective \wedge (in L^*) corresponds to a branching node (in LF).*

Correspondence Principle 4 *Truth value 1 (in L^*) corresponds to a terminal node (in LF).*

Correspondence Principle 5 *A restricted (existential or universal) quantifier Q (in L^*) may correspond to a node X (in LF).¹³³ If X is a maximal projection, i.e. an XP , then the restrictor and nuclear scope of Q correspond to the specifier and complement of XP , respectively.*

At some points in the thesis, mainly when using the quantifier over an event variable, a unrestricted quantifier is used, as in (286). In such cases I do not want to claim that the eventual quantifier is unrestricted; I simply do not wish to deal with the question which conjunct corresponds to the restrictor in the given example, i.e. whether (285) is properly represented using formula (286a) or (286b).

(285) Some dog is barking.

(286) $\exists e: \exists x [\text{dog}(x)] \text{agent}(x, e) \wedge \text{barking}(e)$
 a. $\exists e [\exists x [\text{dog}(x)] \text{agent}(x, e)] \text{barking}(e)$
 b. $\exists e [\text{barking}(e)] \exists x [\text{dog}(x)] \text{agent}(x, e)$

The hypothesis about restricted quantification was based only on the generalization of the conservativity conditions of GQ theory and the hypothesis about triviality of the semantic component. It is thus encouraging to see that minimalism (and also some other syntactic theories) offer an independent argument favoring the hypothesis. Syntactic trees are binary branching, and we have argued that quantificational nodes in L^* corresponds to (some) nodes at LF. It follows that two arguments are provided to a quantifier by the syntax. Since unrestricted quantifiers are unary (they have one argument), they cannot occur in an L^* formula corresponding to some LF expression. On the other hand, restricted quantifiers have the appropriate number of argument places (two), and therefore may occur in such formulas.

4.3 Atomic formulas

In this section we begin the discussion on the aspects of LF– L^* correspondence concerning predication.¹³⁴ The simplest formulas of any formal logical language are *atomic formulas*, i.e. formulas build of a predicate and its

¹³³In §4.4.1 we will provide the correspondence principle determining which nodes are actually associated to quantifiers.

¹³⁴I emphasize that we do not discuss the subject–predicate (where predicate is usually a verb) relation here. In the thesis the term predication is always used to refer to the relation between a predicate and its arguments in formal logical languages, specifically, in L^* .

arguments. Atomic formulas are combined into complex formulas using connectives; the variables occurring as arguments, are bound by quantifiers. The correspondence principles developed in the thesis, thus deal with three aspects of LF–L* relation: atomic formulas, logical connectives and quantifiers. These aspects are not independent. Therefore, the correspondence principles cannot be motivated for each aspect separately. This fact is reflected in the organization of the present chapter as well.

Specifically, we will not be able to motivate all predicational aspects of LF–L* correspondence without taking into account the quantificational aspects of the correspondence. In the present section, we only deal with the atomic formulas. As mentioned, these consist of a predicate and its arguments. Since L* has no individual constants and function symbols, only variables can be arguments. In §4.3.1 we shall conclude that sequences of functional projections (in LF) we shall call *spines* correspond to variables (in L*).

Correspondence principle 2 claims that predicates correspond to conceptual features. In §4.3.3 we shall argue that predicates also correspond to formal features; we shall discuss, how a variable “becomes” an argument, i.e. how an atomic formula is generated.

The details of predication heavily depend on the assumptions on X-bar theory. In the thesis, *X-bar theory without specifiers*, argued for in Starke [2004], will be adopted, since adopting this theory yields the simplest LF–L* correspondence. Thus, before we begin discussing the predicational aspect of LF–L* correspondence in §4.3.3, we introduce this X-bar theory in §4.3.2. (§4.3.4 shows the details of the predication if standard minimalist X-bar theory is adopted.)

As mentioned, this section only deals with internal structure of atomic formulas. We shall deal with the question how atomic formulas are included into the truth conditions of a complete sentence in §4.5, armed with the results on quantificational aspect of LF–L* correspondence from §4.4.

4.3.1 Variables

In formulas of L* (and any other logical language) variables are represented by some symbols, usually letters. An important property of logical languages is that variable symbols are *interchangeable*. Thus, the interpretation of a formula does not change if all occurrences of symbol x are replaced by y , while all occurrences of y are replaced by x . Actually, we may replace all occurrences of a given (variable) symbol by an arbitrary (variable) symbol (however, the same symbol for all occurrences of the original symbol) which does not occur in the formula. Considering interchangeability of variable

symbols we assume that at LF variables are not encoded by “letter” features ($[x]$, $[y]$, etc.).¹³⁵

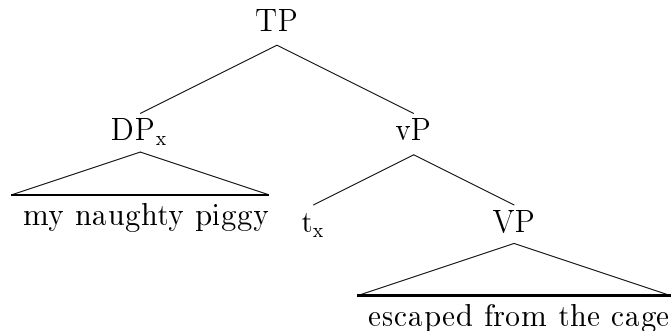
As linguists/mathematicians we have the intuition that variables correspond to phrases, e.g. noun phrases.

(287) My naughty piggy escaped from the cage.

Ignoring the internal structure of DP *my naughty piggy* and eventual decomposition of (287), the truth conditions of the sentence are given by formula (288a). Comparison of formula (288a) and LF (288b) reveals that occurrences of variable x in L^* correspond (at LF) to surface position of DP *my naughty piggy* and the DP’s traces.¹³⁶ As the first approximation we shall therefore assume that a moved NP and its trace stand for the same variable.

(288) a. $\exists x$ [my-naughty-piggy(x)] escape-from-the-cage(x)

b.



This assumption can be simplified by adopting some version of multiple-dominance X-bar theory [see Chomsky 2001, Starke 2001, Kracht 2001]. These theories unify the Merge and Move operations, resulting in a generalized Merge operation, which may combine (i) two non-intersective constituents (as usual Merge), or (ii) two constituents in a subset relation (as Move)—so called *internal Merge*. The “moved”, i.e. internally merged, phrase thus occurs both in the “base-generated” and “surface” position. The stipulation that the same variable stands both for a phrase and its trace becomes redundant, since the trace and the moved phrase are one and the same syntactic object.

Of course, DP *my naughty piggy* is a complex phrase, both syntactically and semantically. Its rough internal structure is shown in (289b). At a rough

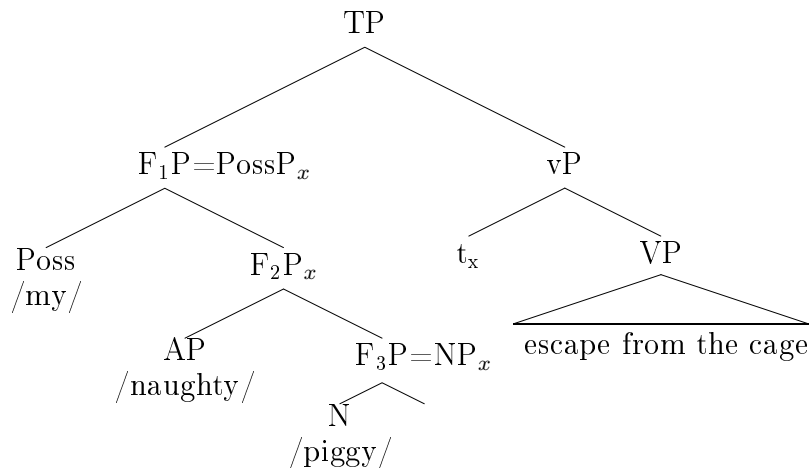
¹³⁵Cf. with indices of the binding theory [Büring 2005].

¹³⁶In the representational terms: a variable corresponds to a *chain*. For a definition of a chain see e.g. Brody [2003].

level of analysis, a one-place (L^*) predicate (my, naughty, piggy) corresponds to every word of the DP. All these predicates have the same argument, variable x —the same variable that was above assumed to correspond to the whole DP and its traces.

(289) a. $\exists x [\text{my}(x) \wedge \text{naughty}(x) \wedge \text{piggy}(x)] \text{escape-from-the-cage}(x)$

b.



It is not unexpected that the variable corresponding to the whole DP is the argument to each of the predicates in the decomposition of the DP (my, naughty, piggy). These elements are intersective: something is my naughty piggy, if it is mine, naughty and a piggy. (In the thesis, we shall not deal with non-intersective adjectives as e.g. *alleged*.)

Each of the predicates my, naughty and piggy corresponds either to a head (Poss, N) or a specifier (AP) or some functional projection in the extended projection of the DP.¹³⁷ Thus, the individual variable corresponding to some DP is an argument of predicates corresponding to heads and specifiers of this DP. It follows that it is more appropriate to claim that a nominal extended projection, and not a noun phrase, corresponds to an individual variable.

It is easy to generalize this conclusion to the other types of variables. Every type of variable corresponds to the extended projection of some lexical

¹³⁷This is not entirely correct. The approach developed in §4.3.3 will assume that only heads (actually features) can correspond to predicates. Specifiers will be semantically decomposed. Specifically, by analogy to theta roles (see §2.2.1), AP in (289b) will be decomposed using a property variable p : instead of $\text{naughty}(x)$ we shall write $\exists p [\text{naughtiness}(p)] \text{property}(p, x)$ ‘there is a property p , which is naughtiness; p is ascribed to x .’ Predicate naughtiness corresponds to a lexical head; variables P and x are associated using predicate property, which corresponds to functional head F_2 from (289b). (Also see §5.2.1.)

category. Thus, for example, eventual variables correspond to extended verbal projections. In (290), event f corresponding to the extended projection of the embedded clause, is on one hand an argument of predicates in the embedded clause (verb, adverb and thematic predicates in the embedded clause); on the other hand, it is also an argument of the thematic predicate theme in the matrix clause, since the embedded clause with eventual variable f is an object to the verb in the matrix clause.

- (290) a. Marie told Jon, that Herman ate lettuce yesterday.
b. $\exists e: \text{tell}(e) \wedge \text{agent}(\text{marie}, e) \wedge \text{recipient}(\text{jon}, e) \wedge$
 $(\exists f: \text{eat}(f) \wedge \text{yesterday}(f) \wedge \text{agent}(\text{herman}, f) \wedge \text{theme}(\text{lettuce}, f) \wedge$
 $\text{theme}(f, e))$

The above generalization that individual variables correspond to nominal extended projections is a simplification. The ontology of entities associated to a DP is richer. Zamparelli [2000] distinguishes between *individuals* and *stages*, where individuals can be either *objects* or *kinds*.

Zgornja posplošitev, da individualne spremenljivke ustrezajo samostalniškimi ogrodjem, je poenostavitev. Ontologija entitet, povezanih s samostalniško besedno zvezo, je bogatejša. Tako Zamparelli [2000] razlikuje med *posamezniki* in *stadiji*, posameznike pa loči na *predmete* in *vrste*.

Individuals do not appear directly in everyday life. Rather, they manifest themselves as “stages”, spatiotemporal “slices” of individuals [...] Some predicates, such as *be in this room*, *be ready*, *be tired* may only apply to stages of individuals, and go under the name of “stage-level” predicates.

Individuals, objects and kinds are interconnected by two relations: *instantiation* (I), and *realization*, (R). Kinds are “instantiated” by objects [...] or by other kinds in some special cases.[...] For example, the object John is an instance of the kind ‘people’ (or ‘fictitious linguistic characters’—kinds can also be composite, and a single object can be an instance of multiple kinds). Individuals (both objects and kinds) are “realized” by stages, via the “realization relation” R . [Zamparelli 2000: 174]

Furthermore, Zamparelli assumes that in the NP-syntax stages, objects and kinds correspond to SDP, PDP and KIP phrases (in our terminology, KIP is NP) and argues that SDP, PDP and KIP have the following order in the nominal fseq: SDP > PDP > KIP.

In this thesis, Zamperelli's assumptions will be formalized by assuming that extended projections consist of several continuous complement sequences,¹³⁸ which we shall call *spines*, and that variables do not correspond to extended projections, but spines. Thus, we assume that an extended nominal projection consists of a stage spine (the highest one), object spine (the middle one) and kind spine (the lowest one).¹³⁹

Other extended projections could be partitioned in a similar way. However, such partitions are for the most part not important in the thesis and will be mainly ignored. Thus, we shall talk about nominal, verbal and adjectival spine, as if each of the extended projections consists of a single spine and therefore corresponds to a single variable. By making a distinction between an extended projection and a spine I mainly wish to set up the terminology for further research; besides, the distinction will be relevant in the discussion about the exceptional properties of the numerical spine, in §4.5.5.

Correspondence Principle 6 *Variables of L^* are in bijective correspondence to spines at LF .*

I emphasize that the above principle does not state that spines are in a one-to-one correspondence to *occurrences* of variables. The bijective correspondence is to *symbols*. (The above principle will occasionally be terminologically misused: (i) the expression the spine corresponding to variable x , will be abbreviated to spine x ; (ii) the expression the spine of functional projection FP will refer to the spine, which contains FP.)

4.3.2 X-bar theory without specifiers

It is a widely spread belief that only lexical items (more precisely, elements of enumeration) may be syntactic heads. Lexical items are (unstructured)

¹³⁸In §4.3.3 we shall argue that a functional projection and its specifier are the two arguments of an L^* predicate. Since correspondence principle 6 states that spines correspond to variables, a functional projection and its specifier cannot be a part of the same spine. It follows that spines are sequences of *complements*.

¹³⁹I leave open the question whether a spine is a complement of a specifier of the directly dominant spine, and whether this is fixed universally. (More precisely, this is a question about the relation between the lowest functional projection of the upper spine and the highest functional projection of the lower spine.) In principle, all three options are available. Cf. Brody [2003] for a discussion on a similar question for functional projections in general.

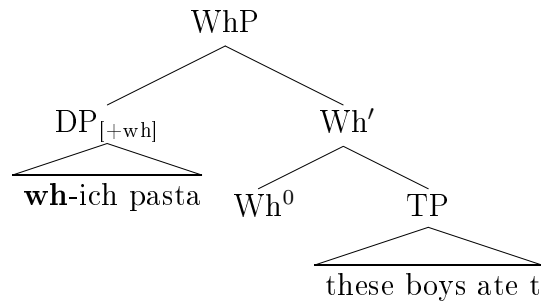
It will follow from the discussion in §4.3.3 that in the case that the lower spine is a specifier of the upper one, the lowest functional projection of the upper spine and the highest functional projection of the lower spine are in some semantic relation. In the case that the lower spine is the complement of the higher one, this is not necessarily so (although the option is available in principle, see §4.5.5).

feature bundles; they are syntactically non-complex expressions. Thus, in standard minimalism, heads must be non-complex (simple).

The consequence of this belief is that two complex expressions YP and ZP can only be combined indirectly. First, one of them, say, YP, is merged with a simple head X into the intermediate projection X'; the other one (ZP) is then merged with X' into XP. YP and ZP are called complement and specifier (of X(P)), respectively. So, a question phrase *which pasta* and TP *these boys ate t* are combined indirectly, through the use of head Wh. Head Wh is merged with TP into Wh', which is further merged with DP into WhP. The theory motivates the movement of DP with a feature-checking mechanism: a question DP contains a [+wh] feature, which must be licensed; this is done by checking the feature at head Wh. (The example is taken from Starke [2004].)

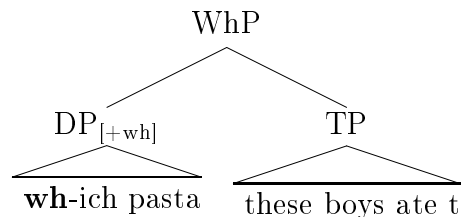
(291) I wonder which pasta these boys ate.

(292) I wonder...



Starke [2004] argues against the opinion that heads can only be simple, and claims that complex syntactic expressions can also be heads. In his X-bar theory, which we shall call *X-bar theory without specifiers*, tree in (292) is replaced by tree (293).

(293) I wonder...



As in standard X-bar theory, DP contains a [+wh] feature, which must be licensed, and the licensing requirement of this feature triggers the movement of DP. However, the feature is not licensed by checking it. It is checked by

projecting it. In (293) DP and TP are combined in a single step. Feature [+wh] within DP is licensed by labeling the resulting complex expression, which is called feature projection. DP, which the feature was projected from, is called the *complex head* of functional projection WhP.

Starke's main arguments for complex heads (and thus for the claim that specifier is nothing but a complex head) are the following.

The “Doubly Filled Nothing” generalization. In contemporary minimalism, where functional projections, such as CP, IP and DP, are decomposed into finer-grained, semantically specialized heads, it is never the case that both a head and its specifier are phonologically realized. (This is a generalization of so-called *Doubly Filled Comp* generalization [Chomsky and Lasnik 1977]. The counterexamples to this generalization must be reanalyzed, maybe by introducing new functional projections. Dealing with counterexamples is out of scope of the dissertation.) Starke [2004:253] claims that »the optimal answer is that we see only one position because there *is* only one position.«

Why can't “specifiers” project? Usually it is assumed that the head-specifier relation is identity with respect to some feature(s) (agreement, checking). Both a head and its specifier contain the same feature [f], which is also the label of the resulting object. If a head and its specifier contain the same feature, a question arises why can be projected by the head but not by the specifier. The answer cannot be that the feature is inaccessible within the specifier: if that were true, it could not be checked. Starke concluded, that standard theory does not offer a satisfactory answer, but contains the following implicit assumptions. (i) Specifiers cannot project. (ii) Two complex syntactic objects cannot be combined directly, the composition must be carried out in two steps: first, the complement is merged with the head, next, the resulting object is merged with the specifier. These assumptions are undesirable. Thus, (292) should be replaced with (293).

4.3.3 Predication in X-bar theory without specifiers

Argument assignment

How does a variable become an argument of some predicate, if we adopt the X-bar theory with complex heads? We shall work this out using the case of theta roles.

In §2.2.1 Davidsonian semantics was adopted. The semantic part of our theory therefore deals with theta predicates such as agent. This predicate

has two arguments: an individual variable representing the agent, and the eventual variable representing the event.

In syntax the usual assumption [Adger 2003, Radford 1997] is that the agent is determined by the DP (whose trace is) in the specifier position of AgentP; in our terminology, the DP that is the complex head of AgentP. We shall make the same assumption with respect to the other theta roles, although the literature is in general less clear about these cases. So the complex heads of ThemeP and GoalP will represent the theme and recipient of the event, respectively; ThemeP and GoalP are functional projections is the so-called VP-shell.¹⁴⁰ To claim that the theme, which is usually the direct object, sits in a specifier of a special functional projection, is non-standard, but has nevertheless been proposed by several authors [e.g. Brody 2000]. In the terminology of X-bar theory with complex heads: DPs referring to the participants in the event are complex heads of appropriate functional projections.

The syntactic configuration where the agent theta role is assigned is shown below. DP in (294) is the complex head of AgentP; it contains feature [Agent] and projects is into the verbal spine.

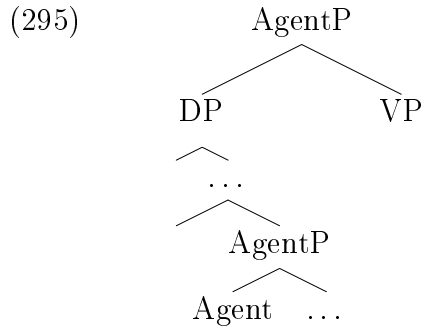


Feature [Agent] cannot “hang in the air”: it must be built into DP somehow. The only possibility is that it is, as any other feature, projected to its own functional projection, which is a part of the nominal extended projection.¹⁴¹ The detailed structure of (294) is thus (295). For expository reasons we will assume that AgentP is the highest projection in DP_[Agent], as in (296).¹⁴²

¹⁴⁰Adger [2003] and Radford [1997] do not introduce special functional projections ThemeP and GoalP, but simply place the theme and recipient in the specifier and/or complement of VP, depending on the arity of the verb.

¹⁴¹I attribute the idea to Starke [2001] where it is used for θ P in general, for any theta role. Starke’s argument favoring the existence of projection θ P is an observation that Relativized Minimality [Rizzi 1990] “sees” the theta relations [Starke 2001: §3]. Further discussion on the subject is out of scope of the thesis.

¹⁴²I assume that a complex head can project a feature (corresponding to some functional projection in its extended projection) also is this functional projection is not the highest projection in the extended projection. Cf. with feature percolation in standard minimalism [Radford 1997].



(296) contains two constituents labeled **AgentP**. This is not a contradiction, since they are not the same object; a contradiction would arise only if an object would be a part of itself. To facilitate referring to functional projections, I introduce indexing: let us index a functional projection **FP** with the L^* variable corresponding to the spine that contains this **FP**. Thus, (296) is indexed as in (297).¹⁴³ (e and x are eventual and individual variables, respectively.)



Feature **[Agent]** is projected twice in the course of generation of (297): the first time it is projected from the simple head **Agent** into the nominal spine x ; the second time it is projected from the complex head **AgentP_x** into the verbal spine e .

Constraints on projection

Could feature **[Agent]** in (297) be projected again, i.e. could a clause containing (297) (and no other **[Agent]** feature), project feature **[Agent]** into **AgentP** of some higher spine? Feature **[Agent]** was projected twice—could feature **[N]** also be projected twice?

¹⁴³I emphasize that indexing is not a part of the theory. It is only a notational tool facilitating talk about LF nodes.

I claim that constraints on projection are determined by the argument structure of predicates. Predicate agent, corresponding to feature [Agent], has two arguments, thus [Agent] must be projected exactly twice. Predicates corresponding to lexical items, e.g. piggy, have only one arguments, thus [N] can be projected only once. Projection will therefore be constrained with the following correspondence principle.

Correspondence Principle 7 *Head predicates correspond to syntactic features. The arguments of head predicates are determined by projection: the variable corresponding to the spine which the feature is projected into becomes the argument of the head predicate of the feature.*

Syntax does not determine how many times a feature can be projected.¹⁴⁴ From syntactic viewpoint all features behave identically, and could in principle be projected an arbitrary number of times. Projection is only constrained with the meaning of features. Since the generated LF will only be interpretable if every head predicate will have the appropriate number of arguments, the above correspondence principle, by determining the mode of argument assignment, constrains projection.

A potential problem of this approach is that it allows for head predicates of an arbitrary arity, while it seems that natural language contains [at most two]-place head predicates—at least in the course of writing the thesis I haven't found a counterexample.*

Hypothesis 3 *All head predicates have at most two arguments.*

So far, we have considered lexical predicates (*piggy*, *eat*, etc.) to be one-place predicates. However, we shall argue in §4.5.1 that this cannot be the case. Nevertheless, we shall argue in the same section that one-place predicates do exist, and that they are used to determine the type of the variable.

An important aspect of the correspondence principle 7 is that it does not determine the order in which the arguments should be assigned. In (297) the first argument is variable x (an agent) and the other argument e (an event);

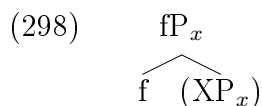
¹⁴⁴Syntax constrains projection only by the fseq generalization (see §3.1.4). Only LFs satisfying this generalization are legitimate: can F_lP be a complement of F_kP only if $l \geq k$. (Also see footnotes 66 to 67 on page 84.)

*The only potential counterexample that comes to mind is predicate standard used in §5.6. However, I have not worked out its semantics in enough detail to confirm or reject it as a counterexample. I leave the issue for further research.

however, it could be the other way around.¹⁴⁵ This property will be very important in the thesis (see §4.5.5 and chapter 5).

Standard X-bar theory defines minimal, intermediate and maximal projection. These terms play an important role in the standard theory, since they are used to define complements and specifiers: a complement is the sister to a minimal projection, a specifier is a sister to the intermediate projection. L* theory, using X-bar theory with complex heads, recognizes different relations between constituents, and therefore needs its own terminology.

Let a *simple head* be a head, generated without merging—thus an occurrence of a feature in a syntactic expression, f in (298). A head which is not simple, is *complex*, fP_x in (299). As far as I see, by this definition simple heads and complex heads correspond to heads and determiners of the standard X-bar theory, as desired.



When can a head project a feature? The trivial requirement is that the head must contain the feature. Furthermore it is obvious that we have to allow simple heads to project: they project the only feature they contain. In the case of complex heads it is not immediately clear, which features a complex head can project. Can it project only a feature of its highest

¹⁴⁵Because the arguments are not “recognized” by the assignment order, they can only be recognized by their type (individual, property, eventual, degree). It follows that predicates with arguments of the same type must be symmetric, i.e. $P(x_1, \dots, x_k) = P(x_{p(1)}, \dots, x_{p(k)})$, where p is an arbitrary permutation of numbers from 1 to k . The only head predicate used in the thesis, having arguments of the same type is overlap \checkmark , which is symmetric.

As far as I see, there is only one other symmetric relation needed for natural language analysis: possessive relation. To say that two things are in a possession relation is in general nothing else but to say that they are associated in some (contextually determined) way [Gil 2006]; such a relation is of course symmetric. (That modification with possessive adjectives and pronouns is not limited to ownership can be seen by observing that noun phrase *my car*, which prototypically refers to the car that I own, can also refer to the case that I want to buy, or to the car I have seen, or to the car I dream about, etc. The symmetricity of the relation is exemplified by pairs such as *daughter’s mother—mother’s daughter*.)

functional projection? Can it project any feature it contains? The discussion about this is out of scope of the thesis: for concreteness, I adopt (300).

- (300) If XP is the complex head of a functional projection fP, then the XP's spine contains some functional projection fP.¹⁴⁶

Let us call a projection of a feature *an initial (or first) projection*, if its head is simple. fP is *k*th projection ($k > 1$) of a feature [f], if its (complex) head is a spine containing ($k - 1$)th projection of feature [f]. A projection of [f] contained in a spine that is not a complex head of some fP, is *a final projection*. Furthermore, let us call the complement of the first/*k*th/final projection the first/*k*th/final complement.

In the thesis only two-place head predicates are used, so we will only be using the terms first, second and last projection. I emphasize that not every final projection of a feature corresponding to a two-place predicate is a second projection. A simple head can project two first projections. The second initial projection is seen as movement; both initial projections are simultaneously also final projections; for example see §4.5.5.

Since in standard minimalism projection is defined as labeling the complex object, there is no projection without merge in standard minimalism. Does this hold in L* theory as well? Since extended projections and spines are finite structures, the lowest complement must exist in every spine, which, of course, cannot have a complement of its own. The lowest complement of every spine is therefore a head, either simple or complex. Heads are created by feature projection: it follows that L* theory must allow projection without merging.

The lowest complement of a spine is therefore created without merging. The reverse is also true: any syntactic object created without merging is the lowest complement of its spine. (It is also possible that it is the only functional projection in the spine.)

For an example of projection without merging see the discussion on lexical predicates in §4.5.1 and the discussion on sentential negation in §5.7.

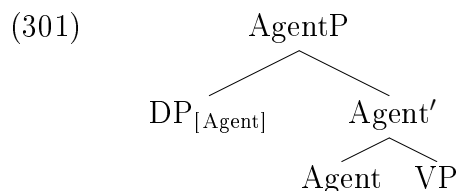
4.3.4 Predication using standard X-bar theory

In this section we will put the correspondence principle 7 in the context of the standard minimalist X-bar theory. The resulting formulation will be less elegant than the formulation in the context of the X-bar theory with complex heads. However, I do not take this to be an argument against the formulation. The problems with this formulation will arise then we will try

¹⁴⁶Cf. with feature percolation, see e.g. Radford [1997].

to integrate atomic formulas in truth conditions of whole sentences. Since this has to do with the scope of implicit quantifiers that will be introduced in §4.4, the problems will be mentioned only later, in §4.5.

Using standard minimalist X-bar theory, a theta role as assigned as shown in (301). The agent are the individuals referred to by DP in spec-AgentP.



The event, whose agent is being determined, is determined as in §4.3.3. Head Agent projects in the verbal spine e .

As in §4.3.3, feature [Agent] on DP must be integrated in the structure in (301). This means that the extended projection of DP in (301) must contain a functional projection AgentP projected by a head Agent. Thus, the agent is also determined by a projection. Head Agent projects into a nominal spine x .

We thus have two projections of two Agent heads: one of them determines the agent (x), the other determines the event (e). The association problem arises: x is the agent, but the agent of which event; e has an agent, but who is the agent?

It seems reasonable to assume that the association is carried out through feature checking. Feature [Agent] on DP must be checked, i.e. DP must be merged with the intermediate projection Agent' (in the verbal spine) (or moved to the spec-AgentP), as in (301).

I emphasize that feature percolation must be allowed in the standard approach as well, since the feature that gets checked in the specifier, must be “accessible” to the checking mechanism [prim. Starke 2004].

Next, the standard approach cannot explain the generalization (if it is valid at all) that head predicates can have (at most) two argument positions. As soon as we allow for a functional projection to have more than one specifier (or allow adjunction), we enable using head predicates with more than two arguments.

4.4 Quantification

The correspondence principles we will develop in this section state how the positions of quantifiers (\exists and \forall) are computed based on the information in

LF. (As usual in this thesis, the term quantifier refers to the quantifiers of L^* .)

4.4.1 The scope of quantifiers

Correspondence principle 5, given in §4.2.3, stated that restricted quantifiers may correspond to LF nodes—we shall loosely say that an *implicit quantifier* may occur in the node. An almost inevitable consequence of the restricted quantification hypothesis that the position of the implicit quantifier binding a certain variable is determined by the positions where this variable occurs. In other words, we will argue that, because LF contains the necessary information about the occurrences of a variable (see §4.3), it is unnecessary to encode the information about the scope of quantifiers directly at LF. All we need is a principle about the interpretation of free variables.

It is inevitable that quantifier Q binding variable x scopes over all occurrences of this variable. The implicit positions of quantifier Q is thus either (i) the lowest node dominating all occurrences of x , or (ii) some node dominating the node described in (i). We will argue that in L^* expressions generated by the semantic component, quantifiers always appear in positions described in (i).

In §4.2.2 we have concluded that every quantifier in an L^* expression generated by the semantic component must be restricted: it requires both the restrictor and the nuclear scope. Generally, both the restrictor and the scope can contain an occurrence of the bound variable (x). More precisely, the restrictor *must* contain at least one occurrence of x , while this is not required for the scope [see Živanović 2002]. In general this is achievable only if the following is required.

Correspondence Principle 8 *The implicit quantifier Qx occurs in the lowest node dominating all occurrences of variable x in the L^* expression.*¹⁴⁷

I emphasize that the scope of quantifier in an L^* expression is determined by the occurrences of its variable in L^* (i.e. with the positions of spines at LF) and not with the surface position of DP. In Slovenian these two usually coincide, for illustration see (302). (The sentence should be read using neutral intonation.)

- (302) a. En pujs je vsak kos solate povohal. ($1 > \forall$)
 one piggy is every piece lettuce smell
 ‘A piggy smelled every piece of lettuce.’

¹⁴⁷Why we have included ‘in the L^* expression’ to the condition will become clear in §4.5.3.

- b. Vsak kos solate je en pujs povohal. ($\forall > 1$)
every piece lettuce is a pig smell
'Every piece of lettuce was smelled by some piggy.'

In English the so-called inverse scope of quantifiers often arises.¹⁴⁸ In these cases the scope of a DP is wider than implied by the surface syntax. Sentence (303) is ambiguous. Its first meaning is as implied by the surface syntax; in its second meaning, the scope of the object is interpreted as higher as the scope of the subject.^{149,150} (The example is taken from Beghelli and Stowell [1997: 11–2].)

(303) Every student read two books. ($\forall > 2$) / ($2 > \forall$)

The correspondence principle 8 also allows more than one quantifier to occur in the same node. These quantifiers thus share the restriction and the nuclear scope. (We shall call them double, triple, etc. quantifiers.)

Unselective quantification

Introducing free variables is not a new approach in formal semantics, although the details of the present proposal differ from the usual approaches. While semantic theories with introducing free variables usually assume that they are introduced in the structure by specific syntactic or semantic categories, we have assumed that every spine stands for a free variable. If a formula is to be interpretable, it shouldn't contain free variables. Semantic theories usually bind free variables either (i) by adopting a general rule governing their interpretation or (ii) by using *unselective quantifiers*, i.e. quantifiers binding all free variables within their scope.

¹⁴⁸In this thesis, we should probably call this the inverse scope of quantificational *phrases*. In linguistic terminology, the terms (i) quantifier usually refer to (i) a DP containing a determiner containing a logical feature with quantificational force, and (ii) the constituent c-commanded by this DP. The term quantifier is not used in the meaning (i) in this thesis; the term scope has its standard meaning (ii) when we discuss the scope of phrases, not the scope of quantifiers \exists and \forall .

¹⁴⁹The notation $2 > \forall$ means that the sentence is understood so that the DP containing numeral 2 scopes over the DP containing the universal determiner (*every*). One (but not the only) criterion for determining the scope in this sense is the variability of the individuals which the lower DP refers to.

¹⁵⁰Usually it is assumed that the inverse reading is a consequence of a covert movement (which happens in the covert syntax, see figure 3.1 on page 80) of DP to the positions implied by its semantic scope. The apparent incoherence between the surface position and the position of the variable, or more generally, covert movements and their motivation, is a broad topic of research, which is conducted by many researchers; it is, however, out of the scope of this thesis. Among others, see Chomsky [1995], Brody [2003], Brody and Szabolcsi [2000], Szabolcsi [1997].

So Heim [1982] and Kamp [1981] assume that free variables are introduced by indefiniteDPs and can be bound either (i) by a unselective (restricted) quantifier denoted by a logical feature of a lexical item, such as (a) determiners *every* and *most*, (b) adverbs *usually* and *always*, (c) conditionals, etc., or (ii) using a principle of interpretation of free variables, more specifically, with an existential quantifier having scope over the entire discourse.¹⁵²

In this subsection I argue that unselective quantification is an unnecessary tool.

First, it is not the case that all the relevant data can be analyzed solely with unselective quantifiers. This is a well known fact. Actually, theories of dynamic semantics are based on it. A classical problem for an approach relying exclusively on unselective quantifiers are cases of inter-sentential binding, (304). The scope of existential quantifier $\exists x$ is wider than a sentence, therefore this quantifier cannot be a reflex of some lexical item's logical feature.

- (304) a. There was [a girl]_i walking on the road. I whistled to her_i.
 b. $\exists x: \text{girl}(x) \wedge \text{walk}(x) \wedge \text{whistle}(I, x)$

Second, I will argue that the approach using unselective quantifiers is unexplanatory, using the analysis of n-words from Zeijlstra [2004: 247–8] as a (random) example. Zeijlstra tries to use the assumption that negation introduces an unselective existential quantifier to explain the structure of the sentences containing so-called *n-words* (e.g. Slovenian *nihče*, *nič*, *noben*, *nikoli*, etc.).* The meaning he ascribes to the negation operator is given in (306a), where \exists is an unselective quantifier binding all free variables in its scope; the meaning of an n-word *nihče* ‘nobody’ is given in (306b), which contains a free variable x . So the meaning (306) is assigned to the Greek sentence (305).¹⁵³ (The derivation of the meaning is shown in sub-items.)

- (305) Dhen irthe kanenas.
 neg came n-body
 ‘Nobody came.’

- (306) $\neg \exists x: \text{person}'(x) \wedge \text{come}'(x)$

¹⁵²Existential quantifiers introduced by the principle of interpretation of free variables is also unselective, in that it binds all free variables in its scope. However, I wish to restrict the term unselective quantifier to unselective quantifiers corresponding to logical features.

¹⁵³Greek is (as Slovenian) a language with *strict negative concord*: a subject, whose head is an n-word, can precede the negative marker. (Cf. with Italian or Spanish having *non-strict negative concord*. [Zeijlstra 2004])

*N-words are words participating in negative concord. The above Slovenian n-words *nihče*, *nič*, *noben*, *nikoli* translate to English as ‘nobody, nothing, no, never’, but note that these English translations are not n-words; they are so-called negative operators.

- a. $\|\text{Op}_-\| = \neg(\exists)$
- b. $\|\text{n-body}\| = \lambda P(\text{person}'(x) \wedge P(x))$
- c. $\|\text{come}\| = \text{come}'$
- č. $\|\text{n-body}\|(\|\text{come}\|) = (\text{person}'(x) \wedge \text{come}'(x))$
- d. $\|(305)\| = \neg\exists x: (\text{person}'(x) \wedge \text{come}'(x))$

My objection against unselective quantification is based upon the question how the theory determines the occurrences of free variable x . It is clear that x is free in (306č); the question is how do we know that all occurrences of x (in the sentence) are contained in (306č). If they are not (e.g. because *n-body* moves in some subsequent step of the derivation), then (i) the other occurrences of x will not be bound, or (ii) they will be bound by the principle of free variable interpretation. The semantic structure will be ill-formed in both cases: in the former case some occurrences of x are not bound, in the latter case some occurrences (i.e. both occurrences contained in (306č)) are bound twice. Within the *semantic* theory we can only avoid this problem by assuming that the unselective quantifier introduced by the negative operator “sees” if there are any other occurrences of x , and does not bind it in such a case. The solution violates compositionality, so I doubt any semanticist would be ready to accept it.

The other possibility is that the occurrences of x are constrained by the syntax, probably by constraints on movement of the *n-word* *n-body*.¹⁵⁴ In this case the introduction of an unselective quantifier as a part of the negative operator is superfluous, since the same result can be achieved by adopting a suitable free variable interpretation principle, which, as we have argued above, is independently needed.¹⁵⁵

I emphasize that I do not claim that L* theory explains why in (305), all occurrences of variable x are within the scope of negation, i.e. why *n-word* *n-body* cannot move above sentential negation. I only claim that the theory presented in Zeijlstra [2004] is just as unexplanatory as L* theory. However, the latter uses a lighter theoretical toolbox, because it does not use unselective quantification.

¹⁵⁴The scopal possibilities of indefinites, among which, according to Zeijlstra [2004], *n-words* belong, are subject to many inquiries. For opposite views see Fodor and Sag [1982] and Ludlow and Neale [1991].

¹⁵⁵The objection remains valid in the classical examples of dynamic semantics, such as conditionals and donkey anaphora.

- (i) If a farmer owns a donkey, he beats it.
- (ii) Every farmer who owns a donkey beats it.

As in the main text, the objection is based upon the fact that the theory must independently determine the scopal possibilities of the indefinite DP *a donkey*.

4.4.2 Type of quantification and negation

In §4.2.2 we have concluded that only restricted quantification must be allowed in L^* theory. Let us compare the existential and universal restricted quantification in the unrestricted notation, (202) to (203) on page 109, repeated in (307)–(308).

(307) Restricted existential quantification:

$\exists x [\phi] \psi$ is the abbreviation for $\exists x: \phi \wedge \psi$.
 ϕ is the *restrictor*, ψ the (*nuclear*) *scope*.

(308) Restricted universal quantification:

$\forall x [\phi] \psi$ is the abbreviation for $\forall x: \neg\phi \vee \psi$.
 ϕ is the *restrictor*, ψ the (*nuclear*) *scope*.

Whereas the restricted notations differ only in the quantifier symbol, the unrestricted notations differ at three points. First, different quantifier symbol is used. Second, only universal restricted quantification contains a negation in the definiens: the subformula that forms the restrictor of the restricted notation is within the scope of negation in the unrestricted notation. Second, different connectives appear in formulas. In the formula for existential quantification, conjunction can be found; in the formula for universal quantification, we find disjunction instead. It follows that only two out of eight logical possibilities, shown in (309), only two can be used, since only two are logically equivalent to restricted quantification: (309a) in (309g)..

- (309) a. $\exists x: A(x) \wedge B(x) \sim \exists x [A(x)] B(x)$
 b. $\exists x: A(x) \vee B(x)$
 c. $\exists x: \neg A(x) \wedge B(x)$
 č. $\exists x: \neg A(x) \vee B(x)$
 d. $\forall x: A(x) \wedge B(x)$
 e. $\forall x: A(x) \vee B(x)$
 f. $\forall x: \neg A(x) \wedge B(x)$
 g. $\forall x: \neg A(x) \vee B(x) \sim \forall x [A(x)] B(x)$

A single parameter must be responsible for the difference between (309a) and (309g), i.e. LF expressions which are translated into (309a) and (309g) may differ in one detail only. If more than one parameter was active here, we would expect to find more than two options in (309) in natural languages: four in the case of two parameters and all eight in the case of three parameters.

An ideal parameter would be a feature on a node which the semantic component would map into some symbol occurring in (309); in the case that

an implicit quantifier sits the node, the presence of this feature would signal the type of the implicit quantifier.

I claim that this parameter is presence vs. absence of feature [Neg(ation)], which I generally assume to introduce the negative operator into L^* expressions. In concord with (307)–(308) I assume that the presence and absence of [Neg] signal universal and existential quantification, respectively.¹⁵⁶

The choice seems appropriate. Feature [Neg] is independently motivated in syntax. Furthermore, in §4.1.2 and 4.1.3, the entailingness and NPI licensing environments were characterized by counting negations. If we assume that [Neg] does not only introduce the negative operator, but also regulates the type of restricted quantification, “negation-counting” algorithm can be implemented in LF.

LF of (310a) must therefore contain a [Neg] feature. Based on the inspection of (308), the zero hypothesis seems to be that [Neg] is projected into functional projection NegP in the nominal spine of DP *every piggy* and that its presence negates predicate piggy, as required by (310b). However, unlike in negative sentences, (310a) contains no negative marker. I thus conclude that LF of (310a) does not contain a NegP.

LF stavka (310a) mora torej vsebovati oznako [Neg]. Prva misel je, da je ta oznaka projicirana v funkcijsko projekcijo NegP v samostalniški hrbtenici DPja *vsak pujs* in da prisotnost projekcije NegP negira predikat *pujs*, kot zahteva (310b). Vendar se, v nasprotju z zanikanimi stavki, v (310a) ne pojavlja označevalec negacije *ne*. Zato predpostavljam, da LF tega stavka ne vsebuje funkcijske projekcije NegP.

- (310) a. Every piggy is eating.
 b. $\forall x: \neg \text{piggy}(x) \vee \text{eat}(x)$
 Every group of individuals x contains a member that is not a pig or is eating.

¹⁵⁶I argue that the choice of a feature introducing symbol \wedge , \vee , \exists or \forall is inappropriate.

It is impossible that the difference between LFs would be in the presence of \wedge vs. \vee . Correspondence principle 3 states that connective \wedge corresponds to a branching node by default. Specifically, \wedge does not correspond to a feature. It is thus reasonable to assume that there is no [\wedge] feature.

Next, consider the possibility that the difference would be presence vs. absence of feature [\vee]. By correspondence principle 3, \wedge corresponds to a branching node by default, thus it would only make sense to assume that presence of [\vee] overrides the default correspondent \wedge and replaces it with \vee . However, then \vee does not regulate the type of quantification.

Finally, features [\exists] and [\forall] cannot be used to determine the type of quantification (this is suggested by Butler [2005]). We have concluded in §4.4.1 that quantifiers will be introduced by a principle of free variable interpretation, partly specified in correspondence principle 8. However, if features [\exists] and [\forall] were used, they would not only determine the type of quantifier, but also introduce it into the formula.

Feature [Neg] corresponding to the negative operator \neg in L^* must be therefore contained in some other functional head. Considering the assumption that every feature projects its own functional projection, this is unexpected. However, as mentioned in §3.1.4, [Neg] is unusual in other respects as well, in particular from the view of the cartography of syntactic structures. I believe this justifies its special status in Direct Semantics. (For further discussion, see §5.7 and 6.3.)

We will therefore assume that some features can have *negative value* (or simply, that they are negative) and that functional projections headed by such features (we shall say that such functional projections have negative value, or simply, that they are negative) introduce the negative operator \neg in L^* . (I assume that the set of potentially negative features is derivable from some general principles or maybe universally fixed.)

We will thus assume that universal determiner *every* realizes some negative feature. According to Beghelli and Stowell [1997], the universal (and distributive) meaning of *every* stems from the presence of feature [Dist].¹⁵⁷ For concreteness, we will adopt this assumption.¹⁵⁸ In (311) the occurrence of the universal quantifier is a consequence of the fact that [Dist] has negative value, [Dist_(Neg)].

We have concluded that Neg is not a feature, but a feature value. This conclusion is further confirmed by the fact that in L^* an operator (\neg) corresponds to Neg, while head predicates correspond to features.

Predicates and operators differ both in arguments and in the result. In general, arguments of predicates are terms (in L^* only variables, since there are no individual constants or function symbols in L^*); arguments of operators are arbitrary expressions (of the employed formal language). The result of a predicate is a truth value, true or false; the result of an operator is not necessarily a truth value: in general, the result is some (other) expression (of the employed formal language).

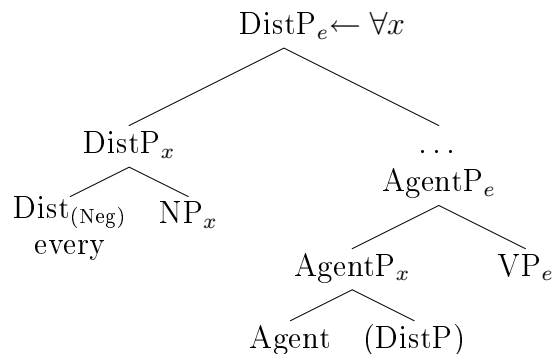
¹⁵⁷In §3.1.4 we have not included DistP into the verbal fseq. Opinions on its position in fseq differ: some authors even argue for multiple non-adjacent occurrence of this and related features [Brody and Szabolcsi 2000].

¹⁵⁸I believe that, in general, universal determiners do not necessarily contain some specific (universal or distributive) feature, but simply *some negative* feature. The content of this feature must be figured out for each language separately, based on syntactic and semantic evidence. If language has more than one universal determiner—as English, which has *each* and *every*—this must be done for each of the universal determiners.

Such an approach opens the path to the explanation of differences in typical scope of different universal determiners. If we assume that the negative feature of *each* must be projected higher than the negative feature of *every*, wider scope of *each* is expected. (Distributivity of *each* can be seen as a consequence of its wide scope.)

Investigating featural content of universal determiners falls out of scope of the thesis.

(311)



For example, the argument of modal adverb *possibly* is a proposition (corresponding to the set of possible worlds, where it is true), and the result is a change of *information state*: some other set of possible worlds—the worlds the speaker judges that the proposition might be true in [Nilsen 2003].

A general discussion on the syntax–semantics relation of operators with respect to the hypothesis that syntax–semantics relation is an isomorphism, falls out of scope of the thesis. I remain undecided with respect to the question whether (or, how much) the meaning of operators is syntactically transparent, i.e. to what extent their syntactic and semantic representation are isomorphic. I only wish to claim that the negative operator is syntactically transparent; I present a correspondence principle stating its syntax–semantics relation in this section.¹⁵⁹

Next, let us discuss the argument of the negative operator \neg . The nodes of syntactic trees are binary branching (see §4.3.2), whereas \neg is a unary operator. Is its argument the complement of the complex head?

The discussion on universal determiner hits that we should negate the complex head (in L^* , the restrictor of the universal quantifier is negated, and the complex head corresponds to the restrictor). On the other hand, it is usually (implicitly) assumed that the complement of NegP is negated in sentential negation [cf. Zeijlstra 2004]. At this point in the development of the theory we are still unable to discuss a possible unification of both assumptions (for the discussion see §5.7); we thus stipulate the following dichotomy.

¹⁵⁹It is obvious that argument structure of operators is syntactically transparent: denotation of a syntactic constituent forms an argument to the operator. I guess that syntactic and semantic decomposition of operators are isomorphic when it comes to an embedded negative operator: if a negative operator is used in the semantic decomposition, then its syntactic decomposition contains a negative feature. I believe that only in this way the results of §4.1.2 and 4.1.3 on entailingness and NPIs can be kept.

It is often assumed that operators can bind free variables [Zeijlstra 2004].

Correspondence Principle 9 *The negative operator in L^* can be introduced by (i) a functional projection $NegP$: then its complement is negated; or a (ii) final functional projection of a feature having negative value: then the complex head of its functional projection is negated.*

Inspecting LF (311) on the preceding page we see that, if (311) is to correspond to (310b), the first projection of $[Dist]$ ($DistP_x$) must be within the scope of negative operator. Therefore the second point of the above correspondence principle states that the negative operator is introduced by the *final* projection of a negative feature. (See also §5.6.)

Correspondence Principle 10 *An implicit (restricted) quantifier is universal if it occurs in the final projection of a negative feature; otherwise, it is existential. (The node where \forall occurs is interpreted as a disjunction.¹⁶⁰)*

Correspondence principle 10 implies that all implicit quantifiers occurring in the same node are of the same type. This is a welcome result; otherwise, such LF would be ambiguous. The correspondence principles do not (and, as far I can see, cannot) determine the dominance relation among implicit quantifiers in the same node, so both quantifiers Q_1x and Q_2y occurring in some node could in principle be ordered either in sequence Q_1xQ_2y or in sequence Q_2yQ_1 . If one of them was universal and the other existential, the resulting L^* expressions would represent different truth conditions. If the types of the quantifiers occurring in the same node are the same, such a difference cannot arise.

4.5 Integration of atomic formulas

In the present section we will develop the correspondence principles dealing with integration of atomic formulas into the truth conditions of the whole sentence. The integration algorithm will be divided into two parts: determining the global and the local position. By the determination of the global position I mean determining at which functional projection an atomic formula will be integrated. More precisely, which is the functional projection, whose complex head and complement the atomic formula will be combined? By the determination of the local position I mean the mode of composition of these three items: the order of composition, which connectives are used.

The principle for the determination of the local position will be motivated using data on focusing. In §4.5.1 the grounds for focus analysis in L^* is

¹⁶⁰Because the restrictor of the universal restricted quantifier is always negated, this implies that the restrictor and the nuclear scope are in an implication relation.

prepared by suggestion the mode of interconnectedness of formal semantics and CI. In §4.5.2 we take the analysis of focus from Herburger [2000] as our starting point, and write an L^* formula describing the truth conditions of a sentence containing focus. In §4.5.3 we (i) argue, which LF corresponds to this formula; (ii) reveal a partial incompatibility between LF and L^* expression (we use this incompatibility to argue that X-bar theory with complex heads should be adopted); (iii) state the correspondence principle determining the local position of atomic formulas; and (iv) state the initial assumption on the global position of atomic formulas. In §4.5.4 we reveal a special status of elliptic structures with respect to the position of implicit quantifiers. In §4.5.5 we deal with assignment of the numerical argument to predicate # and adjust the initial assumption on the global position of atomic formulas.

4.5.1 Conceptual variables

At first sight, the question how (lexical/conceptual) predicates as *piggy*, *dog*, *eat*, etc. find their way into an L^* formula, appears quite innocent. However, in the discussion on modularity in §3.3 we have concluded that conceptual features, which correspond to these predicates, cannot be a part of syntax (and thus formal semantics). Since L^* is a tool used by the formal semantics, conceptual predicates should not be part of the formal language. Besides, there are no first-order constants in L^* (these would refer to specific individuals, as John, Bill, etc., or specific events, as Slovenia becoming independent); thus, it is reasonable to assume that it does not recognize second-order constants (i.e. conceptual predicates) as well.

This assumption fits well within the framework of nanosyntax (see §3.3.2), which assumes that syntactic objects contain neither phonological nor conceptual information. It is the mental lexicon that associates syntactic objects to phonological and CI expressions, and this happens after the syntactic derivation.

The conceptual expressions, generated by CI, will be associated to syntactic expression in the following way.¹⁶¹ We assume the existence of a feature [Root],¹⁶² whose head predicate root requires two arguments: one of them is a familiar objective variable x (individual, eventual, etc.), while the other is a *conceptual* variable P .¹⁶³ The atomic understand the atomic formula

¹⁶¹Note that what follows is quite speculative. . .

¹⁶²Comparison to the root projection (\sqrt{P}) from Distributed Morphology [Halle and Marantz 1993] comes to mind, rightfully. This projection is associated to the part of mental lexicon, called Encyclopedia [Marvin 2002].

¹⁶³I assume that conceptual variables are singular.

$\text{root}(P, x)$ to be true iff P refers to a one-place predicate (defined by CI) and $P(x)$ is true.

It might seem that conceptual variables are second-order variables, since they range over concepts, which are usually taken to be predicates, and quantification over predicates generally signals second-order logic. This would be undesirable, since second-order logic has quite different properties than first order or intinirary logic. Specifically, the results proven in Živanović [2002] are not valid in second-order logic.

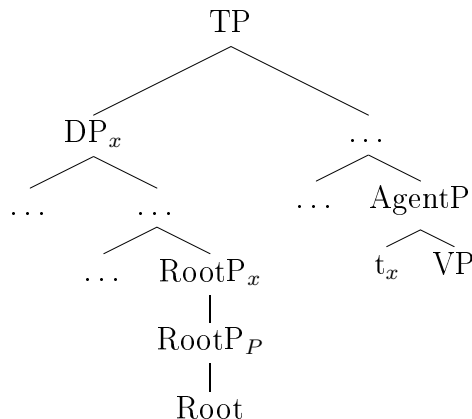
Fortunately, the usage of conceptual variables described above is restricted enough that first-order logic (more specifically, L^* as defined in 2.2.1 and 4.1.1) suffices to formalize it. Conceptual variables occur only as arguments (so far, of predicate root); according to the previous discussion, they are never used as predicates in an L^* formula. We can thus take conceptual variables to be simply a type of objectual variables, just as individual and eventual variables are. While the domain of interpretation of the latter types is external to the mind, the domain of conceptual predicates is a particular kind of representations in the mind, i.e. concepts, which humans use to categorize the world.¹⁶⁴ Thus, in a way, root could be seen as the predicate containing all the lexical knowledge of the speaker, i.e. root is a predicate whose meaning is computed by the CI.

Let us continue by illustrating how [Root] works. In this section I adopt the standard assumption that the lexical category heads the lowest projection in the extended projection. In our terms, RootP is the lowest projection in its spine. Note that our theory does not force this conclusion; I mainly adopt it for expository reasons: to present the configuration of projection without merging, mentioned in §4.3.3.

We will show how [Root] is used within a DP. Take a typical example, where the DP is a subject and an agent, as shown in LF (312). Formula that corresponds to this LF is sketched in (313).

¹⁶⁴It would probably be more accurate to claim that other types of variables also refer to cognitive objects. Thus individual and eventual variables could be taken to refer to mental representations of individuals and events, respectively.

(312)

(313) $\exists x [\dots \wedge \exists P [\text{root}(P, x)]] \dots$

To sum up: formally, we have to write (314b) instead of (314a), since syntactic (i.e. formal semantic) representation must be free of conceptual features. These are associated with the syntactic structure only when the lexicon kicks in, after the syntactic representation has been built.

However, for expository reasons we shall remain sloppy. When fine detail will be irrelevant, we shall continue using notation $\text{muflon}(x)$; otherwise we will use the “intermediate” notation (314c), which also provides the information about the intended lexical associate.

- (314) a. $\text{muflon}(x)$
 b. $\exists P [\text{root}(P, x)]$
 c. $\exists P [P = \text{muflon} \wedge P(x)]$

A potential problem is that at this point we cannot be sure whether quantifier P actually has a restrictor, as shown in the formula; why couldn't we have $\exists P [] \text{root}(P, x)$ instead of $\exists P [\text{root}(P, x)]$? It turns out that the problem is only apparent. First, the correspondence principle we will state in § 4.5.3 guarantees that the option chosen in (313) is correct. Second, I argue that $\text{root}(P, x)$ is actually not the only thing occurring in the restrictor of $\exists P$, the other thing being the predicate determining the type of variable P .

The information about the type of a variable must be encoded somehow. To be explicit, I assume this is done in the syntax using one-place predicates (let us call them *type predicates*) like individual and event, corresponding to features [individual] and [event], respectively. Thus, I assume that every spine contains a functional projection like IndividualP or EventP. I shall not graphically represent these projections though, for reasons of clarity. The type of a variable can be figured out since certain letters are consistently used for various types of variables.

meaning. It is about the fact that Mare hears that Možek imitates something, and asserts that the thing that Mare hears that Možek is imitating is a mouflon. If we tried to represent this meaning as in (317b), the eventual variable of the embedded clause f would not be bound in the part of the formula corresponding to focus. If the background formula is repeated, as in (317c), the problem does not arise.

(316) $\exists e [\text{imitate}(e) \wedge \text{agent}(\text{možek}, e)] \text{theme}(\text{mouflon}, e)$

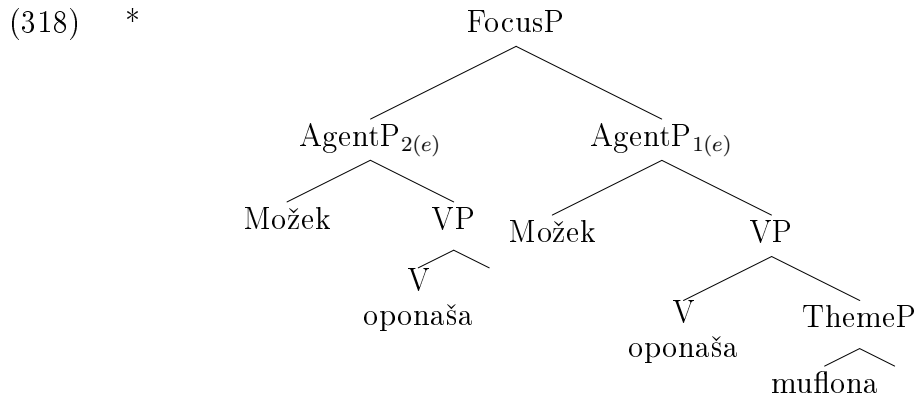
- (317) a. Mare sliši, da Možek oponaša MUFLONA.
Mare hears that Možek imitates mouflon
'Mare hears that Možek imitates a MOUFLON.'
- b. $*\exists e[\text{hear}(e) \wedge \text{agent}(\text{mare}, e) \wedge \text{theme}(\exists f: \text{imitate}(f) \wedge \text{agent}(\text{možek}, f)), e]$
 $\text{theme}(f, \text{mouflon})$
- c. $\exists e[\text{hear}(e) \wedge \text{agent}(\text{mare}, e) \wedge \text{theme}(\exists f: \text{imitate}(f) \wedge \text{agent}(\text{možek}, f)), e]$
 $\text{hear}(e) \wedge \text{agent}(\text{mare}, e) \wedge \text{theme}((\exists f: \text{imitate}(f) \wedge \text{agent}(\text{možek}, f) \wedge \text{theme}(\text{mouflon}, f)), e)$

However, this analysis of focus is unusable in L^* theory, since it violates correspondence principle 6. To sentence (315a), we have assigned L^* formula (315b) corresponding to LF (318).¹⁶⁸ AgentP_1 in AgentP_2 are belong to different spines. (The fact that AgentP_2 is unpronounced is irrelevant.) By correspondence principle 6 each of them must correspond to a different (eventual) variable. Herburger's (315b) contains only one eventual variable and thus violates correspondence principle 6. We must thus assign to LF (318) a L^* formula containing two eventual variables, e and f , corresponding to matrix and embedded verb's spines, respectively.

The other problem concerning formula (315b) is that, according to results of §4.1.2, all predicates in (315b) should be in a upward entailing environment. This prediction seems to be wrong. While sentences with a transitive verb without focus certainly allow for upward entailing both in the verb (321)(319) and in the object (320) it seems that sentences containing focus do not allow upward entailing in neither in the verb (321) nor in the object (322).¹⁶⁹

¹⁶⁸In (318), we have ignored the subject and object movement, and the existence of higher functional projections. For expository reasons we assume for the time being that a special functional projection FocusP is involved in focusing.

¹⁶⁹I exclude the subject from the discussion. It seems from examples (321)–(322) that upward entailing is allowed in the subject. However, I believe that a more detailed analysis would show that subject scopes above FocusP , making the counterexample irrelevant.



(319) a. Možek glasno oponaša muflona.
 ‘Možek loudly imitates a mouflon.’

b. \Rightarrow Možek oponaša muflona.
 ‘Možek imitates a mouflon.’

(320) a. Možek oponaša muflona.
 ‘Možek imitates a mouflon.’

b. \Rightarrow Možek oponaša žival.
 ‘Možek imitates an animal.’

(321) a. Možek glasno oponaša MUFLONA.
 ‘Možek loudly imitates a MOUFLON.’

b. $\not\Rightarrow$ Možek oponaša MUFLONA.
 ‘Možek imitates a MOUFLON.’

(322) a. Možek oponaša MUFLONA.
 ‘Možek imitates a MOUFLON.’

b. $\not\Rightarrow$ Možek oponaša ŽIVAL.
 ‘Možek imitates an ANIMAL.’

Admittedly, the intuition that upward entailing is impossible in (321) and (322) is not as firm as the intuition that downward entailing is impossible in (319) and (320). However, I believe that this might be a consequence of the fact that sentences (a) and (b) in (321) and (322) cannot be used in the same context. So, for example, (322a) is appropriate in a context where we talk about different animal species, whereas (322b) is appropriate in a context where we talk about animals, plants and people.

Since we are developing a theory which calculates the entailingness properties based only upon the information contained in L^* formulas, we should

represent the meanings of the above sentence by a formula prohibiting upward entailing in sentences containing focus. The results of §4.1.2 imply that these formulas must contain (at least) two occurrences of predicates corresponding to the verb and the object, a positive and a negative one.

Thus, the formula for a sentence containing focus must (i) contain two eventual variables, corresponding to the proposition and the background, and (ii) the polarity of the verb and the object in the proposition and the background must be different. Formula (323) satisfies these requirements: (i) variables e and f correspond to the spine of the proposition and the background, respectively; (ii) since the quantifier over f is universal, all predicates in the restrictor of $\forall f$ are within the scope of negation (see §4.4.2).

$$(323) \quad \exists e: (\forall f \forall P [\text{imitate}(f) \wedge \text{agent}(\text{možek}, f) \wedge \text{theme}(P, f)] f \checkmark e) \wedge \text{imitate}(e) \wedge \text{agent}(\text{možek}, e) \wedge \text{theme}(\text{mouflon}, e)$$

There is a group of events e , such that the following is true. For every event f and predicate P , such that f is Možek's imitation of P , the event f equals some event in the group of events e . e are the events of Možek's imitation of a mouflon.

Compared to previously used L^* formulas, the novelty in (323) is the occurrence of a conceptual variable P . In §4.5.1 we have suggested how lexical predicates associate to LF; we have done this using conceptual variables, which were bound by an existential quantifier having very narrow scope (it scoped only over $\text{Root}P_P$ in (312)) In (323) the scope of the quantifier over P is wider: it scopes over the whole background, just like the eventual quantifier $\forall f$. Since it occurs in the same node as $\forall f$, it also has the same type: it is universal, $\forall P$.

Herburger's analysis offers no point of contact to the alternative semantics [Rooth 1985]. The background of sentence (315a) is Možek's imitation, but it is not explicitly mentioned that something is actually being imitated (i.e. the theme theta role is not assigned). So it is not possible to discuss the alternatives to mouflon that Možek could imitate. In formula (323) the connection to the alternative semantics is transparent: it stems from the universal quantification over P . The values of P that could satisfy the restrictor, are animal species that Možek could imitate: mouflon and the alternatives to mouflon.

Formula (323) asserts that whichever alternative P (and event f) we choose, the event f of Možek's imitation of P will equal the event e , which is the event of Možek's imitation of mouflon. I emphasize that this does not preclude Možek from imitating some other animal as well. The event, that must be the value of eventual variable e , if the formula is to be true, could also be the event of Možek's imitation of a mouflon and a rooster, since, because we have assumed that theta role assignment is not exhaustive, every

event of imitating both a rooster and a mouflon is also an event of imitating a mouflon. This result is consistent with the linguistic intuition that sentences (315a) and (324) are not synonymous.¹⁷⁰

- (324) Možek oponaša samo muflona.
 ‘Možek is only imitating a MOUFLON.’

In (323) the conceptual variable P is associated to the alternatives to the focus; we shall thus call it an *alternative* variable. I assume that other types of variable can have the function of the alternative variable, depending on the category of the focused constituent. In (325), the alternative variable is once more a conceptual variable.¹⁷¹ In examples such as (326), the whole DP is focused, so individual variable x' functions as an alternative variable.¹⁷² (To the (alternative) values of x' are Metka, Špela, Barbara, etc.)

- (325) a. Možek oponaša nekega/vsakega MUFLONA.
 ‘Možek is imitating some/every MOUFLON.’
 b. Možek oponaša nekega/vsakega DOLGODLAKEGA muflona.
 ‘Možek is imitating some/every long-furred MOUFLON.’
- (326) a. Janko je poljubil METKO.
 Janko is kissed Metka
 ‘Janko kissed METKA.’
 b. $\exists e: (\forall f \forall x' [\text{kiss}(f) \wedge \text{agent}(\text{janko}, f) \wedge \text{theme}(x', e)] f \checkmark e) \wedge \text{kiss}(e) \wedge \text{agent}(\text{janko}, e) \wedge \exists x [\text{metka}(x)] \text{theme}(x, e)$
 There is a group of events e such that the following is true. For every event f and individual x' such that f is Janko’s kissing of x' , f equals some event in the group e . e are the events of Janko kissing Metka.

¹⁷⁰(i) presents a context where (315a) is true but (324) is false.

- (i) A: I remember that Možek was imitating a cow, and I know that he was imitating some other animal as well, a mouflon or a rooster, by I can’t remember which? Do you remember? What was Možek imitating?
 B: Možek was imitating a MOUFLON.

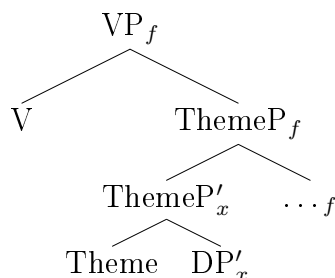
¹⁷¹Because in (325) only a part of the DP at the sentence final position is focused, the focused word is emphasized. On the other hand, the focus in (315a) does not carry a special emphasis, since the constituent in the sentence final position consists of a single word. Cf. the discussion in §2.1.4.

¹⁷²(315a) can also have the interpretation where individual variable functions as an alternative variable. This is necessary when actual animals are the alternatives and not different animal species.

Herburger does not use theta predicate theme in the background subformula. (We have already hinted that this is problematic, when we have discussed the entailingness properties of sentences containing focus. Our analysis overcomes the problem, since the alternative variable (P) occurs within the scope of negation.) This presents the following problem. The part of LF presented in (328) corresponds to the relevant part of the formula, (327). If the atomic formula with the predicate theme is absent in the background formula, this implies the absence of ThemeP_f in the LF. Generally, this projection can have a complement (say GoalP), as indicated by the three dots in (328). In this case the focus (i.e. the part of LF lacking in the background) is not a constituent. However, if we assume that DP'_x (or maybe ThemeP'_x) is absent, the problem does not arise. But in this case the theta role assignment must be present in the formula, i.e. the background formula must contain $\text{theme}(x', f)$.

(327) $\dots \wedge \text{theme}(x', f) \wedge \dots$

(328)



Herburger [2000: 23–29] opts for the analysis without the theta role assignment in the restrictor based on examples of negative pronoun focusing. The crucial data is given by Spanish examples. Spanish is a language with non-strict negative concord:¹⁷³ when sentence contains no sentential negative marker, the negative pronoun such as *nadie* ‘nobody’ must precede the verb. Herburger observes that there is an exception to this generalization: the negative pronoun can follow the verb if it has narrow scope, i.e. when it is not the case that the whole proposition is negated. So (329a) entails that the speaker said something (although what was said was not said to anyone in particular).

(329) a. ... dije bajito a nadie que todo era mío.
 said-I softly to n-body that everything was mine
 ‘I said softly to nobody that everything was mine.’

¹⁷³See footnote 153 on page 158.

- b. $\exists e: \text{agent}(I, e) \wedge \text{say}(e) \wedge \text{theme}(\dots, e) \wedge$
 $\neg(\exists x [\text{human}(x)] \text{recipient}(x, e))$

Observe sentence (330a) where a *nadie* ‘to n-body’ is focused. Herburger analyses it as in (330b).^{174,175} The sentence entails that the speaker said that everything is his or her, but not that this was said to someone. In the latter case the sentence would be contradictory, since it explicitly asserts that the speaker said this to noone. Exactly this is predicted by formula (330b), where recipient theta role is not assigned in the restrictor of eventual quantifier $\exists e$. Formula (330c), where the recipient is assigned, is contradictory, since the background entails that someone is the recipient in the event whereas the proposition entails that noone is the recipient.

- (330) a. ... dije bajito A NADIE que todo era mío.
 said-I softly to n-body that everything was mine
 ‘I said softly TO NOBODY that everything was mine.’
- b. $\exists e [\text{agent}(I, e) \wedge \text{say}(e) \wedge \text{theme}(\dots, e)]$
 $\neg(\exists x [\text{human}(x)] \text{recipient}(x, e)) \wedge$
 $\text{agent}(I, e) \wedge \text{say}(e) \wedge \text{theme}(\dots, e)$
- c. * $\exists e [\text{agent}(I, e) \wedge \text{say}(e) \wedge \text{theme}(\dots, e) \wedge$
 $\exists x [\text{human}(x)] \text{recipient}(x, e)]$
 $\neg(\exists x [\text{human}(x)] \text{recipient}(x, e)) \wedge$
 $\text{agent}(I, e) \wedge \text{say}(e) \wedge \text{theme}(\dots, e)$

Let us consider adjusting formula (330c) by negating the recipient theta role assignment in the background, so that it is negated just as in the proposition. Such an adjustment would not be appropriate, since it follows that the background of the sentence where a negative pronoun is focused is not the same as the background of the sentence where a “usual” non-negative DP is focused. The backgrounds of such sentences would be the same, since both sentences are used to answer the same question, *To who did you softly say that everything is yours?*

¹⁷⁴For reasons of uniformity, formula (330b) contains some trivial changes, which do not influence the discussion.

¹⁷⁵The notation used in Herburger [2000: 26–27, zglied (28)] is ambiguous: is is not clear whether the negation stemming from n-word *nadie* scopes only over one theta role assignment or over the whole scope of the eventual quantifier, i.e. whether the meaning of (330a) should be represented by (330b) or (330b). I opt for (330b) because I believe that (i) is inconsistent with the formula for a sentence without focus, see (329).

- (i) $\exists e [\text{agent}(I, e) \wedge \text{say}(e) \wedge \text{theme}(\dots, e)]$
 $\neg(\exists x [\text{human}(x)] \text{recipient}(x, e) \wedge \text{agent}(I, e) \wedge \text{say}(e) \wedge \text{theme}(\dots, e))$

The above analysis of focus in L^* does not wrongly predict that the background of sentence (326a) on page 172 entail that Janko kissed someone, although the background subformula assigns the recipient theta role. The wrong prediction does not arise because the quantifier binding the eventual variable in the background subformula is universal, not existential. The background subformula in (326b) asserts only that every event of Janko kissing someone is the same as the event of Janko kissing Metka, and not that there is an event such that Janko kisses someone; the background subformula is merely compatible with such situation. In the case that a negative pronoun is focused the background subformula in (326b) is true, because no value of variables f and x' satisfies the restrictor. In the case that a non-negative DP (e.g. *Metko*) is focused, the background subformula is true because every event f where Janko is kissing x' is the event where Janko is kissing Metka (and maybe someone else, too).

The truth conditions for (330a) are therefore represented by formula (331) in L^* .

$$(331) \quad \exists e: (\forall f \forall x [\text{agent}(I, f) \wedge \text{say}(f) \wedge \text{theme}(\dots, f) \wedge \\ \text{recipient}(x, f)] f \checkmark e) \\ \text{agent}(I, e) \wedge \text{say}(e) \wedge \text{theme}(\dots, e) \wedge \\ \neg(\exists x [\text{human}(x)] \text{recipient}(x, e))$$

Thus, in general, the form of an L^* formula for a sentence containing focus is the following. The meaning of the proposition is described by a conjunction of (complex) predicates whose argument is the eventual variable e . One of these conjuncts describes the meaning of the background. The form of this conjunct is that of double universal quantification: the quantifier over the eventual variable f corresponding to the background event and the quantifier over the alternative variable z , corresponding to the focus, share the restrictor and the nuclear scope. The restrictor contains all the conjuncts of the proposition except for the conjunct corresponding to the focus. The theta role assignment is present; it associates variables f and z (directly, if the whole verbal argument is focused, and indirectly, if only some proper subpart of it is focused). Atomic formula $f \checkmark e$ occurs in the nuclear scope of the double quantifier's restrictor.

Formula (331) conforms to the *uniqueness pattern* (332), which is a generalization of the definiteness pattern from §2.2.5. (The type of variables u , u' and v is arbitrary; however, the type of u and u' must be the same. Formula ϕ' is isomorphic to ϕ , with a possible exception of the conjunct containing v as a free variable.) We shall see in chapter 5 that the uniqueness pattern is useful for semantic analysis of many constructions.

$$(332) \quad \exists u: \dots (\forall u'(\forall v) [\phi'(u')] u' \check{\text{Q}} u) \wedge \phi(u)$$

4.5.3 Head predicates and implicit quantifiers

Based on L* formula for sentences containing focus (I repeat the relevant sentence and formula in (333) and (334), respectively), we assume such sentences to have the LF as in (335). The background is introduced by a special functional projection B(ack)g(round)P. The complement of BgP_e corresponds to the proposition. Comparison of (323) on page 171 and (326b) on page 172 reveals that the structures of the proposition and the background are almost completely parallel. This licenses the ellipsis of the background [cf. Merchant 2001]. It is not necessary for a focused constituent to contain some special feature, e.g. [Focus].¹⁷⁶ We determine the focus by comparing the proposition and the background. A constituent of the proposition, whose parallel correspondent in the background is missing, is focused.¹⁷⁷

(333) Možek oponaša MUFLONA.

Možek imitates mouflon

‘Možek is imitating A MOUFLON.’

(334) $\exists e: (\forall f \forall P [\text{imitate}(f) \wedge \text{agent}(\text{možek}, f) \wedge \text{theme}(P, f)] f \check{\text{Q}} e) \wedge \text{imitate}(e) \wedge \text{agent}(\text{možek}, e) \wedge \text{theme}(\text{mouflon}, e)$

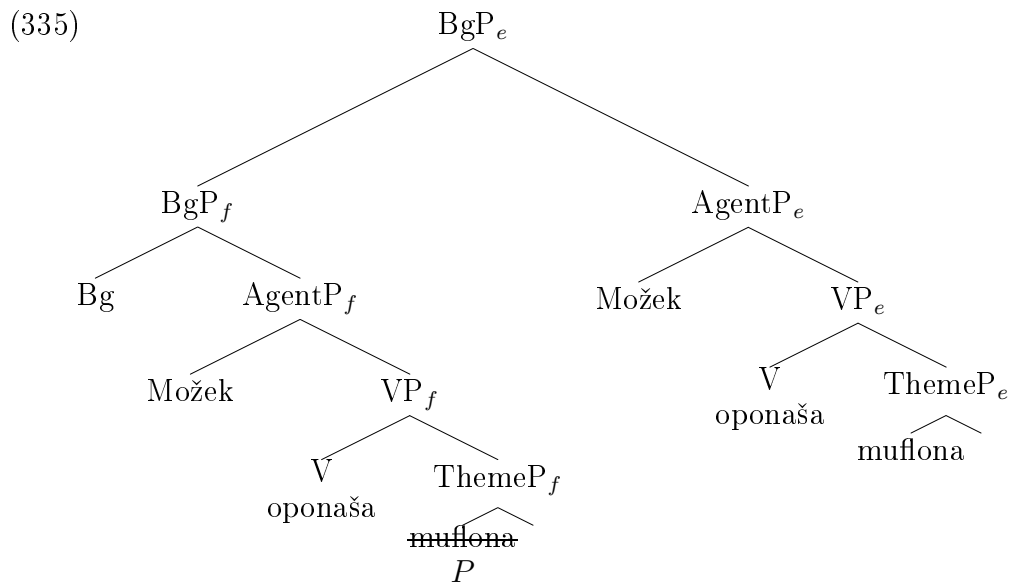
Double restricted quantifier $\forall f \forall P$ occurs in the background subformula $(\forall f \forall P [\dots] f \check{\text{Q}} e)$ in (334). Its nuclear scope contains atomic formula $f \check{\text{Q}} e$. It follows that the overlap predicate ($\check{\text{Q}}$) corresponds to feature [Bg]. (Predicate $\check{\text{Q}}$ needs two arguments, so [Bg] must project twice.) Because the double quantifier is universal, this feature should be negative, $[\text{Bg}_{(\text{Neg})}]$.

This is the first time we try to use to correspondence principles simultaneously. The head predicate $\check{\text{Q}}$ associates the two eventual variables; the position of the implicit quantifier $\forall f \forall P$ must be determined. Comparison of L* formula (334) and LF (335) reveals that both atomic formula $f \check{\text{Q}} e$ and double universal quantifier $\forall f \forall P$ occur next to functional projection

¹⁷⁶For criticism of approaches assuming that focus contains a special feature or moves to the specifier of a special functional projection see Neeleman and van de Koot [2007].

¹⁷⁷Traditionally, the sentence is divided into focus (foreground) and background. LF (335) does not follow this view, since it partitions the structure into background and proposition, and the latter which contains both focus and a “repetition” of the background. The difference between our proposal and the traditional view should be understood as a difference between the syntactic and information structure of a sentence.

It is worth emphasizing that not every partition to focus and background partitions a whole sentence. When the sentence contains a sentential topic (see §6.2.1), only the comment is partitioned.



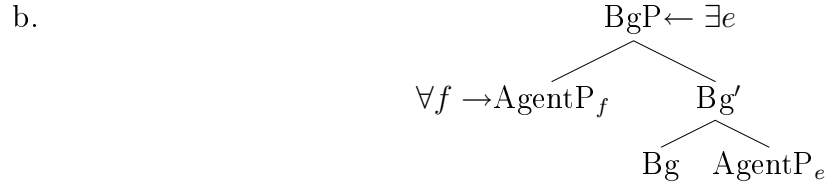
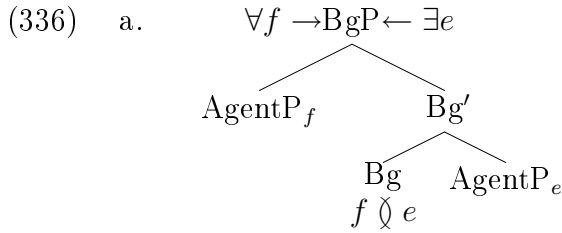
BgP. Thus, we must provide a correspondence principle which states how an atomic formula (globally positioned next to BgP) is integrated into L^* formula corresponding to BgP, so that the implicit quantifiers are positioned correctly (i.e. as required by formula (334)).

We will see that LF (335) and L^* formula (334) can be made to correspond to each other only if we adopt X-bar theory with complex heads [Starke 2004] instead of standard X-bar theory; see § 4.3.3.

AgentP_e and AgentP_f correspond to the proposition and the background, respectively. The proposition, the background and the atomic formula $f \checkmark e$ must be integrated in the same L^* formula based on information in LF. Let us first try to achieve this using the standard X-bar theory, where AgentP_f and AgentP_e are combined in two steps: first Bg and AgentP_e are merged into Bg', then Bg' and AgentP_f are merged into BgP. (336) offers two possibilities with respect to the position of implicit quantifier $\forall f$ (and $\forall P$, which can be safely ignored for now) in (335): BgP or AgentP_f. (For clarity of exposition the internal structure of AgentP_f and AgentP_e is suppressed. To be concrete assume that $\exists e$ occurs in BgP—although it could actually occur higher.)

In which node do we find the implicit quantifier $\forall f$? By correspondence principle 8 it occurs in the lowest node dominating all the occurrences of f . Variable f is surely contained in AgentP_f; it is not entirely clear whether it occurs in functional head Bg. The options are shown in (336a) and (336b), respectively.

We could argue that head Bg contains variable f , since f is an argument of the head predicate, as depicted in (336a). However, by correspondence

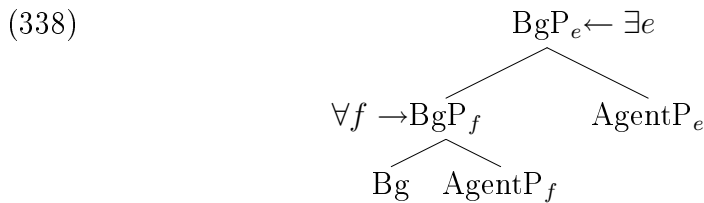


principle 6 this would imply that head Bg contains the spine (of f), which is nonsensical in the standard minimalism. It would also follow that the implicit quantifier $\forall f$ occurs in node BgP, scoping over the intermediate projection Bg' and therefore also over AgentP_e. This would yield wrong truth conditions: the nuclear scope of $\forall f$ would contain the preposition subformula, as shown in (337). If no pair (f, P) satisfied the restrictor of the double quantifier $\forall f \forall P$, the formula would automatically be true and the interpretation of the nuclear scope would thus be irrelevant. It follows that (337) would be true in a situation where Možek is imitating no (contextually relevant) animal, including a mouflon; this prediction is obviously wrong, since we judge (333) to be true only if Možek is imitating a mouflon.

(337) $\exists e: \forall f \forall P [\text{imitate}(f) \wedge \text{agent}(\text{možek}, f) \wedge \text{theme}(P, f)]$
 $f \ \checkmark \ e \wedge \text{imitate}(e) \wedge \text{agent}(\text{možek}, e) \wedge \text{theme}(\text{mouflon}, e)$

The other option, shown in (336b), is that the implicit quantifier $\forall f$ occurs in AgentP_f. However, then it does not dominate head Bg. Since we want LF to be isomorphic to L*, this means that the overlap predicate \checkmark cannot be within its scope at L*, which contradicts formula (323).

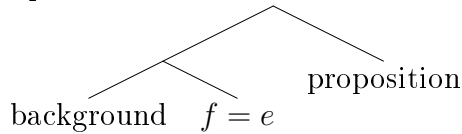
Thus, using the standard X-bar theory we get stuck. Conversely, Starke's [2004] X-bar theory with complex heads (see §4.3.2), is (more) compatible to our proposal. Using this X-bar theory, we would replace (336) with (338). Here, BgP_f is a complex head, which projects feature [Bg] in spine e . The implicit quantifier $\forall f$ occurs in the AgentP_f node.



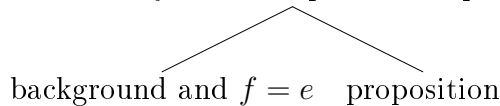
LF (338) is more compatible to (334) than (336). First, the complex head BgP_f actually contains spine f , so it is not unexpected that f is an argument of the head predicate \check{Q} . Second, there is no dilemma with respect to the position if the implicit quantifier $\forall f$. In the X-bar theory with complex heads the standard head and specifier coincide, so variable f in (338) only occurs in the complex head BgP . Thus, the implicit quantifier $\forall f$ should occur in BgP_f . Third, it follows that AgentP is not within the scope of $\forall f$, as required by (334).

However, even LF (338) is not completely isomorphic to formula (334). This is shown in (339). (339a) shows what we want to do: combine three subformulas: the background subformula, the proposition subformula and the atomic formula of the head predicate. Thus, the X-bar theory should provide us with three nodes. X-bar theory with complex heads provides only two nodes, as shown in (339b): a single node corresponds to the background subformula and the atomic formula of the head predicate. On the other hand, the standard X-bar theory provides three nodes, but they are merged in the wrong order, as shown in (339c).

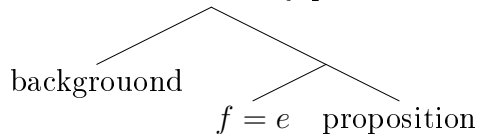
(339) a. requirement of L^* formula:



b. X-bar theory with complex heads provides:



c. standard X-bar theory provides:



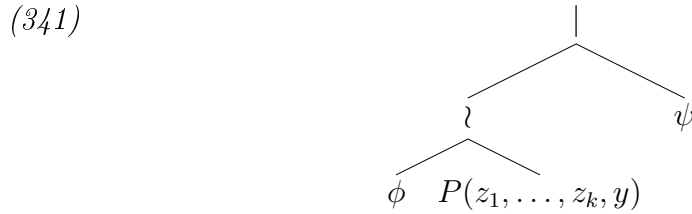
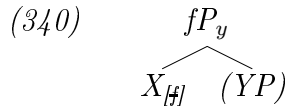
I believe that X-bar theory with complex heads is more appropriate than the standard X-bar theory. Although (339a) and (339b) are not isomorphic, (339b) is at least a homomorphic image of (339a): we get (339b) from (339a) by identifying the background node and the atomic formula node. The standard X-bar theory does not enable this: the mapping from (339a) to (339c) is not homomorphic.

We formalize the above conclusions, based upon the analysis of focus, in the following generally applicable correspondence principle, which determines the local position of the atomic formula of a head predicate in an L^* formula.

Correspondence Principle 11 *Let formula ϕ correspond to node X . Let X contain feature $[f]$, which is projected from X into fP , i.e. X is a head of fP . Let functional projection fP be a part of spine y : fP is a fP_y . Let head predicate P correspond to feature $[f]$. If fP has a complement, call it YP and call its corresponding L^* formula ψ .*

Assume that the global position of the atomic formula of head predicate P is next to functional projection fP_y .¹⁷⁸ Further assume that feature $[f]$ is also projected in spines z_1, \dots, z_k : the atomic formula is thus of the form $P(z_1, \dots, z_k, y)$.

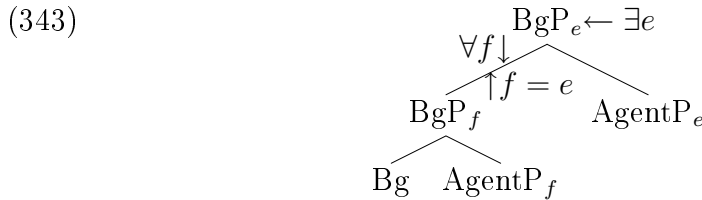
Then L^ formula $(\phi|P(z_1, \dots, z_k, y)) \wr \psi$ corresponds to LF expression (496), where $|$ and \wr are connectives determined by other correspondence principles. (A tree-like representation of the formula is given in (497).)¹⁷⁹*



We thus assume that in L^* formula an extra node corresponds to the projection of a feature. This node contains the L^* formula corresponding to the complex head and the atomic formula of the head predicate. The node is then combined with the L^* formula corresponding to the complement.

It follows by correspondence principle 11 that LF (343) will correspond to formula (334) on page 176, here repeated in (342). The implicit quantifiers must be placed in the nodes of the L^* expression (i.e. tree like (497)).

(342) $\exists e: (\forall f \forall P [\text{imitate}(f) \wedge \text{agent}(\text{možek}, f) \wedge \text{theme}(P, f)] f \wr e) \wedge \text{imitate}(e) \wedge \text{agent}(\text{možek}, e) \wedge \text{theme}(\text{mouflon}, e)$



¹⁷⁸We will determine the global position of the atomic formula with the correspondence principle 13 on page 187. The working hypothesis of this section is that the atomic formula is integrated between some final projection and the head of this projection.

¹⁷⁹The potential absence of the complement in (496) is graphically shown by parenthesis around YP . If the complement is absent, formula $\phi|P(z_1, \dots, z_k, y)$ corresponds to fP_y .

f only occurs in background subformula (ϕ in (497)) and the atomic formula of the head predicate $f \check{\exists} e$ ($P(z_1, \dots, z_k, y)$ in (497)), and not in AgentP_e (ψ in (497)). Thus, the implicit quantifier $\forall f$ is placed in the node of L^* formula corresponding to \imath in (497). We will be sloppy and say that $\forall f$ is placed “between BgP_e and BgP_f ”.¹⁸⁰

Formula (342) implies that we have to assume that when an implicit quantifier is placed between two functional projections, the atomic formula of the head predicate and the complex head are contained in the scope and the restrictor of the quantifier, respectively.

Next, by comparing LF (343) and the corresponding L^* formula (342) we can state our initial assumption on the global position of atomic formulas. I claim that the atomic formula of a head predicate must occur under the final projection (i.e. between the final projection and its head) of its feature. (So $f \check{\exists} e$ in LF (343) occurs under BgP_e .)

If we had conversely assumed that in LF (343) atomic formula $f \check{\exists} e$ occurs under the initial projection (BgP_f) of feature $[\text{Bg}]$, the resulting L^* formula would give us wrong truth conditions. The implicit quantifier $\forall f$ would occur in BgP_f , so the atomic formula $f \check{\exists} e$ and the background subformula would occur in its restrictor and scope, respectively.¹⁸¹ Entailingness properties disagree with such structure. The background subformula would not be within the scope of a negation, so we would wrongly predict that sentences containing focus allow upward entailing, see the discussion in §4.5.2.

It is clear from (339) that by stating correspondence principle 11 the assumption that the LF– L^* relation is an isomorphism was violated. However, I emphasize that this small violation is not comparable to the violation presented by LF–GQ relation, see §4.2.1. For example, conceptual features are greatly displaced there, cf. (268b) on page 133 and (270b) on page 134; the LF to L^* translation simply introduces a new node, while the basic shape of the tree is kept (as mentioned, the mapping from L^* to is a homomorphism). Furthermore, the introduction of the new node is based upon the syntactic information (feature projection), not logical features, which are foreign to syntax.

The mapping from (339a) to (339b) is not an isomorphism of hierarchical structure, because it identifies the background node and the atomic formula

¹⁸⁰By notation $\forall f \downarrow$ and $\uparrow f \check{\exists} e$ I wish to show that $\forall f$ and $f \check{\exists} e$ are placed between BgP_e and BgP_f . $f \check{\exists} e$ is graphically lower than $\forall f$, because it is within its scope in L^* formula: BgP_f and $f \check{\exists} e$ are the restrictor and the nuclear scope of $\forall f$, respectively.

¹⁸¹We have concluded as early as in §4.2.3 that the (complex) head (the specifier, in the terminology of that section) and the complement are the restrictor and the scope of a restricted quantifier, respectively.

node. Nevertheless, LF and L* expressions can be considered isomorphic: an L* formula contains all the information needed to generate the corresponding LF, and vice versa. The hierarchical information of L* that gets lost in LF by the identification of nodes is supplemented by *labeling* of syntactic objects: remember that the label simply the projected feature. So (496) is labeled fP since it was built by projecting [f] (as the last step in the derivation). The information contained in node λ in (497) is in LF therefore present as the *label* of the functional projection.

4.5.4 Elliptic structures

A detailed structure of LF corresponding to L* formula (334) is given in (344).¹⁸²

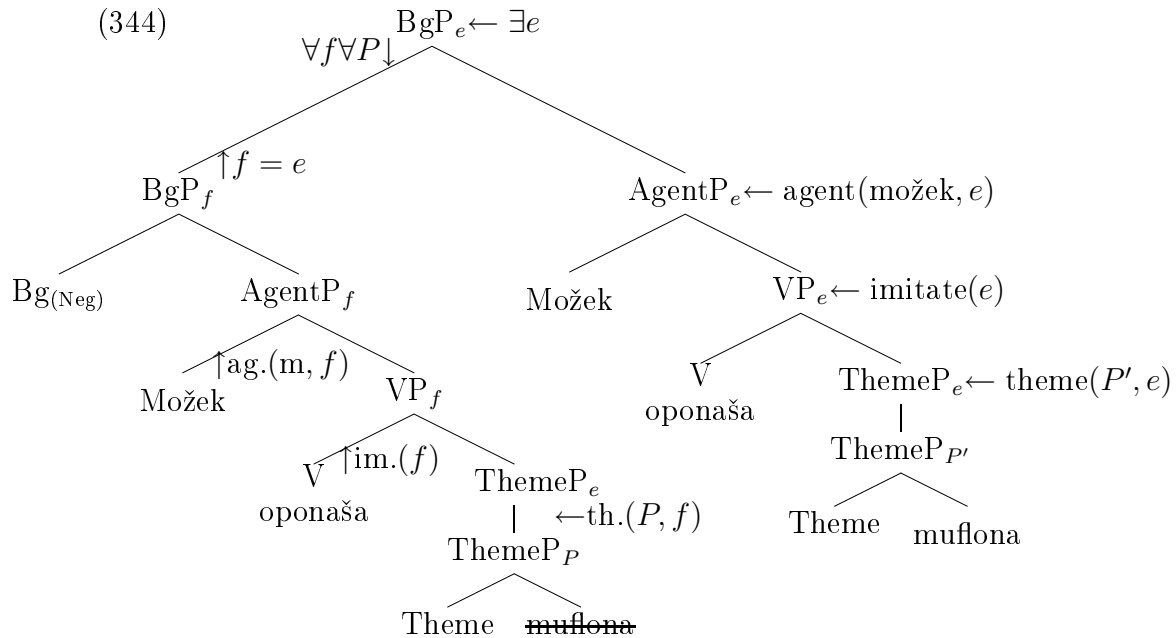
Podrobna zgradba logične oblike, ki ustreza L* formuli (334), je podana v (344).¹⁸³

The head predicate of [Bg] is the overlap predicate \checkmark . In (344), \checkmark associates two eventual variables, e and f . Thus [Bg] is projected twice, the complement of the first and the second projection being the background and the proposition, respectively. The complements are almost the same, the only difference lies in the absence of the focus in the background. Alternative variable P corresponds to the spine of the focus. The implicit quantifier over P is not placed between ThemeP $_e$ and ThemeP $_P$, as required by correspondence principles 8 and 11: it is placed between BgP $_e$ and Bg $_f$, the same as the quantifier over the background event variable $\forall f$. I assume this is what the focal mapping does: it widens the scope of the alternative quantifier to the whole background, or, in other words, it places the alternative quantifier higher in the structure, to the lowest node containing the whole background.

The background (AgentP $_f$) is unpronounced. So, the sentences with focus contain an elliptic structure, above BgP. It would find it unexpected if some principle of semantic interpretation would rely on the presence of a certain functional projection, as BgP. I thus assume that the exceptional positioning

¹⁸²For reasons of space some predicates are abbreviated. The precise position of the atomic formulas is shown in the background only. Since typesetting such representations is difficult and time-consuming, I will usually use the system used in the propositional part of this LF, i.e. the atomic formulas will be associated in the final projection. The notational systems used in the background and the proposition are meant to be equivalent.

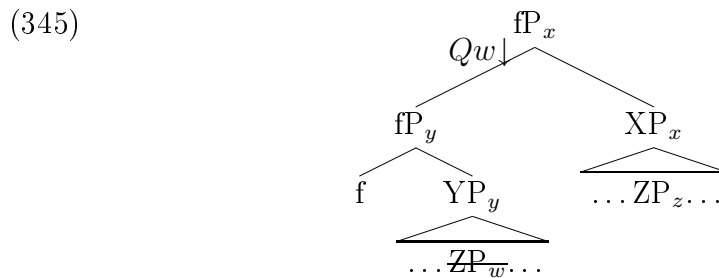
¹⁸³Zaradi prostorske stiske je zapis nekaterih predikatov okrajšan. Natančen položaj vseh atomarnih formul je prikazan le v ozadju. Zaradi zahtevnosti postavitve tako označenih drevesnikov bomo večinoma uporabljali sistem označevanja, uporabljen v propoziciji, tj. atomarno formulo jedrnega predikata bomo grafično postavili v zadnjo projicirano funkcijsko projekcijo oznake, ki ji jedrni predikat ustreza. Dogovorimo se, da sta sistema označevanja, ki ju v (344) uporabljamo v ozadju in propoziciji, ekvivalentna.



of the quantifier described above is not limited to focusing, i.e. to the ellipsis of BgP, but take it to be a generally applicable principle.

Correspondence Principle 12 *Let XP and YP in (345) be isomorphic modulo ZP , i.e. they would be truly isomorphic if YP would also contain ZP , in the position, parallel to the position of ZP in XP . Then fP_x is an elliptic structure.^{184,185}*

Assume that variable w corresponds to the spine in YP in the position parallel to the position of ZP in YP . Then the implicit quantifier Q over w is positioned between fP_x and fP_y .¹⁸⁶



¹⁸⁴For discussion on phonological realization of elliptic structures see §6.4.

¹⁸⁵Of course we also assume that fP_x is an elliptic structure if XP and YP are truly isomorphic.

¹⁸⁶The type of quantifier Q , \exists or \forall , is determined by the correspondence principle 10 and thus depends on the polarity of feature $[f]$.

Usually it is assumed that one of conditions on ellipsis is structural and semantic identity of the elided and realized constituent. In our theory this means that we have to require the following two things to be the same (i) the LFs of the elided and realized constituent and (ii) the conceptual features, which the lexicon associates to the parallel positions in these constituents. (This implies that a syntactic structure is not elliptic per se; ellipsis only applies when the lexicon kicks in.) (344) satisfies this condition.¹⁸⁷

4.5.5 The numerical spine

This section deals with the question how the argument slots of predicate # are filled. Also, the correspondence principle determining the global position of an atomic formula is given.

The analysis will use the conclusion from §3.1.4 that ϕ -phrases are exceptional with respect to the fseq generalization: they are exempted from fseq and can appear anywhere in the extended projection.

In the thesis I only deal with ϕ -feature number. I associate it with numerical variables of L^* . These are special with respect to other (substantive) variables, since they are not plural. In this section I will argue that just as there are spines corresponding to substantive variables, there are also (numerical) spines corresponding to numerical variables. I suggest that the observation about the free distribution of ϕ -phrases is reflected in the following property of the numerical spine: it can *interrupt* any other spine/extended projection.

Formally, if $\langle F_1, \dots, F_i, G_1, \dots, G_j \rangle$ is a legitimate extended projection, then $\langle F_1, \dots, F_i, N_1, \dots, N_k, G_1, \dots, G_j \rangle$ is also legitimate in general, where $\langle N_1, \dots, N_k \rangle$ is a numerical spine. I assume that the list of positions where an extended projection may be interrupted is language-specific.

Let us now turn to the question how the argument slots of # are filled. One of its arguments is a numerical variable (n), the other a substantive variable of an arbitrary type (x). Atomic formula $\#(n, x)$ is true if the number of members in the group x is exactly n .

¹⁸⁷If we wanted to verify the validity of the given correspondence principle, we would have to study elliptic structures in general, and compare the above suggestion to other approaches to ellipsis and related phenomena. Unfortunately, this falls out of scope of the thesis: we only deal with elliptic structures associated to definite determiners, and superlative and comparative structures. Correspondence principle 12 is only used in the case of comparative and superlative structures with relative reading, which I assume to be actually associated to focus. Thus, the general validity of the proposed principle cannot be verified using those examples. The same goes for the preliminary analysis of sentential topic in §6.2.1.

I claim that $\#$ corresponds to some feature realized by cardinal numerals. It is easy to see that these determine the size of a group of individuals, (346)–(347).

- (346) a. Trije fantje igrajo nogomet.
three boys play football
'Three boys are playing football.'
- b. $\exists x [\text{boy}(x) \wedge \#(3, x)] \text{play-football}(x)$
There is a group of individuals x , whose members are boys and whose size is 3. The members of x are playing football.
- (347) a. Peter vidi natanko eno zvezdo.
Peter sees exactly one star.
'Peter sees exactly one star.'
- b. $\exists y [\text{star}(y) \wedge \#(1, y)] \text{see}(\text{peter}, y)$
There is a group of individuals y , whose members are stars and whose size is 1. Peter sees the members of y .

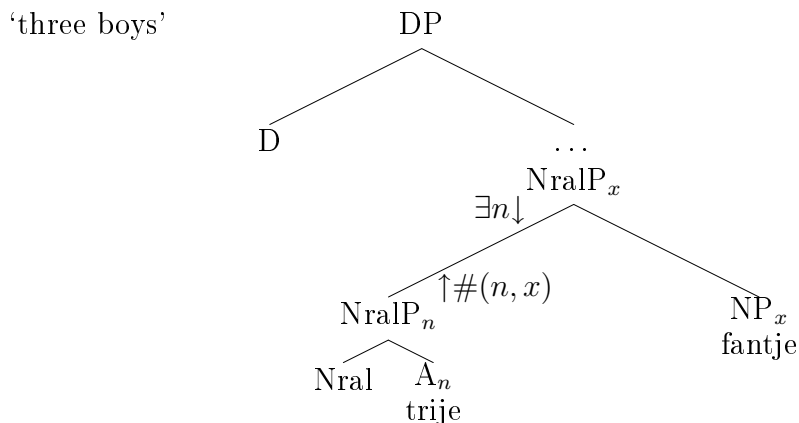
I assume that a cardinal numeral is a (complex) head of functional projection $N(\text{ume})\text{ralP}$ belonging to the nominal spine, and that, by correspondence principle 7, head predicate $\#$ is associated to feature $[N\text{ral}]$.

Since L^* has no individual constants, the numerical argument of $\#$ must be a variable, too: a numerical variable, usually written as n . Therefore, formulas (346b) and (347b) are not really formulas of L^* : in L^* , the meaning of (346) is represented with formula (348).

- (348) $\exists x [(\exists n [\exists (n)] \#(n, x)) \wedge \text{boy}(x)] \text{play-football}(x)$
There is a group of individuals x such that there is a number n which is 3, that the size of x is n and that all members of x are boys. The members of x are playing football.

The internal structure of DP corresponding to the restrictor of quantifier $\exists x$ in formula (348) is given in (349).

- (349) $[_A \text{ trije}] \text{fantje-NOM.PL.}$



Trije ‘three’ is an adjectival cardinal numeral (see §2.1.1). It is usually assumed that adjectives are (in the terminology of the standard X-bar theory) specifiers of certain functional projections (or adjuncts of these projections), and not heads. The cardinal numeral *trije* in (349) is a complex head of *NralP* in the nominal spine, so LF (349) is compatible with the usual assumption.

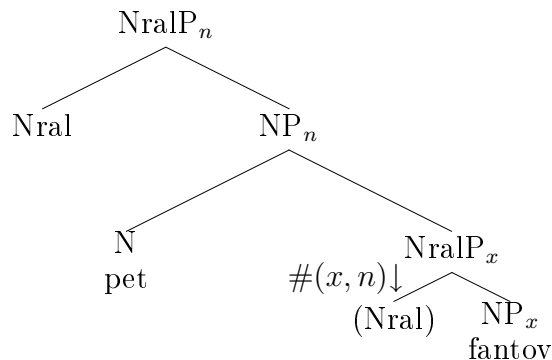
In formula (348) a numerical variable was used, so LF (349) contains a numerical spine. Formula (348) contains predicate 3, whose argument is a numerical variable: atomic formula $3(n)$ is true iff n equals 3. Predicate 3 is comparable to lexical predicates such as piggy, eat, etc. It is a one-place predicate (but see §4.5.1) and it belongs to a lexical category (adjective). Somewhat surprisingly, it follows that 3 is a conceptual feature and that, according to the definition in §2.1.1, cardinal numerals are not determiners at all!

So, the lexical item of the cardinal numeral *tri* ‘three’ is the triple $\{\pi, \lambda, \gamma\}$, where π is its phonological representation /tri/, γ is its conceptual representation 3 and λ is its syntactic representation containing (at least) feature [Nral] and categorial feature [A]. (Cardinal numeral *tri* realizes *NralP* with an AP complement.)

Until now, the second argument slot of a two-place head predicate was always filled by means of a second projection of the feature, i.e. by the projection from a complex head (as e.g. [Bg] in (344) on page 183, which is projected from BgP_f into BgP_e). Another option exists: the simple head can project again, yielding movement.

The nominal cardinal numerals will be analyzed by movement of simple head *Nral*. We assume that the numerical spine interrupts the nominal one, and that LF (350) corresponds to a DP with nominal cardinal numeral.

(350) [N pet] fantov-GEN.PL
 ‘five boys’



In (350) the arguments slots of $\#$ are filled in the reverse order with respect to (349). So, in (349) [Nral] is first projected in the numerical spine n and next (from the complex head) into a nominal spine x . In (350), [Nral] is first projected in the nominal spine x , and next (by movement) in the numerical spine n . This is consistent with correspondence principle 7, where we have emphasized that projection/argument assignment order is not fixed.

As mentioned, until now the second argument was always provided by a second projection, i.e. projection from a complex head. The truth conditions associated to (344) on page 183 forced us to assume that the global position of an atomic formula is next to the second, final projection. When we try to determine the global position of atomic formula $\#(x, n)$ in LF (350), a problem arises, because [Nral] has two final projections, NralP_x and NralP_y . Should the atomic formula $\#(x, n)$ be placed under NralP_x (in the “base-generated” position) or under NralP_n (in the “derived” position)? The analysis of cardinal numerals offers no answer to this question.

I claim that we should opt for the lower position, NralP_x , and I will argue so in chapter 5, when discussing comparative and superlative structures. Here, I simply stipulate the correspondence principle which will be used in these analysis.

Correspondence Principle 13 *The atomic formula of the head predicate of some feature is integrated between the lowest final projection of the feature and the head of this projection.*

L* formula (351) corresponding to LF of a nominal cardinal numeral (350) differs from L* formula (348) corresponding to LF of an adjectival cardinal numeral (349). The chief difference lies in the scope of the existential quantifier over n : in (351)/(350) it scopes over NP, whereas in (348)/(349) it does not. The truth conditions of both formulas are the same.

(351) $\exists x [\exists n: 5(n) \wedge \#(n, x) \wedge \text{boy}(x)] \text{play-football}(x)$

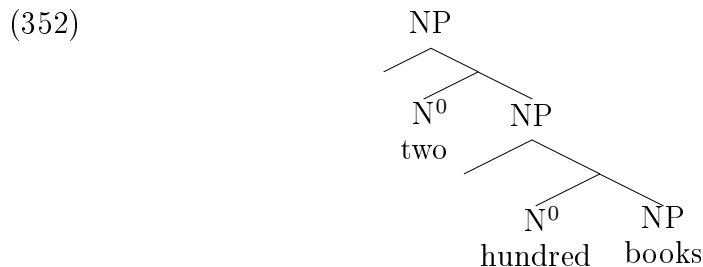
There is a group of individuals x such that there is a number n such that n is equal to five, the number of x 's members is n and the members of x are boys.

The members of x are playing football.

(351) does not specify what is the restrictor of quantifier $\exists n$. $5(n)$ cannot form the restrictor, since NP_n is not the highest projection in spine n ; the same goes for $\#(x, n)$ because we have assumed that it is placed under the lowest final projection. I assume that grammatical number forms the restrictor, see §6.5.1.

(349) and (350) yield the correct meaning. What about their syntax, is it appropriate? Ionin and Matushansky [2006] criticize the approaches introducing a special functional projection associated with number. The criticism impacts both the approaches claiming that (nominal) cardinal numerals are the heads of this projection, and the approaches claiming that they are its specifiers. I argue that our proposal escapes the criticism. On one hand, we do not assume that nominal cardinal numerals are heads complex heads (i.e. specifiers). On the other hand, in our analysis the cardinal numeral is a head, but it is the head of an NP (in the sense of NP as a projection of head N), not the head of NralP. The criticism only applies to such analysis: the authors emphasize that they are unable to deal with complex numerals (as e.g. *twohundred* or *twenty-one*).¹⁸⁹

The authors suggest their own approach, which is superficially¹⁹⁰ the same as ours: syntactically, cardinal numerals are lexical heads (N/A for nominal/adjectival cardinal numerals); semantically, they are operators. The generation of cardinal numerals is implemented recursively: to DP *two hundred books*, LF (352) is attributed.

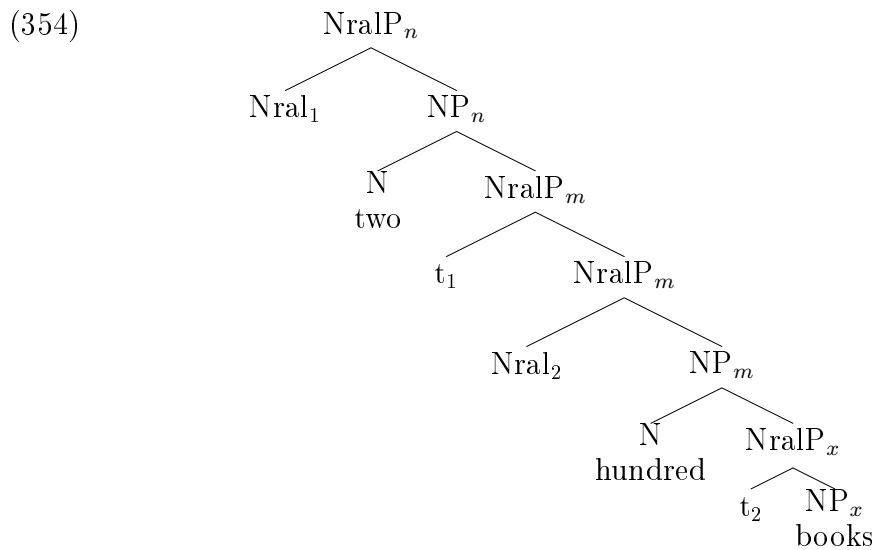


¹⁸⁹In §6.2.2 a rough analysis of coordination is provided. If the assumption of Ionin and Matushansky [2006] that the complement of all coordinated cardinal numerals is the same NP (which is elided, except in the case of the last numeral) is adopted, the analysis can be also applied to the coordinated cardinal numerals.

¹⁹⁰They must provide the semantics of cardinal numerals separately, which is unnecessary in our theory.

Their idea about recursion is directly usable in our theory. Let every cardinal numeral correspond to its own numerical spine. Next, we associate these spines with predicate #. We get formula (353) and LF (354). (The formalization of spine-interrupting in the beginning of this section allows for multiple interrupting.)

(353) $\exists x [\exists n [2(n)] \exists m [\#(m, n)] \#(x, m) \wedge 100(m) \wedge \text{book}(x)]$
 There is a group of individuals x such that the following is true. There is a number n , which is 2, such that the following is true. There is a group of numbers m of the size n , such that the following is true. The size of the group x is m , every member of m is the number 100 and the members of x are books.



The analysis of complex cardinal numerals forces us to change our opinion on the status of numerical variables. We have assumed that this is the only type of variables which is not plural. However, if they are to be used in the substantive argument of predicate #, as above, they should be. Because complex cardinal numerals will not be further discussed, I leave the formal implementation of this adjustment to further research.*

*During the preparation of the English version of the thesis I have discovered that formula (353) actually does not yield the correct truth conditions, unless some additional assumptions about predicate # are adopted.

The problem is that the formula is true also if there are, for example, only 100 books. It requires that there are two objects, which are number '100,' and that for each of these objects there are 100 objects, which are books. However, nothing prohibits these 100 books to be the same for both of numbers '100', thus yielding a total of 100 books.

The problem can be resolved by an additional requirement on the interpretation of

predicate #. Let us require that the relation R denoted by #, is a *categorizing* relation (with respect to the substantive (i.e. the not necessarily numerical) argument): if $R(m, a)$ and $R(n, a)$, where m, n are positive integers and a is some individual, then $m = n$; just imagine sun rays emerging from the number and going to the objects. This forces the two sets of books from the previous paragraph, the books from each set being associated with some value of variable m (i.e. with some number ‘100’), to be disjoint, thus yielding the correct reading of DP *two hundred books*.

At first sight, this appears a terrible complication of the theory, all for a single predicate. However, let’s see what happens if we assume the categorizing requirement in general: assume that all head predicates (but $\check{\zeta}$; sic) denote categorizing functions. We immediately hit the problem with theta roles. Thematic relations can generally relate any number of events with any number of individuals, i.e. a group of individuals can bear a particular theta role of a group of events, as perhaps happens in *We moved five times in a row*. Thus, thematic relations are not categorizing.

However, there’s a trick we can pull. Let us introduce a new type of object, call it a *participant*, and use it as an intermediary between individuals and events. Participants are built from individuals: introduce a new two-place relation (/head predicate/feature) Part(icipant); a participant p “consists” of all individuals a it is related to by Part(p, a), and assume it is categorizing in the individual argument. Theta roles are assigned to participants: $\theta(p, e)$, and take θ to be categorizing in the event argument. The net effect is that individuals are associated theta roles (via the composite relation), but the categorization requirement is not violated.

This would still be just an ugly trick—if there was no (abstract) case. But I cannot suppress the hunch that the above-defined participants are actually instances of case, so I believe that this trick could provide a semantic motivation for the existence of case, without actually giving to the cases a semantic value on par with the semantic values of other functional projections. But much work remains to be done. . .

Another part of the syntactic theory where the categorization requirement might turn out useful is Binding Theory, specifically Principle C. The categorization requirement cannot be taken as a syntactic principle, but as an interpretive (CI?) one. As such, it is possible to imagine that it holds “globally”: even if there are two occurrences of some predicate (i.e. feature) in the syntax, they denote the same relation. Thus, the categorizing requirement could make their interpretations dependent. Specifically, take root from § 4.5.1. It obviously cannot be categorizing in its conceptual argument; it should thus be categorizing in the substantive one. This predicts that the same individual cannot be characterized by two concepts, i.e. that I cannot be both a student and a dancer. In this form, the requirement turns out to be too strong, of course, but imagine that it could be restricted to apply only under c-command. Then, I believe, the Principle C would emerge.

(Let me mention a point concerning adjectival modification. The categorizing requirement does not prohibit a real-world object from being both a box and red. It only prohibits our mental representations of them to be such. This is not problematic, however, since, as we will argue in §5.2.1, a proper semantic representation of a *red box* does not assert that there is something which is a box and is red; it asserts there is something (an individual x) which is box, and something (a property p) which is redness, and these are related (by some relation: Property, or maybe Color.)

4.6 Conclusion

The theory developed in this chapter deals with the quantificational aspects of semantic interpretation of LF under the assumption that FL is modular.

We have stated the correspondence principles (collected in appendix A), which associate an LF expression λ to the formula ϕ of language L^* representing the appropriate truth conditions of a sentence having LF λ .

Our expectations about the content of correspondence principles, mentioned in the introduction to §4.2, are (only) partially fulfilled. The correspondence principles explicate the LF– L^* isomorphism* (variables are spines, features are predicates, predication is projection, negative operator is the polarity of a feature; the principle determining the position of an atomic formula in a constituent containing all the predicate’s arguments, is more complex); however, a “computational” aspect of the correspondence principles exists. It seems that they partially state the properties of the system of the mind (maybe a subsystem of CI) responsible for computing the quantificational structure of linguistic expressions.

In the course of development of our theory we have used the following (results of) existing semantic and syntactic theories: (i) the results of GQ theory and theorems proven in Živanović [2002], which translate these results from assertions about model-theoretic properties of determiners into assertions about formal properties of L^* formulas; (ii) the assumption about the modularity of FL, instantiated in some aspects of Starke’s work (nanosyntax, X-bar theory with complex heads); (iii) event semantics and its application to analysis of focus from Herburger [2000].

The empirical data directly used in the course of development, are scarce, and contain sentences with (i) indefinite determiners, (ii) universal determiners, (iii) cardinal numerals, (iv) English superlative determiner *most*, and (v) focus. (Specifically, data on definite determiners, superlative constructions (except for *most*) and comparative constructions was not used; I deal with this data in chapter 5.¹⁹¹ The poverty of used empirical data is methodologically desired: every further successful application of the developed theory shows that it has enough expressive power to deal with new data, thereby confirming the theory.

¹⁹¹Also, the used data on universal determiners was very scarce. In §5.2.3 we deal with universal determiners in more detail.

Actually, it is an endomorphism, i.e. an isomorphism between LF and a subclass of L^ formulas. While $LF \rightarrow L^*$ mapping is injective (i.e. it is never many-to-one), not every L^* formula corresponds to some LF (formulas using unrestricted quantification don’t, as well as formulas where the scope of some quantifier too high). Thus,

Chapter 5

Quantificational structures in L* theory

This chapter provides the LF/L* representations of certain quantificational structures, mostly dealing with comparative and superlative structures. In chapter 2, L* formulas for the two readings (majority and plurality) of superlative determiner (SD) were given. We have seen that the first one resembles the formula for the definite determiner (DD). Both formulas correspond to the pattern we have called the definiteness pattern. In §4.5.2 the definiteness pattern was generalized to the uniqueness pattern. In this chapter we will see that the latter is useful in the analysis of all comparative and superlative structures, and even beyond that.

The chapter is organized as follows. The definiteness pattern is the simplest manifestation of the uniqueness pattern, so it is the first we discuss, in §5.1. In §4.5.5 we have argued that a numerical spine can interrupt a nominal spine; in §5.2 we shall argue that it can also interrupt a verbal spine. This result will be used in the semantic decomposition of superlative and comparative structures containing focus. So, in §5.3 the plurality SDs are analyzed, in §5.4 superlative adjectives are discussed, and in §5.5 we deal with comparative structures in general. §5.6 discusses negative (gradable) adjectives. §5.7 uses the uniqueness pattern for the analysis of sentential negation. §5.8 concludes the chapter.

In this chapter we stop “glossing” the formulas in English. I believe some formulas we will encounter are simply too lengthy to benefit from the gloss.

In the examples in this chapter the DP under discussion is usually an agent and a subject. However, our theory is not limited to such cases. Predicate agent in L* formulas and functional projection AgentP in LF can be replaced by any other theta predicate/projection, e.g. predicate *theme* and

functional projection ThemeP. The fact that a DP is a subject (pretheoretically) means that it is nominative, has a wide scope generally, and is able to bind reflexives. All this is unimportant as far as L* theory is concerned: DPs having various syntactic functions are analyzed the same.

5.1 The definiteness pattern

In this section we will derive LF and L* formula for sentences containing a DD or a majority SD. We have argued in §2.2.5 that these (L*) structures conform to the definiteness pattern. In this section we will argue that the definiteness pattern is a reflection of the presence of a functional projection DefP in the nominal spine. Languages which do not license the definiteness pattern are therefore languages not licensing DefP in the nominal spine.

In §5.1.1 and 5.1.2 we discuss DDs and majority SDs, respectively.

5.1.1 The definite determiner

In §2.2.2 we provided Russellian-like truth-conditions for English sentences containing DD *the*. L* formula the closest to the original Russell's notation is repeated in (355). (Modernized Russell's and L* notation are superficially the same. The interpretations differ, however, since L* variables are plural. (355b) is also usable when the complement of *the* is plural.)

- (355) a. The S Vs / The Ss V.
 b. $\exists x: S(x) \wedge V(x) \wedge (\forall y: S(y) \Rightarrow y \checkmark x)$

Since in L* theory formulas corresponding to LF expressions, the precise form of a formula matters a lot. In general, this is not the case in semantics. So it is usually implicitly assumed that Russell suggested (356) as the analysis of *the*.

- (356) $\exists x: (S(x) \wedge (\forall y: S(y) \Rightarrow y \checkmark x)) \wedge V(x)$

We have argued in §4.2.2 that all truth-conditions should be written without using unrestricted quantifiers. In the restricted notation the difference between (355b) and (356) translates to the question whether the uniqueness condition $(\forall y: S(y) \Rightarrow y \checkmark x)$, in restricted notation $\forall y [S(y)] y \checkmark x$ belongs into the restrictor (357) or the scope (358) of $\exists x$.

- (357) $\exists x [S(x) \wedge \forall y [S(y)] y \checkmark x] V(x)$
 (358) $\exists x [S(x)] (\forall y [S(y)] y \checkmark x) \wedge V(x)$

Since two variables (x and y) have been used in the L^* formula, the corresponding LF has to contain two spines, by correspondence principle 6: one for x and one for y . (Denote these spines by xP and yP .) In the uniqueness condition, variables x and y are related by the overlap predicate \checkmark . By correspondence principle 7 this predicate is a head predicate of some functional projection. Let us call this projection *definiteness phrase* (*DefP*)—as we shall see, its presence gives us the truth conditions, specific for the Russellian analysis of definite determiners. Since x and y are arguments of a two-place predicate \checkmark , by correspondence principle 7 feature [Def] had to be projected twice, once into spine x and once into spine y . If the first projection was into y , yP is contained in xP ; otherwise vice versa. The question whether the uniqueness condition is a part of the restrictor of $\exists x$, is therefore equivalent to the question whether yP is contained in xP .

$V(x)$ is nothing but a shorthand for $V(e) \wedge \text{vršilec}(x, e)$, see §2.2.1. Variables x and e are related by predicate agent. Therefore, xP is a complex head of functional projection *AgentP* in verbal spine e and as such cannot be contained in yP . (So, xP is the DP *the S*.) Feature [Def] is first projected into y and then into x . So predicate \checkmark occurs within xP , and the uniqueness condition occurs in the restrictor of $\exists x$, as in (357).

What is the internal structure of the restrictor? Atomic formula $S(x)$ cannot occur within the scope of $\forall y$, because formula (359) does not give the correct truth conditions for (355a). For example, it is true in a situation where there are no S s, if only there is a V . (If there is no S , then anything is true for every y , which is an S .)

$$(359) \quad \exists x [\forall y [S(y)] y \checkmark x \wedge S(x)] V(x)$$

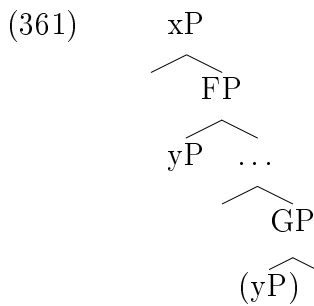
Suppose that the implicit quantifier $\forall y$ occurs in some functional projection *FP* in spine x . Because $S(x)$ may not be in the scope of $\forall y$, *NP* corresponding to $S(x)$ may not be contained in *FP*, unlike what is shown in (360).

$$(360) \quad * \quad \begin{array}{c} xP \\ \widehat{\text{FP} \leftarrow \forall y} \\ \widehat{\text{NP}} \end{array}$$

However, the *NP*-layer of the nominal extended projection (containing the noun, adjectival modifiers and relative clauses) is its lowest part [Cinque 1994], so *NP* is surely base-generated below *FP*. A movement of *NP* to a position above *FP* should occur. From a semantic viewpoint, this should be phrasal movement, since not only noun, but also adjectival modifiers and

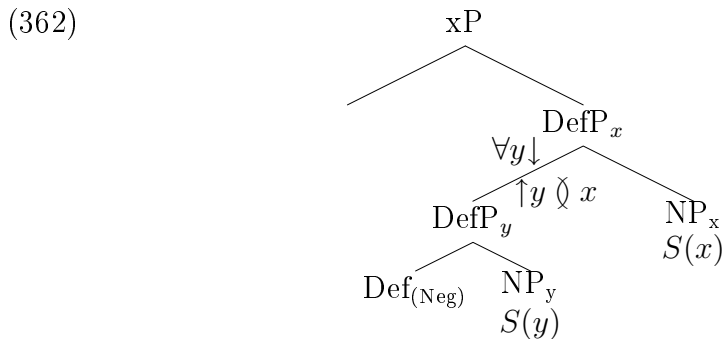
relative clauses should move out of scope of $\forall y$; however, it is usually assumed that noun undergoes head movement DP-internally. (For details see Cinque [1994]; an argument against phrasal movement is presented in Brugè [2002].)

Therefore, the original assumption that the implicit quantifier $\forall y$ occurs within FP, belonging to the nominal spine, is therefore wrong. Luckily, adopting truth conditions in (357) does not require assuming that $\forall y$ occurs in this position. This would be necessary only if the position of yP as a complex head would be derived, i.e. if yP would move into its position from some lower position, say a position of a complex head of some functional projection GP. In such event, FP would be the lowest node containing all occurrences of y , so, by correspondence principle 8, the implicit quantifier $\forall y$ would occur there.



Furthermore, according to (361), variables x and y are related by two predicates. However, in (357) / (359) the only predicate linking x and y is the overlap predicate \checkmark . Truth conditions therefore tell us that yP couldn't undergo the movement shown in (361). yP projects only one feature into spine x : feature [Def], as shown in (362).

We therefore suggest (362) as LF structure for DD. (362) also shows some of the yP's internal structure: we assume that it contains functional projection DefP and noun phrase NP below DefP (as standardly assumed).



In an L^* formula, $S(x)$ and $S(y)$ correspond to NP_x and NP_y , respectively. Atomic formula $y \checkmark x$ with head predicate \checkmark and formula $S(y)$ contain

occurrences of y , so $\forall y$ occurs in some higher position. The subformulas corresponding to DefP_x and NP_x do not contain occurrences of y , so $\forall y$ must immediately dominate $S(y)$ and $y \checkmark x$. It follows that $\forall y$ occurs between DefP_x and DefP_y , and thus does not scope over $S(x)$, as required by the truth conditions in (357).

Finally, we have to explain the type of the quantifier over y : which aspect of LF causes it to be a universal and not existential quantifier. By correspondence principle 10 $S(y)$ is within the scope of a negation. Thus, DefP plays a double role: it introduces both the overlap predicate and the negation operator (negating DefP_y). By correspondence principle 9 $[\text{Def}]$ is a negative feature, $[\text{Def}_{(\text{Neg})}]$.

I leave a detailed investigation of plural definite phrases (e.g. *the boys*) and definite phrases containing a cardinal numeral (e.g. *the five boys*) to further research.

The phonological realization

It seems reasonable to assume that English DD *the* is a phonological realization of feature $[\text{Def}]$.¹⁹²

(362) contains two NPs (NP_x in NP_y). Overtly, however, only one NP appears. Thus, (362) is an elliptical structure. By a common assumption on elliptical structures, NP_x and NP_y are isomorphic.

Could it happen that NP_y would get phonologically realized? All phonologically realized NPs must have (abstract) case (probably in order to achieve morphological integrity; c.f. also with so-called Case Filter in the Government and Binding Theory [Golden 2001:78]). I believe that NP_y is unable to get case, i.e. move into some appropriate functional projection,¹⁹³ so (362) must be an elliptical structure. It follows that it has to contain the same conceptual features as NP_x , see §4.5.4. Thus, in formulas for DD, as (355b), atomic formula $S(y)$ cannot be replaced by some atomic formula with some other predicate but S .

¹⁹²DDs may additionally realize other features (cross-linguistic variation in the distribution of DDs is probably a consequence of this fact). Specifically, Ihsane and Puskás [2001] claim that English *the* contains feature $[\text{Specific}]$, related to topicalization.

¹⁹³Correspondence principle 7 puts certain conditions on movement, which are not explored in the thesis. Thus it might be the case that the theory has something to say about why NP_y cannot get case, my guess being that this is a consequence of either it being embedded too deeply or $[\text{Def}]$ having a negative value.

5.1.2 The majority reading of a superlative determiner

In §2.2.5 we have shown that the only difference between the formulas for *the* (363a)/(364a) and *most* (363b)/(364b) is that the formula for *most* additionally constrains the size of groups x and y : it requires their sizes to be the same.

- (363) in unrestricted notation
- a. *the*: $\exists x: S(x) \wedge V(x) \wedge (\forall y: S(y) \Rightarrow y \checkmark x)$
 - b. *most*: $\exists n: \exists x: S(x) \wedge \text{quant}(n, x) \wedge V(x) \wedge (\forall y: \neg(S(y) \wedge \text{quant}(n, y)) \vee y \checkmark x)$
- (364) in restricted notation
- a. *the*: $\exists x [S(x) \wedge (\forall y [S(y)] y \checkmark x)] V(x)$
 - b. *most*: $\exists n: \exists x [S(x) \wedge \text{quant}(n, x) \wedge (\forall y [S(y) \wedge \text{quant}(n, y)] y \checkmark x)] V(x)$

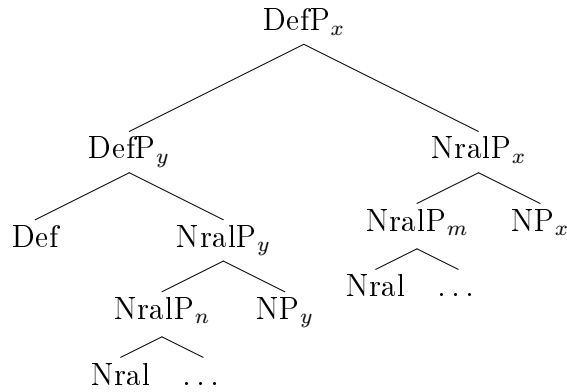
The similarity of L^* formulas implies the similarity of LFs, therefore we can use LF for *the*, (362), as a base for the analysis of *most*. In formula for *most* we use predicate $\#$, which is head predicate of NralP. Therefore, LF for *most* should also contain NralP.

We have to figure out the relative order of DefP and NralP in the nominal fseq: DefP > NralP or NralP > DefP? LF (362) for *the* is an elliptical structure, so LF for *most* is an elliptical structure, too. In formula (364b) predicate $\#$ occurs twice, so LF for *most* should contain two heads Nral. We have assumed that *most* realizes features [Def] and [Nral]: since in LF for *most* feature [Nral] occurs twice, while the word *most* realizing is obviously pronounced only once, one occurrence of [Nral] is elided. In (362) the complement of DefP_{*y*} was elided. I therefore assume that NralP_{*y*} is contained within the complement of DefP_{*y*}. This implies the ordering DefP > NralP.

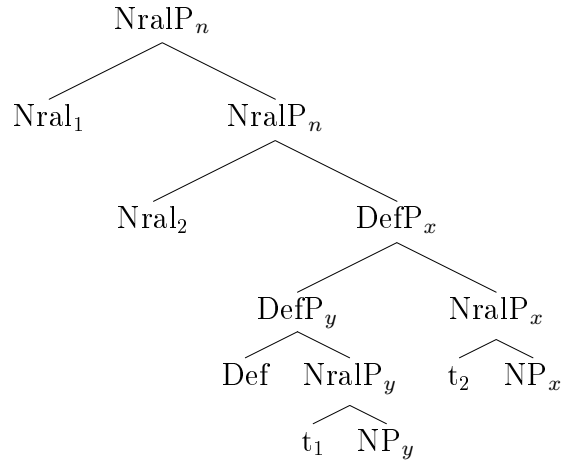
Only one numerical variable, n , occurs in formula (364b). It follows that (both) [Nral] features are first projected into a nominal spine (into two different nominal spines). If this was not the case, LF (365) would result: we would get two numerical spines, corresponding to two different numerical variables. (It would be impossible to relate the two variables by some head predicate: node NralP_{*m*} does not c-command NralP_{*n*}, or vice versa, so the positions cannot be related by movement.)

Thus, projections NralP_{*x*} and NralP_{*y*} have simple heads. So, where do the head predicates $\#$ get their numerical argument? I assume that—as in §4.5.5—the numerical spine n can interrupt the nominal spine x . Simple heads Nral project again (i.e. they move) into spine n , (366). This guarantees that the numerical argument of both occurrences of $\#$ is the same.

(365) *



(366)

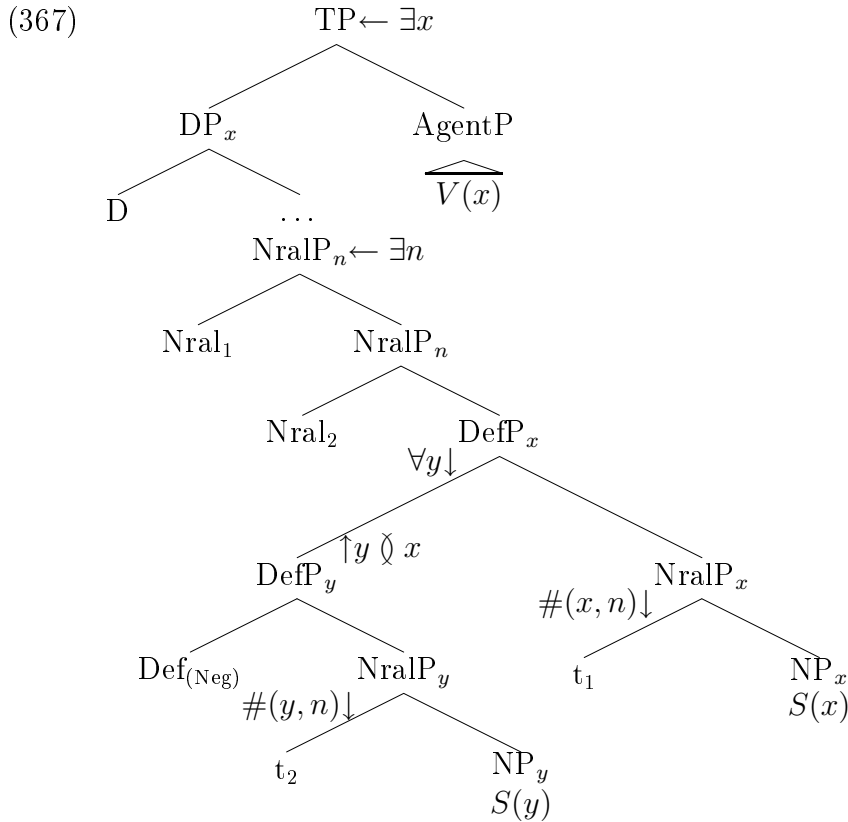


(367) is the LF of the whole sentence containing *most*. Positions and types of implicit quantifiers (correspondence principles 8 and 10) and positions of atomic formulas (correspondence principle 11) are shown.

Quantifier over x occurs in TP, by correspondence principle 8. x in the restrictor is not within the scope of negation, so the quantifier is existential, $\exists x$. Because NP_x does not contain any occurrences of y , quantifier over y occurs between $DefP_x$ and $DefP_y$, by correspondence principle 11. The quantifier is universal, since $DefP_x$ introduces the negation operator negating $DefP_y$. The head predicate of Def is the overlap predicate $\check{\exists}$, which is not within the scope of negation, by correspondence principle 11.

The markings in (367) make it clear that LF (367) corresponds to formula (368). This formula is equivalent to (364b) (their forms are minimally different: the distribution of conjuncts is different; the scopes of quantifiers $\exists x$ and $\exists n$ are reversed).

$$(368) \quad \exists x [\exists n: (\forall y [S(y) \wedge \text{quant}(y, n)] y \check{\exists} x) \wedge \text{quant}(x, n) \wedge S(x)] V(x)$$



The only aspect of the relation between LF (367) and L* formula (368) which hasn't been independently motivated in chapter 4, concerns the global position of the atomic formulas $\#(y, n)$ and $\#(x, n)$. I claim that $\#(y, n)$ occurs between NralP_y and t_2 . In the opposite case (if it occurred between NralP_n and Nral_2), the implicit quantifier $\forall y$ would occur in the lower NralP_n , yielding the wrong truth conditions. (See §5.1.1 for the discussion, why NP may not be within the scope of $\forall y$.) Correspondence principle 13 is thus motivated by the relation between LF (367) and L* formula (368).

If the above analysis is not to predict non-existing readings of *most*, we have to assume that the movement out of the elided phrase is appropriately constrained. Specifically, it should be parallel to the movement from the corresponding phonologically realized phrase. (In (367) this condition is satisfied: Nral_2 and Nral_1 are moved in a “doubled” projection NralP_n .) Otherwise we would expect that simple heads Nral_1 and Nral_2 can move into different numerical spines, yielding different numerical arguments to the two occurrences of $\#$.

The phonological realization

Two features, [Nral] and [Def], were used in LF representation of *most*. Thus, the lexical entry for *most* should realize both of them. In standard minimalism this would imply that the lexical entry for *most* is a feature bundle that contains features [Nral] and [Def] (among other features); the feature bundle starts its life in some terminal node; the features get checked in appropriate functional projections during the course of derivation. In L* theory the SMS architecture is adopted (see §3.3.2), meaning that the lexical access occurs only after the syntactic derivation. Thus we have to specify how features [Nral] and [Def] may and/or must be related that they can be realized by the lexical entry for *most*. We only want to allow (simultaneous) realization of locally related features: e.g. we don't want some lexical item to realize feature [Nral] in the matrix clause and feature [Def] in a relative clause.

I assume that a lexical item realizes a feature by realizing some projection of the feature. Thus, conditions on relations between projections must be set. Specifically, for *most*, and SDs in general, I assume that it can realize NralP and DefP if DefP is a complement of NralP. So, in (367), the lexical item for *most* realizes NralP_n and its complement DefP_x.

Furthermore, we need to assume that a lexical item realizing some functional projection fP, also realizes all adjacent functional projections of the same category. Thus, the SD in (367) realizes both the higher and the lower NralP_n.

Note that if we assumed that SD realizes NralP_x and not NralP_n, i.e. that *most* can realize NralP and DefP if NralP is a complement of DefP, LF (367) would not be appropriate, since [Nral₂] would remain unrealized.

As far as ellipsis is concerned, (367) also seems appropriate: if NP_x and NP_y are isomorphic, NralP_x and NralP_y are isomorphic as well.

We apply the same reasoning as in §5.1.1 to see that DefP_x in (367) may and must be an elliptical structure. Also note that it follows that comparatives cannot appear within a DP: in §5.5 we will argue that comparative structures employ the same functional projections as superlative structures; comparatives must contain a phonologically realized comparison class; since no part of NralP_y can be phonologically realized (since it cannot get case), DP-internal comparatives are not possible.

We assume that the above description of a lexical item for *most* is valid for SDs all readings, and, appropriately generalized, also applies to superlative structures in general. For discussion see §5.3 and §5.4.

5.2 Numerical spine in verbal extended projection

In this section we provide two arguments supporting the assumption that numerical spine can interrupt a verbal spine. In §5.2.2 we provide a semantic analysis of copular sentences, and apply it to the examples where the predicate is a cardinal numeral; in §5.2.3 we analyze the (Slovenian) universal determiner *vsi* ‘all’.

§5.2.1 presents a semantic decomposition of gradable adjectives, which is then used in the analysis of copular sentences in §5.2.2. §5.2.3 deals with universal determiners. §5.2.4 concludes the section.

5.2.1 Gradable adjectives in L^*

It is usually assumed [Sharvit and Stateva 2002] that the positive form of a gradable adjective denotes a mapping from degrees (d) to one-place predicates. For example, the meaning of adjective *tall* is defined as in (369).

(369) For a degree d and an individual x , $\text{high}(d)(x) = 1$ iff the height of x is (at least) of degree d .

It is furthermore assumed that these mappings are (downward) monotone with respect to the degree. If d and d' are degrees and $d' < d$, then $\text{high}(d)(x)$ implies $\text{high}(d')(x)$. (This is only valid for positive gradable adjectives. For a discussion on negative gradable adjectives see §5.6.)

This assumption, and consequently the use of operators $>$ and $<$, can be avoided if one employs the tools developed for the analysis of quantification over individuals for the analysis of adjective gradation. Degree, as understood by the standard theory, will be quantized. The formula $\text{high}(d)(x) = 1$ —the height of x is (at least) of degree d —will be represented in L^* as (370).¹⁹⁴

(370) $\exists p [\#(d, p) \wedge \text{height}(p)] \text{property}(p, x)$

A *property* variable p in (370) stands for a group of “quanta” of some property. Standard degree, d , stands for the number of quanta.¹⁹⁵ Formula $\#(d, p)$ asserts that the number of quanta in group p equals d . Furthermore, we specify the property by predication over p : $\text{height}(p)$ means that quanta

¹⁹⁴This resembles the *trope*-based analysis of adjective gradation [Moltmann 2005]. A trope is an abstract individual; it is assumed to be a denotation of a nominalized adjective phrase such as *John’s height*.

¹⁹⁵The numerical variable d is completely identical to the numerical variable n used in quantification over individuals. A different symbol is used only as a mnemonic aid.

of height are members of group p .¹⁹⁶ One part of the meaning of (370) is therefore the assertion that d (different) quanta of height exist. The other part, $\text{property}(p, x)$, associates these quanta with variable x , which stands for an individual (or a group of individuals). Thus, L^* analysis of adjective gradation unifies property predication with theta role assignment. Both use head predicates. Theta roles are assigned using predicates agent, theme, etc. Properties are assigned using predicate property. We shall assume, in accord with correspondence principle 7, that property is a head predicate of some functional projection, PropertyP (property phrase).

Note that here the adjectival modification is simplified in several ways. (i) We only deal with intersective adjectives. Adjectives such as *alleged* and *ex* are thus excluded from the discussion.¹⁹⁷ (ii) Some authors [eg. Kayne 1994] assume that predicative uses of adjectives are derived from relative clauses. In this section I assume this to be false for gradable adjectives. (iii) A detailed investigation of DP cartography reveals that specialized functional projections exist in the DP, dealing only with the assignment of specific properties, such as height, depth, color, nationality, etc. [Cinque 2002]. This translates to the L^* theory by substituting specialized predicates such as *height*, *depth*, *color* and *nationality*, for the general predicate property.

Let us analyze two concrete examples of property assignment. In (371) the quantity of a property is explicitly determined. Above the adjective (A), there is a special functional projection, usually called degree phrase DegP. Head predicate $\#$ corresponds to DegP (just as to NralP).¹⁹⁸ On the contrary, the height is not explicitly determined in (372), so DegP is absent from the adjectival spine.¹⁹⁹

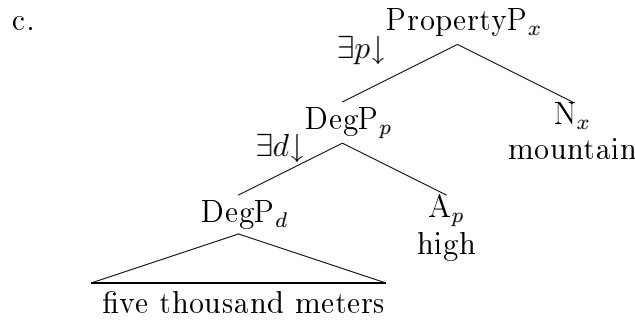
- (371) a. (a) 5000m high mountain
 b. $(\exists p [\exists d [5000m(d)] \#(d, p) \wedge \text{height}(p)] \text{property}(p, x)) \wedge \text{mountain}(x)$

¹⁹⁶I ignore the measure phrase in the thesis (*two meters long*), which probably modifies the property variable p .

¹⁹⁷These adjectives are usually not gradable. It is unclear whether they can be “forcibly” graded, cf. *wooden*, *more wooden*, *the most wooden* and *ex*, *more ex*, *the most ex*.

¹⁹⁸The internal structure of *five thousand meters* hints that determining the quantity of a property is a two-step process: both measure phrases and cardinal numerals are used. However, we shall not deal with measure phrases in the thesis.

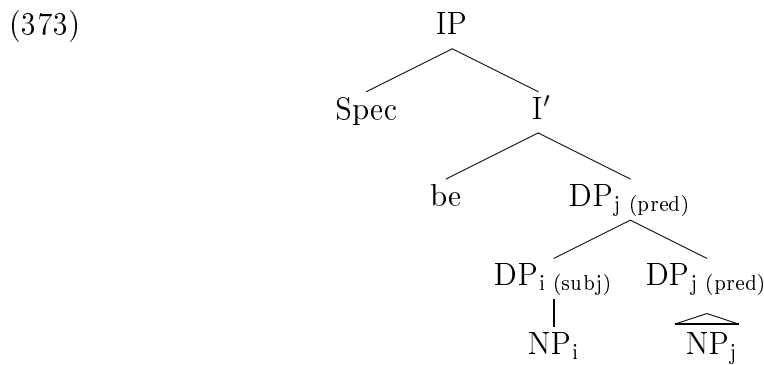
¹⁹⁹I assume that the absence of DegP is somehow connected to the *standard* value; see §5.6. In the thesis I do not deal with the question how the standard of comparison is determined by the context, i.e. how do we get the result that a high mountain is several thousand meters high, while a high person is only two meters high. We avoid a similar question in the case of determiners: the number of Slovenians talked about in *Many Slovenians got the Nobel Prize* and *Many Slovenians participated in at the demonstrations in Trieste* can be quite different.



- (372) a. (a) high mountain
 b. $(\exists p [\text{height}(p)] \text{property}(p, x)) \wedge \text{mountain}(x)$
 c.

5.2.2 Copular sentences

It is usually assumed [Zamparelli 2000] that the predicate of a copular clause is a so-called *small clause*. DP raises from the small clause into the subject position; small clauses are usually assumed to employ adjunction. (373) shows Zamparelli’s proposal for the structure of a copular sentence; the higher DP_j is a small clause [Zamparelli 2000:97]. (The predicative DP_j can be replaced by an adjectival phrase, for example.)



In L* theory, no correspondence principles were given for adjunction structures, and, since I find them theoretically dubious objects, I try to do without them. In §5.2.1 we have assumed that within DP, the property assignment employs head predicate property, corresponding to functional projection PropertyP. Thus, the simplest hypothesis seems to be that property

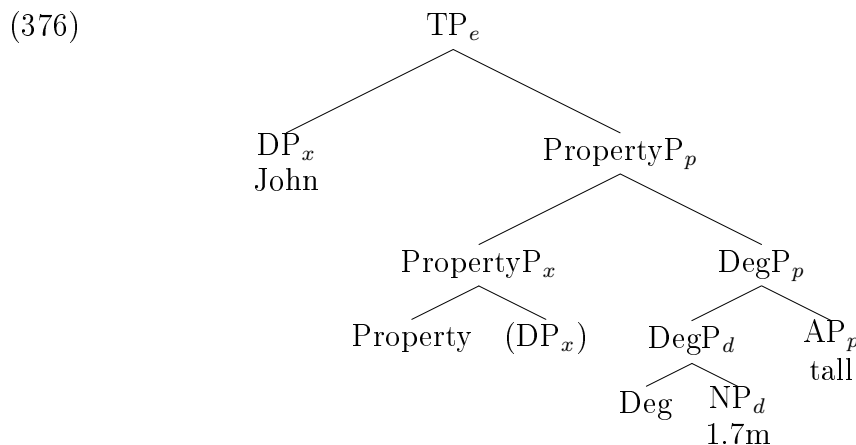
assignment in small clauses works in the same way.²⁰⁰

Correspondence principle⁷ requires that the argument places of head predicates are filled by projection. If a predicate needs two arguments, the feature must be projected twice. Note, however, that the correspondence principle does not prescribe the order of argument place satisfaction. In §5.2.1 feature [Property] was first projected into an adjective spine, and then into a nominal spine. I suggest that in the case of small clauses the situation is exactly the reverse: feature [Property] is first projected into a nominal spine, and only then into an adjective spine. (In copular sentences, the DP contained in a small clause is then raised into the subject position.)

So formula (375) and LF (376) are the analysis of sentence (374).

(374) John is [one meter and seventy centimeters] tall.

(375) $\exists x [\text{john}(x)] \exists p: \text{property}(x, p) \wedge (\exists d [1.7\text{m}(d)] \#(d, p)) \wedge \text{height}(p)$



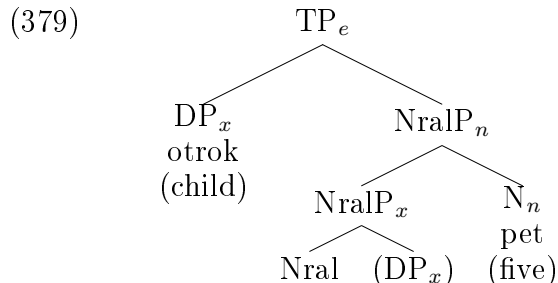
Cardinal numeral as the predicate of the copular sentence

The predicate in a copular sentence can also be a cardinal numeral, (377). We analyze (377) similarly to (374). At (374) we have assumed that small clause is a PropertyP. At (377) we assume that small clause is a NralP. First complement of head Nral is a DP *otrok* ‘child’; second complement is a cardinal numeral (cf. to (349) and (350) on page 186). The small clause of (377) is thus represented by (379). (Raising of DP into the subject position results in LF of the whole copular sentence.)

²⁰⁰I do not deal with copular sentences having full DP as a predicate, such as *Herman is the piggy under the table* or *The piggy under the table is Herman*.

- (377) Otok je bilo (pri hiši) pet.
 children is was (at house) five.
 ‘There were five children (at home).’

(378) $\exists x [\text{child}(x)] \exists n: \#(x, n) \wedge 5(n)$



5.2.3 Universal determiners

There are two universal determiners in Slovenian, *vsak* ‘every/each’ and *vsi* ‘all’. In some other languages, there are even more. In English, there are three universal determiners: *each*, *every* and *all*. In the thesis, we will only deal with the difference between *vsak* and *vsi*. For a discussion on the difference between *each* and *every* see e.g. Beghelli and Stowell [1997].

By correspondence principle 10, an implicit quantifier is universal, if the functional projection hosting it is negative. We will thus assume that both universal determiners contain some negative feature (potentially different for the two universal determiners), which must be checked in an appropriate functional projection in the verbal spine. Specifically, we follow Beghelli and Stowell [1997] in assuming that *vsak* ‘every’ contains feature $[\text{Dist}_{(\text{Neg})}]$, which projects into the verbal spine.²⁰¹

If both universal determiners contain a negative feature, where do the differences between them come from? If a noun phrase contains only a universal determiner and a noun, there seem to be no difference in the meaning. There is a morphological difference: usually, the complement of *vsak* ‘every’ is singular, whereas the complement of *vsi* ‘all’ is plural.²⁰²

- (380) a. Vsak fant je pojedel kosilo.
 every boy is eaten lunch
 ‘Every boy has eaten lunch.’

²⁰¹Cf. footnote 158 on page 162.

²⁰²As we have seen in §4.5.5, a complement of *vsak* can also be plural, cf. *vsake škarje* ‘every (pair of) scissors’. It might also not be entirely wrong to claim that (at least in Standard Slovene) universal determiners *vsi* (which behaves like an adjective) and its complement can be singular, *ves dan* ‘all day’.

- b. Vsi fantje so pojedli kosilo.
 all boys are eaten lunch
 ‘All boys have eaten lunch.’

When the difference between *every* and *all* is discussed, distributivity is usually mentioned [see e.g. Beghelli and Stowell 1997]. Unlike *vsi*, *vsak* is always distributive. Thus, *vsak* is impossible to use with verbs that require a collective interpretation, (381a); *vsi* is acceptable with such verbs, (381b).

- (381) a. *Mesto je obkolil (prav) vsak vojak.
 city is surrounded (really) every soldier
 ‘The city was surrounded by every (single) soldier.’
 b. Mesto so obkolili (prav) vsi vojaki.
 city are surrounded (really) all soldiers
 ‘The city was surrounded by all soldiers.’

In this thesis we use a different tactics. We observe that a difference in meaning between *vsak*- and *vsi*- DPs arises, when a cardinal numeral is present within the DP. The meanings of DPs in (382) and (383) are clearly different.

- (382) a. vse štiri minute
 all four minutes
 b. vseh deset dni
 all ten days
 c. vseh sedem palčkov
 all seven dwarfs
 (383) a. vsake štiri minute
 every four minutes
 b. vsakih deset dni
 every ten days

We get the meaning of DPs (382) simply by “combining” the meanings of the universal determiner and the cardinal numeral. (384) means (i) that seven dwarfs knew Snowwhite and that (ii) all dwarfs knew her. (Thus, there are seven dwarfs altogether.)*

*This conclusion is wrong. We can only conclude that there are *at least* seven dwarfs. This makes the analysis of *vsi* ‘all’ at the end of the subsection inappropriate unless one makes an additional assumption that *x* must be maximal for some reason. I believe the issue to be related to the interpretation of plurals. Consider the case of (plural) cross-sentential anaphora (i), where *them* in the second sentence necessarily refers to all the

- (384) Vseh sedem palčkov je dobro poznalo Sneguljčico.
all seven dwarfs is well know Snowwhite
'All seven dwarfs knew Snowwhite well.'

The DPs in (383) have a completely different meaning. It seems that the cardinal numeral partitions the objects into groups of appropriate size, while the universal determiner asserts that the proposition is true for each of these groups. The construction seems very useful with nouns denoting time intervals, as in (385). More generally, we see that the construction can be used whenever the context partitions the objects into appropriately-sized groups, or then the natural order of objects implies a natural partitioning. The latter is especially valid for linearly ordered aspects of reality, such as time (in folk psychology). However, (386) shows that any other linearly ordered set of things (say pages in a book) will do.²⁰³

- (385) Vsakih pet minut je moral na stranišče.
Every five minutes is have on toilet
'He had to use the bathroom every five minutes.'
- (386) Vsakih deset strani je na rob nekaj načekal.
every ten pages is on edge something scribble
'Every five pages, he scribbled something on the edge.'

Example (386) is especially informative. It reveals that above, the meaning of DPs in (383) was described somewhat inaccurately. We have said, that the proposition is true for groups of objects. In (386), this cannot be true: something can only be scribbled on the edge of a single page. So the meaning of (386) is best paraphrased as in (387).

- (387) If the pages in a book are partitioned in groups of ten (adjacent) pages, he scribbled something on the edge of (at least) one page in every group.

This paraphrase fits well with our intuition that there (386) is vague in some way: the distance between consecutive edge-marks is not necessarily constant—unlike in (388).

²⁰³In Slovenian, using preposition *na* 'on' relaxes the requirement on linear ordering, (i).

(i) Na vsakih pet Tržičanov zna eden slovensko.

sheep Frank owns.

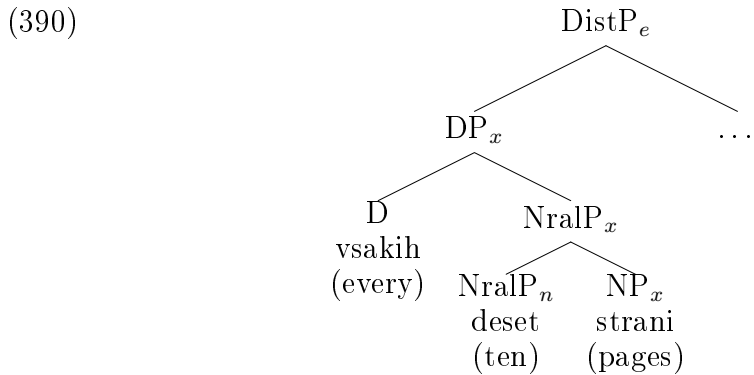
(i) Frank owns some sheep. Bill shears them.

- (388) Nekaj je načekal na rob vsake desete strani.
 something is scribbled on edge every tenth page
 ‘He scribbled something on the edge of every tenth page.’

The meaning of (386) is represented by an L* formula (389), corresponding to LF (390).

Pomen stavka (386) v jeziku L* zapišemo s formulo (389), ki ji ustreza LF (390).

- (389) $\forall x [(\exists n [10(n)] \#(n, x)) \wedge \text{page}(x)] \text{scribble-on}(x)$



In (389), both the cardinal numeral and the noun occur in the restrictor of the universal quantifier. Only the verb phrase occurs in the scope. We know (see §2.2.1) that $\forall x [\phi] \psi$ means that in every group of x s satisfying ϕ at least member satisfies ψ . (Specifically, it is not true that every x that is ϕ is also ψ !) This is exactly the required meaning. In our case, ϕ is $(\exists n [10(n)] \#(n, x)) \wedge \text{page}(x)$, i.e. a group of ten pages. Thus, (386) asserts that in every group of ten pages there is at least²⁰⁴ one with something scribbled on it.

Let us continue by discussing the universal determiner *vsi* ‘all’, starting with DPs without cardinal numerals. The meaning of (391a) can be represented by (391b).^{*} The universal quantifier, whose presence is a consequence of some negative feature in *vsi*, does not bind the individual variable x standing for the dwarfs, but the numerical variable n standing for the size of the group of dwarfs.

²⁰⁴The theory predicts the *at least* reading, whereas by our intuition, (386) should have the *exactly* reading. See the discussion in §2.2.1.

^{*}As noted earlier in this subsection, this only works if we assume that x is somehow forced to be maximal.

- (391) a. Vsi palčki dobro poznajo Sneguljčico.
 all dwarfs well know Showwhite
 ‘All dwarfs know Snowwhite well.’
 b. $\exists x [\text{dwarf}(x)] \forall n [\#(n, x)] \text{know-snowwhite}(x)$
- (392) a. Vseh sedem palčkov dobro pozna Sneguljčico.
 all seven dwarfs well know Showwhite
 ‘All seven dwarfs know Snowwhite well.’
 b. $\exists x [\text{dwarf}(x)] \forall n [\#(n, x)] 7(n) \wedge \text{know-snowwhite}(x)$

We get the meaning of (392a), where the DP contains a cardinal numeral, by adding the condition $7(n)$ into the nuclear scope of quantifier $\forall n$. Note that this only works if $\#$ has the *exactly* reading, i.e. if $\#(7, x)$ is true iff x has exactly 7 members. In the contrary case, the noun phrase *vseh sedem palčkov* ‘all seven dwarfs’ could refer to a group of more than seven dwarfs.

What are the directional entailment properties of sentences with *vsi* ‘all’? At first, the analysis in this section seems to be at odds with the results of §4.1.2. In (391b), the only occurrence of predicate dwarf is positive. We therefore predict that word *palček* ‘dwarf’ can be replaced by a hypernym. However, our intuition tells us just the opposite: that it can be replaced by a hyponym, (393).

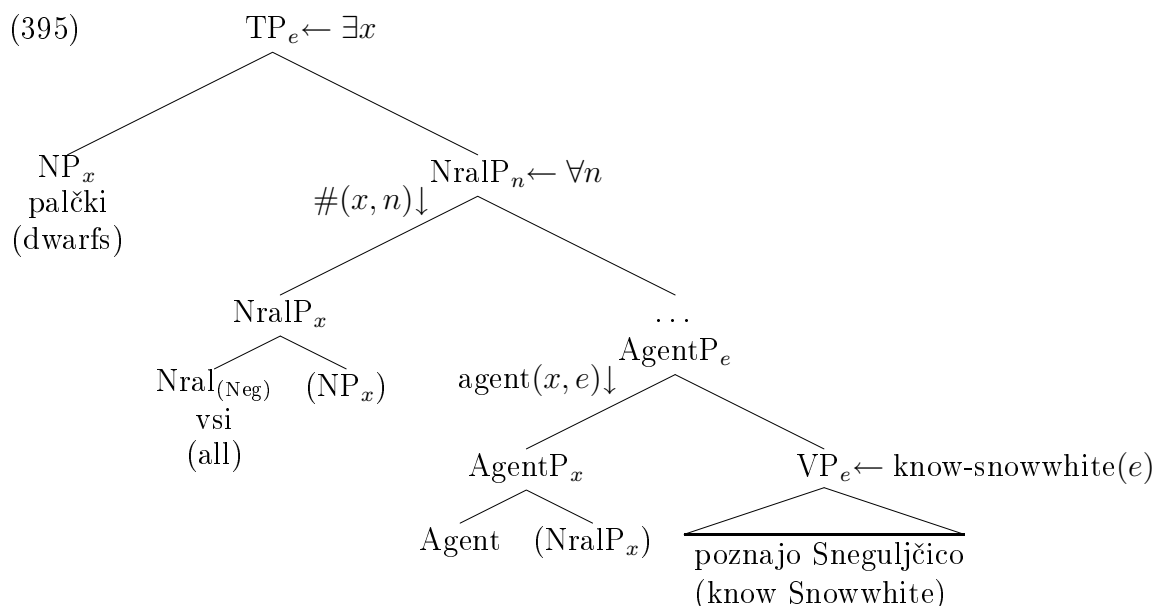
- (393) a. Vsi palčki dobro poznajo Sneguljčico.
 ‘All dwarfs know Snowwhite well.’
 b. \Rightarrow Vsi dobrodušni palčki dobro poznajo Sneguljčico.
 ‘All nice dwarfs know Snowwhite well.’
 c. \nRightarrow Vsa pravljlična bitja dobro poznajo Sneguljčico.
 ‘All magical beings know Snowwhite well.’
- (394) a. Vsi vojaki so obkolili trdnjavo.
 ‘All soldiers have surrounded the fortress.’
 b. \nRightarrow Vsi turški vojaki so obkolili trdnjavo.
 ‘All turkish soldiers have surrounded the fortress.’
 c. \nRightarrow Vsi ljudje so obkolili trdnjavo.
 ‘All people have surrounded the fortress.’

I believe that the solution to the puzzle has to do with collective vs. distributive interpretation of the sentence. In (391a) the interpretation is definitely distributive, since only individuals can know someone. On contrary, verbs such as *obkoliti* ‘surround’ only allow for the collective reading.

Examples (393) and (394) show that downward entailing is only possible in the case of distributive reading. Upward entailing is impossible in both cases.

Thus, formulas (391b) and (392b) are not entirely appropriate as the representation of (391a) and (392a), since the difference between the distributive and the collective reading was not taken into account. I leave this to further research.

It remains to provide an LF corresponding to formulas (391b) and (392b). Quantifier $\forall n$ must have the verb phrase in the nuclear scope. Predicate $\#$, on the other side, must occur in its restrictor. Functional projection *NralP* must therefore occur *above* theta-related functional projections, i.e. above *AgentP*.²⁰⁵ The position of *NralP* above *AgentP* can be understood only if we assume that something similar as in the case of small clauses is happening (see §5.2.2). Feature [*Nral*] is first projected into spine x and only than into spine n , and, crucially, spine n interrupts spine e .



In the case of (392b), another *NralP_n* is present just below *NralP_n* in (395), projected from the cardinal numeral (see §4.5.5).

²⁰⁵Of course, *NralP* cannot form a part of spine e , since the arguments of $\#$ in (391b) are variables x and n , but not e (which is not explicitly mentioned in (391b)). By correspondence principle 6 the sequence of complements in the verbal spine must be interrupted by a numerical spine, as marked by the three dots.

5.2.4 Conclusion

In §4.5.5 we have assumed that cardinal numerals occur within DP at LF. In this section we have shown that they can also occur outside DP, if the order of argument place satisfaction of # is reversed. More precisely, in this case, the final projection of head Nral is NralP_{*n*}, which belongs to the verbal extended projection, below TP. This is also confirmed by the semantic analysis of universal determiner *vsi* ‘all’ implying that NralP_{*n*} can occur between TP and AgentP.

We thus conclude that a numerical spine (*n*) can interrupt an event spine (*e*).

The result that numerical spine can belong to the verbal extended projection (more precisely, to its IP layer, it seems) might have some welcome consequences for the theory of agreement, which I leave for further research. At this point simply note that the idea that ϕ -features have to be checked in the IP-layer might be replaceable by the (semantically motivated) idea that argument places can be satisfied in an arbitrary order. If this is on the right track, then L* theory offers a new, semantic insight to the question why there is agreement.

5.3 The plurality reading of a superlative determiner

In §2.2.5 the difference in behaviour of superlative determiners between Slovenian and English was accounted for by parametrizing the legitimacy of the definiteness pattern: it is allowed in English, but disallowed in Slovenian. In §5.1 we have argued that, syntactically, the legitimacy of the definiteness pattern boils down to the licensing of head Def in the nominal extended projection. While English licenses DefP in the nominal extended projection, Slovenian does not.

Slovenian SD *največ* is closely related to focusing (see §2.1.5). LFs argued for in this section will use feature [Bg_(Neg)] where feature [Def_(Neg)] was used in the analysis of the definiteness pattern (DDs and MSDs). So, we assume that *največ* realizes a NralP with a BgP complement. In §5.1.2 we have assumed that the superlative meaning is a result of a certain universally determined combination of functional projections. I therefore assume that lexical items do not distinguish between different features having the same head predicate (and the same polarity). Simply put, [Def_(Neg)] and [Bg_(Neg)] are one and the same feature. (This is consistent with the main claim of the thesis, that LF and L* are the same.) A generalized version of the assumption

on the content of lexical items for SDs is thus the following: they realize a projection of a feature corresponding to head predicate #, whose complement is a projection of a negative feature corresponding to the overlap predicate \checkmark . Since in Slovenian functional projection of a feature corresponding to \checkmark (DefP) is not legitimate in the nominal spine, *največ* can only be used to realize such functional projection (BgP) in the verb spine.

In §5.3.1 and §5.3.2 we deal with the SD *največ* used as an adverb and a determiner, respectively. In §5.3.3, the non-superlative reading is discussed. In §5.3.4 a syntactic explanation of the cross-linguistic prediction of chapter 2 is given; the additional generalization, discussed in that chapter, is also explained.

5.3.1 Superlative determiner *največ* as an adverb

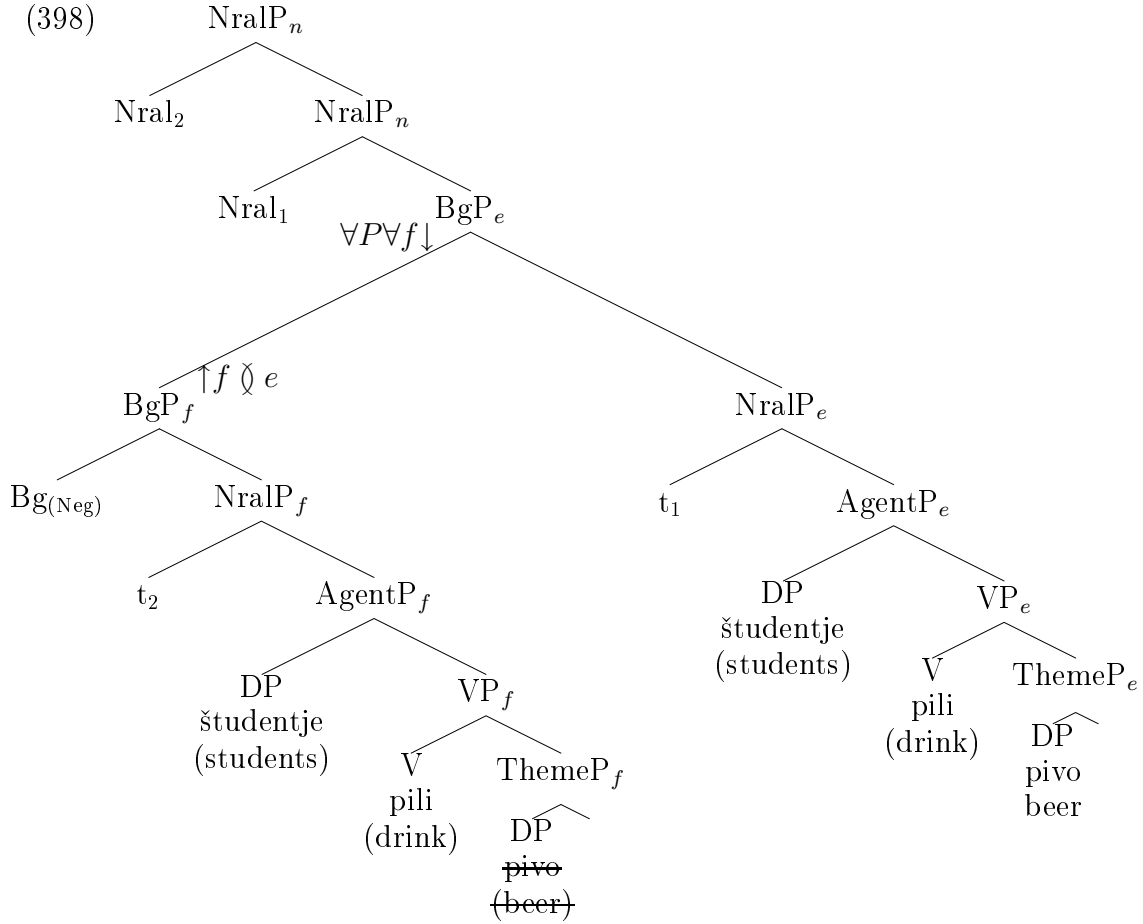
SD *Največ* can be used as an adverb. We analyze sentence (396) with L* formula (397) corresponding to LF (398). The analysis partly resembles (as one would expect) the analysis for English majority SD *most*, (344) on page 183. The main difference is that in LF (367), features [Nral] and [Def] were projected into the nominal spine (the first projection of [Nral] and both projections of [Def]), whereas in (398), features [Nral] and [Bg] are projected in the verbal spine (the first projection of [Nral] and both projections of [Bg]). Furthermore, in (398) BgP_f does not contain the focused object *pivo* ‘beer’.

(396) Študentje so največ pili pivo.
 students are most drink beer
 ‘Students were drinking beer the most.’

(397) $\exists n: (\forall P \forall f [\#(f, n) \wedge \exists x' [\text{student}(x')] \exists y' [P(y)]$
 drinking(f) \wedge agent(x', f) \wedge theme(y', f)] $f \checkmark e) \wedge$
 $\#(x, n) \wedge \exists x [\text{student}(x)] \exists y [P = \text{beer} \wedge P(y)]$
 drinking(e) \wedge agent(x, e) \wedge theme(y, e)

The second projection of both features [Nral] is a projection into the numerical spine, which interrupts the verb spine, just above BgP_e. This way, the equality of the numerical arguments of both occurrences of predicate # is guaranteed. By correspondence principle 13, these occur below NralP_e and NralP_f.

Quantifier over event variable f occurs between BgP_e and BgP_f, because f does not occur in NralP_e, while it occurs as an argument to the head predicate of [Bg], $f \checkmark e$. Since [Bg] is a negative feature, the quantifier is universal.



Focusing causes the quantifier over the alternative predicate variable P to occur between BgP_e and BgP_f . The quantifier is again universal, since $[Bg]$ is a negative feature.

Let us see why (397) gives the correct truth conditions. A positive integer n standing for the quantify of event e must exist.²⁰⁶ Event e is drinking of beer by students. Subformula of (397) in the parenthesis, $\forall P \forall f [\dots] f \checkmark e$, creates the plurality reading; the fact that quantifiers over P and f are universal is crucial in order to get the correct truth conditions. Whichever predicate P and event f satisfying the restrictor we choose, event f will be the same as the event e , which is an event of drinking beer by students. The restrictor requests event f to be drinking of beverage P by students of quantity n (which is the same as the quantity of event e). So, whichever event f and predicate P we choose, if the quantity of drinking P by students in f is (at least) n , then this is actually event e , which is an event of drinking

²⁰⁶We do not discuss the ontology of the “quantity” of an event.

beer (by students). In other words, there is more drinking beer by students than drinking any other beverage by students.

5.3.2 *Največ* as a determiner

When *največ* is used as a determiner, I assume that feature [Nral] is first projected into a nominal spine. Since there is no BgP in the nominal spine, the lexical item for *največ* cannot realize NralP in the nominal spine. Thus, head Nral must move into the verbal extended projection, (immediately) above BgP, where it is projected in the numerical spine n , which interrupts the verbal spine e . (400) and (401) provide the L* formula and LF for (399), respectively.

- (399) Največ ljudi pije pivo.
 most people drink beer_{focus}
 ‘The plurality of people is drinking beer.’
- (400) $\exists n: (\forall P \forall f [\exists x' [\#(x', n) \wedge \text{man}(x')]$
 $\exists y' [P(y')] \text{drink}(f) \wedge \text{agent}(x', f) \wedge \text{theme}(y', f)] f \checkmark e)$
 $\exists x [\#(x, n) \wedge \text{man}(x)]$
 $\exists y [\text{beer}(y)] \text{drink}(e) \wedge \text{agent}(x, e) \wedge \text{theme}(y, e)$

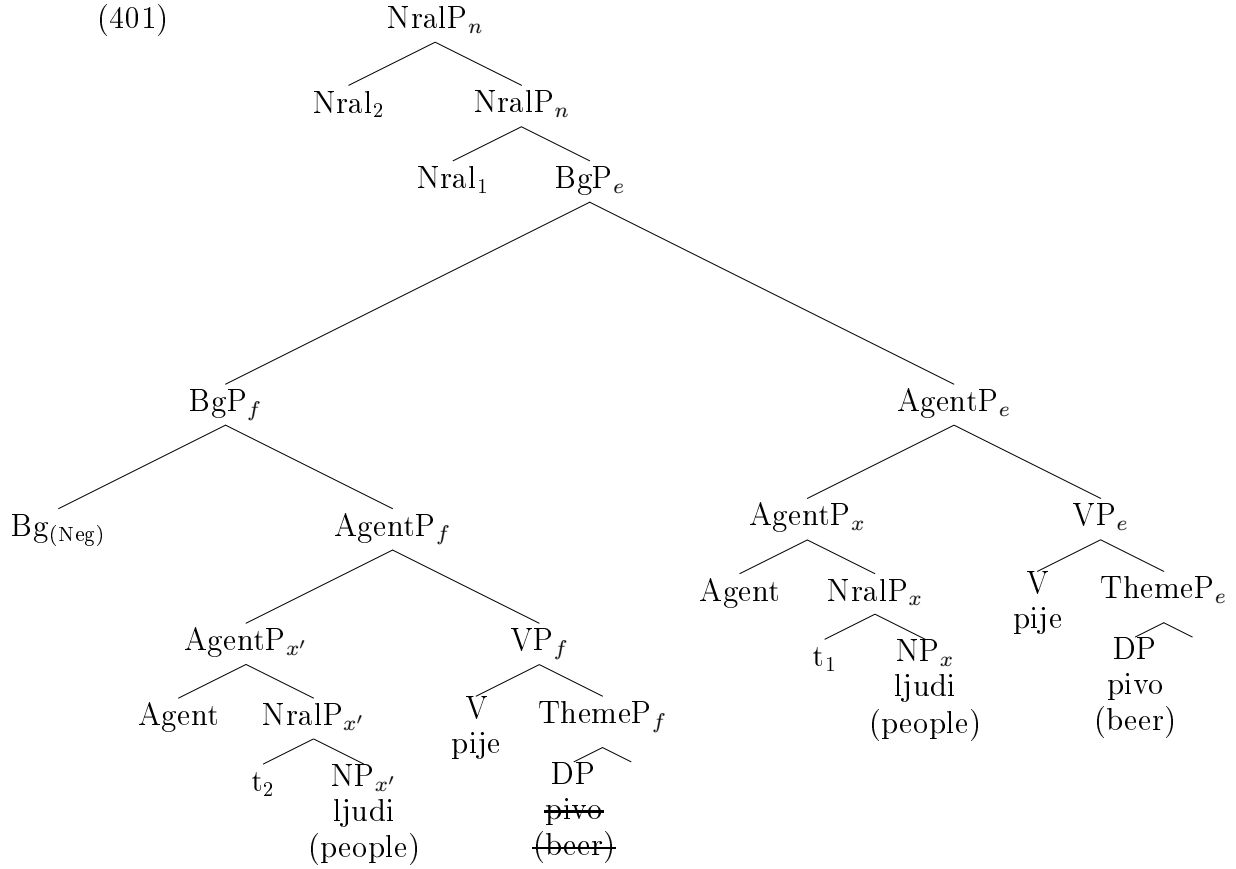
Focusing causes the alternative predicate variable P to occur between BfP _{e} and BgP _{f} . Event variable f occurs only within BgP _{f} and as an argument of head predicate of BgP, so quantifier $\forall f$ also occurs between both BgP projections. Both quantifiers are universal, since feature [Bg_(Neg)] is negative.

The “determiner” reading—i.e. the fact that the number of individuals is being compared, and not the “quantity” of a event—of LF (401) stems from the fact that featzres [Nral] as first projected into a nominal (and not verbal) spine.

Whichever predicate P and event f is chosen, if event f contains n people drinking P , the event f will equal event e , e being an event of n people drinking beer. It is thus impossible to find an event f and drink P different from e and beer, so that n people would drink P in f . Therefore, the plurality of people is drinking beer.

The following examples show that sentences focusing some other constituent than the object, can also be analyzed: in (402) and (403) the locative adverb and superlative determiner’s complement are focused, respectively.

- (402) a. Največ ljudi pije pivo v gostilni.
 most people drink beer [in pub]_{focus}
 ‘The plurality of people is drinking beer in the pub.’



- b. $\exists n: (\forall P \forall f [\exists x' [\#(x', n) \wedge \text{man}(x')] \exists y' [\text{beer}(y')] \text{drink}(f) \wedge \text{agent}(x', f) \wedge \text{theme}(y', f) \wedge \exists z' [P(z)] \text{location}(z', f)] f \checkmark e) \exists x [\#(x, n) \wedge \text{man}(x)] \exists y [\text{beer}(y)] \text{drink}(e) \wedge \text{agent}(x, e) \wedge \text{theme}(y, e) \wedge \exists z [\text{pub}(z)] \text{location}(z, e)$

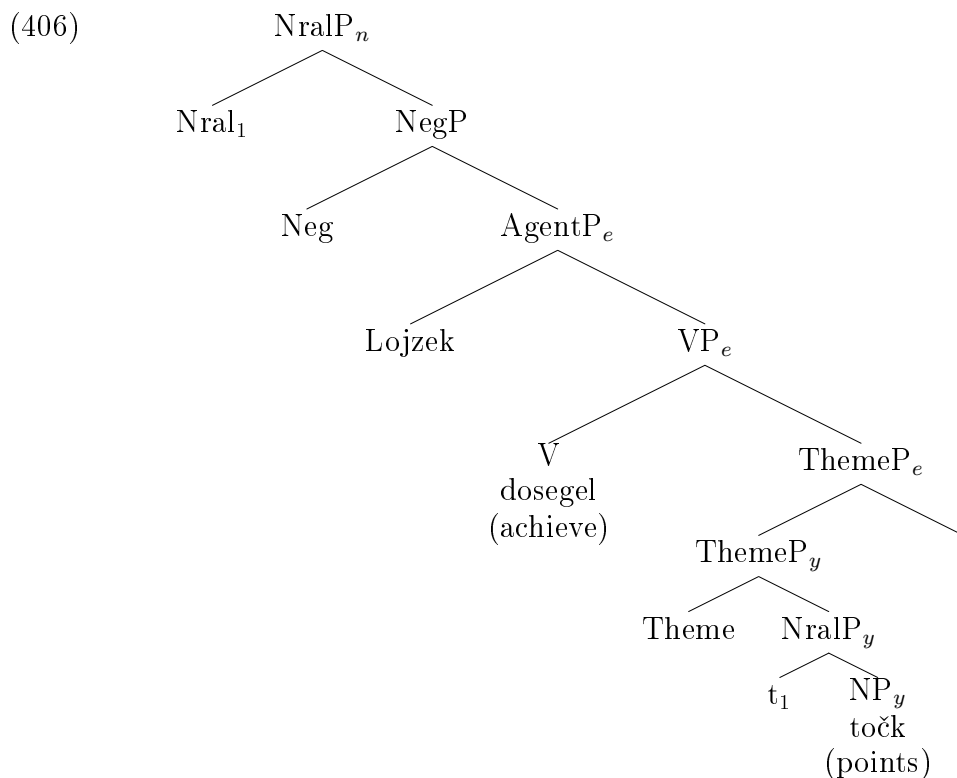
- (403) a. Pivo pije največ LJUDI.
 beer drink most people_{focus}
 'The plurality of beer is being drunk by people.'
- b. $\exists n: (\forall P \forall f [\exists x' [\#(x', n) \wedge P(x')] \exists y' [\text{beer}(y')] \text{drink}(f) \wedge \text{agent}(x', f) \wedge \text{theme}(y', f)] f \checkmark e) \exists x [\#(x, n) \wedge \text{man}(x)] \exists y [\text{beer}(y)] \text{drink}(e) \wedge \text{agent}(x, e) \wedge \text{theme}(y, e)$

5.3.3 Non-superlative reading of *največ*

In §2.1.5 we have mentioned that in association to a sentential negation *največ* also exhibits a non-superlative reading. I repeat the example from §2.1.5 in (404). L* formula and LF for (404) are given in (405) and (406), respectively.

- (404) Lojzek na testu ni dosegel ravno največ točk.
 Leo on test not is achieve exactly most points
 ‘Leo hasn’t achieved a good score at the test.’

- (405) $\exists n: \neg(\exists e: \exists y [\#(y, n)\text{point}(y)]$
 achieve(e) \wedge agent(leo, e) \wedge theme(y , e)



In LF of a superlative reading of *most* and *največ*, the superlative realized (among other features) a negative feature having overlap (\checkmark) as a head predicate. However, in the non-superlative reading, sentential negation feature [Neg] is realized. It seems that we have to stipulate a dichotomy in the lexical item for a superlative determiner, allowing it to realize either a projection

of a negative feature having overlap as a head predicate, or a projection of feature [Neg].

In §5.7 we will develop an analysis of sentential negation conforming to the uniqueness pattern. We will claim that feature [Neg] is negative and has overlap (\checkmark) as a head predicate. If this analysis is correct, the original (non-dichotomous) generalization that a lexical item for a superlative realized a negative functional projection having overlap as a head predicate remains valid.

5.3.4 On the cross-linguistic prediction

In §2.3 we have predicted, based on a semantic analysis, that languages having the majority reading of an SD, must have a DD. The empirical data, presented in §2.3.1, confirmed this prediction. Furthermore, the data hinted at another generalization: there are no languages having both DD and the plurality reading of a SD, without having the majority reading of an SD. In this subsection, we provide a syntactic explanation for both generalizations.

The structure of the explanation for the first generalization is the same as the structure of the prediction given in §2.3. A language licensing a DefP in the nominal extended projection can have a lexical item realizing this projection. One of these lexical items may be a majority SD, which realizes a NralP with a DefP complement. If a language has such a lexical item, it also has the simpler lexical item realizing only DefP, i.e. it has a DD.

We can account for the second generalization by remembering the conclusion from the beginning of this section: features should be identified with polarity-marked head predicates, i.e. a feature is nothing but a positive or negative head predicate. A (superlative) lexical item, realizing a projection of a feature having # as a head predicate, which has a projection of a negative feature having \checkmark as a head predicate, can realize such a configuration in any extended projection.

Thus, if a language has a SD with the plurality reading, it has such a lexical item. If the language furthermore has a DD, DefP must be licensed in the nominal spine. Thus, in general nothing prevents the lexical item of the SD to realize DefP as a complement of NralP in the nominal extended projection. This means, of course, that this lexical item has the majority reading as well.

5.4 Superlative adjectives

It is not difficult to transfer the analysis of SDs to superlative adjectives (SAs). LF for the superlative degree of an adjective will highly resemble the LF of the plurality reading of an SD: the noun–sentence relation will be transferred to the adjective–noun phrase relation, yielding the LF for the absolute reading of an SA, §5.4.1. If an SA is associated to focus, the relative reading arises, §5.4.2. Just as SDs, SDa also have a non-superlative reading, §5.4.3.

Sentence (407) is ambiguous. Its meanings can be paraphrased as (407a) and (407b). In the *absolute* reading (407a) DP *najvišja gora* ‘the highest mountain’ refers to the highest of all contextually relevant mountains. In the *relative* reading (407b) the set of mountains, whose heights are being compared, is narrowed with respect to the alternatives highlighted by focusing: in (407) on the set of mountains that someone has seen.

- (407) Najvišjo goro je videl JANEZ.
 highest mountain is seen John_{focus}
 The highest mountain was seen by John.
- a. John (and not someone else) is the one who has seen the highest of the contextually relevant mountains.
 - b. The mountain seen by John was higher than the mountains seen by other contextually relevant individuals.

5.4.1 The absolute reading

LF of a DP with an SA in the absolute reading is parallel to the LF of a sentence with an SD in the plurality reading. The meaning of (408a) is represented by L* formula (408b).

- (408) a. najvišja gora / najvišje gore
 highest-SING mountain-SING / highest-PL mountain-PL
 ‘the highest mountain(s)’
- b. $\exists d: (\forall x' [\exists p' [\#(p', d) \wedge \text{height}(p')] \text{property}(p', x') \wedge \text{mountain}(x')] \wedge x' \not\sim x) \wedge \exists p [\#(p, d) \wedge \text{height}(p)] \text{property}(p, x) \wedge \text{mountain}(x)$

Let us demonstrate that the above formula provides the correct truth-conditions, both for the singular and the plural form.

- (409) a. (T) Triglav je najvišja slovenska gora.
 Triglav is highest-SING Slovenian-SING mountain-SING

- ‘Triglav is the highest Slovenian mountain.’^{207,208}
- b. (F) Škrlatica je najvišja slovenska gora.
 Škrlatica is highest-SING Slovenian-SING mountain-SING
 ‘Škrlatica is the highest Slovenian mountain.’
- c. (T) Triglav, Škrlatica in Mali Triglav so najvišje
 Triglav Škrlatica and Mali Triglav are highest-PL
 slovenske gore.
 Slovenian-PL mountains-PL
 ‘Triglav, Škrlatica and Mali Triglav are the highest Slovenian
 mountains.’
- č. (T) Triglav, Škrlatica, Mali Triglav, and Mangart so
 Triglav Škrlatica Mali Triglav and Mangart are
 najvišje slovenske gore.
 highest-PL Slovenian-PL mountains-PL
 ‘Triglav, Škrlatica, Mali Triglav and Mangart are the highest
 Slovenian mountains.’
- d. (F) Triglav, Škrlatica in Mangart so najvišje slovenske
 Triglav Škrlatica and Mangart are highest-PL Slovenian-PL
 gore.
 mountains-PL
 ‘Triglav, Škrlatica and Mangart are the highest Slovenian moun-
 tains.’
- e. (T) Triglav, Škrlatica in Mali Triglav so najvišje tri
 Triglav Škrlatica and Mali Triglav are highest-PL three
 slovenske gore.
 Slovenian-PL mountains-PL
 ‘Triglav, Škrlatica and Mali Triglav are the highest three Slove-
 nian mountains.’

Formula (408b) correctly predicts the truth of (409a) and falsity of (409b). In both cases, the DP is singular, so the cardinality of x can be at most 1. Consider (409a) first. In this case, x must be Triglav. So there is a number

²⁰⁷The Slovenian peaks, ordered by height, are the following: Triglav (2864m), Škrlatica (2740m), Mali Triglav (2725), Mangart (2679m), Visoki Rokav (2646m), . . . , Zadnja Mojstrovka (2354m), Mišelj Vrh (2350m), Ojstrica (2350m), Kol (2350m), V Koncu špica (2350m), Bavški Grintavec (2347m), Bricelj (2346m) . . . The data on the heights of Slovenian mountains are based on Kern and Cuderman [2001].

²⁰⁸T and F stand for ‘true’ and ‘false’, respectively.

$d = 2864$ such that there are d particles (meters) of height belonging to x . For every group x' of mountains we choose, such that its every member is associated to d meters of height, all the members of x' are Triglav. In the case of (409b) x must be Škrlatica, so d must be a number, smaller than or equal to 2740. We can choose any group of at least d meters high mountains to stand for x' . Specifically, Triglav alone is a good choice of x' . In this case, x (Škrlatica) and x' (Triglav) are disjoint groups.

The truth of (409c) is also predicted. The cardinality of x is at least three, since DP is plural. x stands for Triglav, Škrlatica and Mali Triglav. 2725 is a good choice of d . Each of x s has 2725m of height. Every group of at least 2725m high x 's will contain Triglav, Škrlatica or Mali Triglav. Thus, groups x and x' overlap, as required by the formula. We proceed in the same way at (409č), we only choose a smaller d , between 2679 and 2724.

We also predict the falsity of (409d). Since x contains Mangart, d must be at most 2679. However, it is then possible to find a group of mountains, i.e. a singleton Mali Triglav, higher than 2679m but disjoint with x .

(409e) does not present any problems either. We analyze the example just as (409c) and (409č). The only difference is that the cardinality of x is stated explicitly.

The following batch of data deals with situations when multiple mountains reach the greatest height.

- (410) a. (T) Mišelj vrh, Ojstrica, Kol in V Koncu špica so najvišje
Mišelj vrh Ojstrica Kol and V Koncu špica are highest-PL
slovenske gore, ki so visoke največ 2350m.
Slovenian-PL mountains-PL REL are high at most 2350m
'Mišelj vrh, Ojstrica, Kol and V Koncu špica are the highest
Slovenian mountains which are at least 2350m high.'
- b. (F) Mišelj vrh, Ojstrica in Kol so najvišje slovenske
Mišelj vrh Ojstrica and Kol are highest-PL Slovenian-PL
gore, ki so visoke največ 2350m.
mountains-PL REL are high at most 2350m
'Mišelj vrh, Ojstrica and Kol are the highest Slovenian moun-
tains which are at least 2350m high.'
- c. (F) Mišelj vrh, Ojstrica in Kol so tri najvišje
Mišelj vrh Ojstrica and Kol are three highest-PL
slovenske gore, ki so visoke največ 2350m.
Slovenian-PL mountains-PL REL are high at most 2350m
'Mišelj vrh, Ojstrica and Kol are the three highest Slovenian
mountains which are at least 2350m high.'

- č. (T) Mišelj vrh, Ojstrica, Kol, V Koncu špica in
 Mišelj vrh Ojstrica Kol V Koncu špica and
 Bavški Grintavec so najvišje slovenske gore,
 Bavški Grintavec are highest-PL Slovenian-PL mountains-PL
 ki so visoke največ 2347m.
 REL are high at most 2347m
 ‘Mišelj vrh, Ojstrica, Kol, V Koncu špica and Bavški Grintavec
 are the highest Slovenian mountains which are at least 2347m
 high.’

In (410č), x stands for Mišelj vrh, Ojstrica, Kol in V Koncu špica. A good choice of d is 2350. Then there is no group of mountains, at least 2350m high, disjoint from x .

On contrary, in (410c), where one of the equally-high highest peaks is left out, there is an x' , i.e. V koncu špica, 2350m high and disjoint with x (Mišelj vrh, Ojstrica and Kol). Adding a numeral, as in ??, does not help: the cardinality of x is 3 indeed, but V koncu špica still represents a group of high-enough mountains disjoint with x .

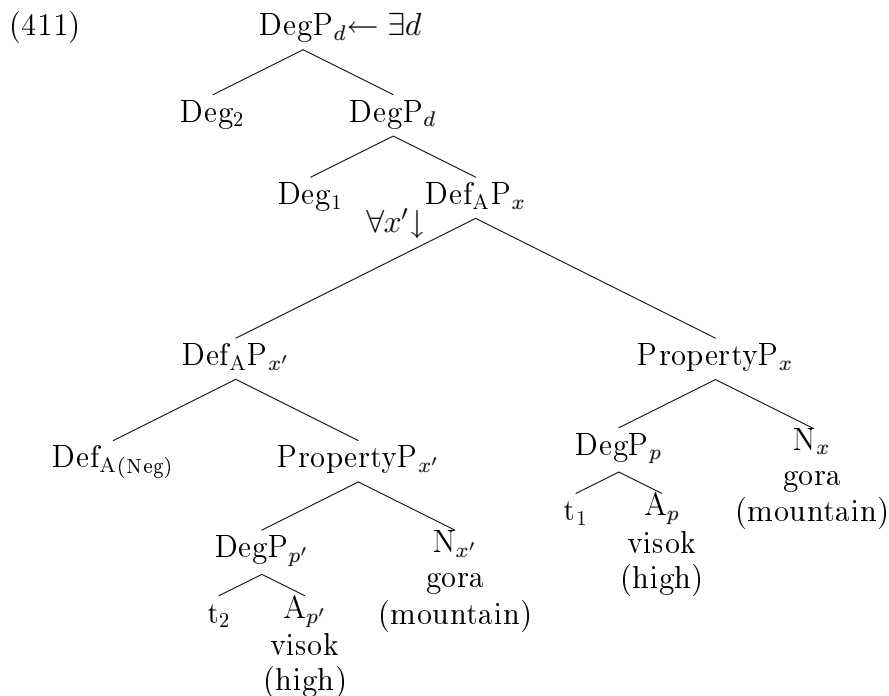
So, we correctly predict that, whenever the greatest height is reached by several mountains, DP *najvišje gore* refers to all of them. On the other hand it is certainly possible that some lower peak is included in its reference, as in ??. The only condition is that all mountains, higher than or equally high as the lowest mountain among the referents, are included among the referents.

LF corresponding to (408b) is given in (411). Let us call the functional projection corresponding to overlap predicate $\check{\text{Q}}$ in formula (408b) a *adjectival definiteness* projection Def_AP . Is is ‘definite’ by the analogy with DefP of English *the*; it is ‘adjectival’ since it can only occur next to an adjective. I assume that in Slovenian, Def_AP is also realized in the “adjectival” definite article *ta*, as in *ta lepa hiša* ‘the beautiful house’ or *ta lepa* ‘the beautiful (one)’ [Marušič and Žaucer 2005].²⁰⁹

The derivation of (411) is parallel to the derivation of LF for an SD with the plurality reading. The SA realizes features $[\text{Def}_{A(\text{Neg})}]$ and $[\text{Deg}]$, and the same head predicates correspond to these features as to features $[\text{Def}]$ ($\check{\text{Q}}$) and $[\text{Nral}]$ ($\#$), which have been used in the analysis of SDs; just as $[\text{Def}]$, $[\text{Def}_A]$ is also a negative feature.

As already mentioned, a lexical item has the superlative reading if it realizes a projection of a feature with a head predicate $\#$, whose complement

²⁰⁹In some dialects the adjectival definite article *ta* is a homonym of the deictic pronoun *ta*. However, both words obviously have different syntactic functions, since *ta/tista ta lepa hiša* ‘this/that the beautiful house’ are acceptable noun phrases. Besides, both *tas* are not complete homonyms: only deictic *ta* carries stress.



is a projection of a negative feature with a head predicate \checkmark . The fact that superlatives can be found in different syntactic environments is a consequence of their differing syntactic categories.

The adjectival spine contains the functional projection DegP. However, it does not contain Def_AP. If [Deg] is to be realized as a part of an SD, it has to (head-)move into a position above Def_AP. Since PropertyP_{x'} cannot receive case, it must be elided. The elliptical structure requires the parallelness of the movement from the elided and overt constituent, thus both Def₂ and Deg₁ must move; specifically, they must move in the same numeric spine. This implies that the same variable occurs as the numerical argument of both occurrences of #.

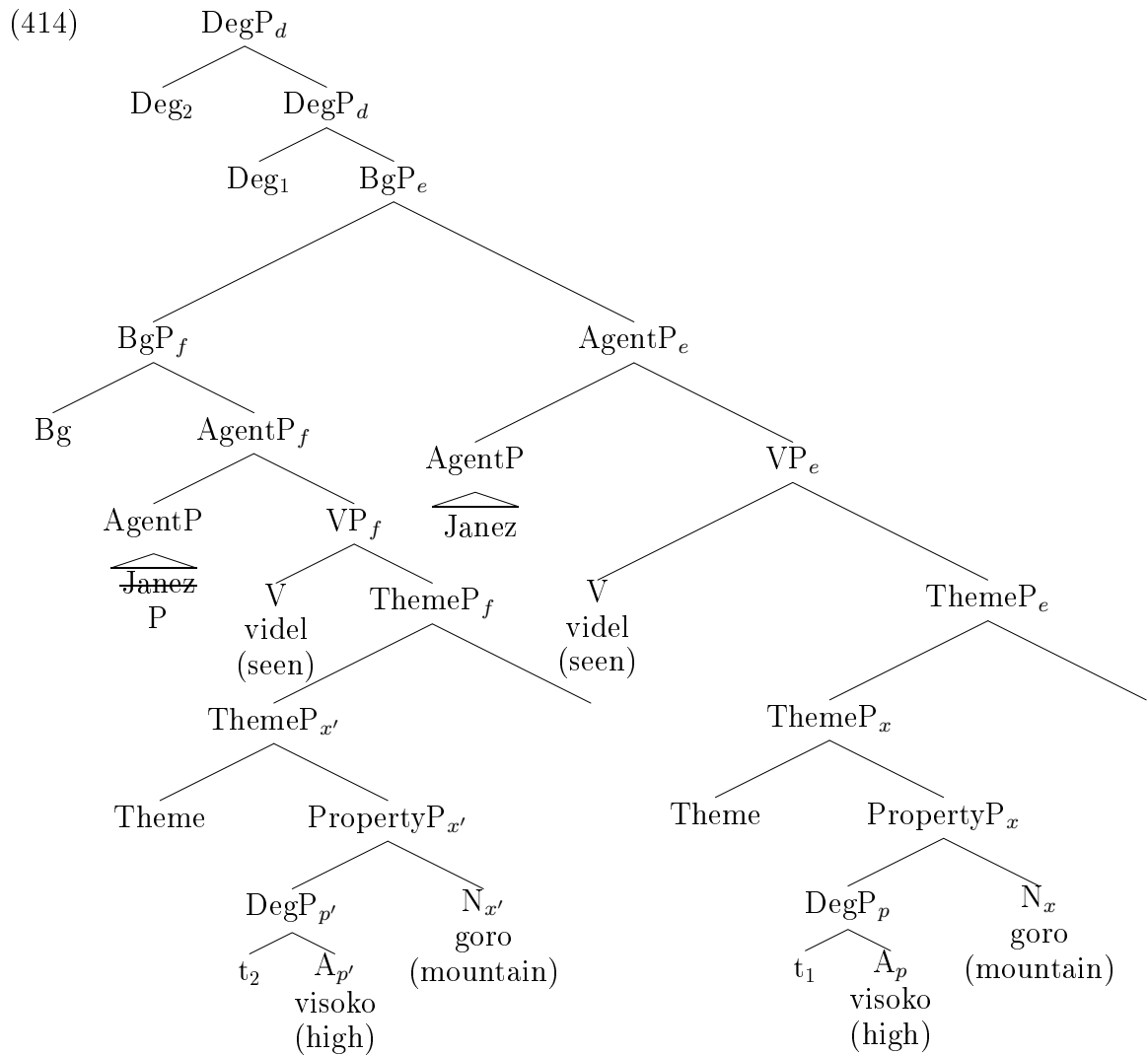
5.4.2 The relative reading

If there is no Def_AP in the nominal extended projection, Deg₁ and Deg₂ cannot project (by moving) into the numerical spine interrupting the nominal spine, since they could not be realized there—the superlative morpheme must also realize a negative functional projection having overlap as a head predicate, i.e. DefP, Def_AP or BgP. If a part of the sentence is focused, it is therefore possible that functional heads Deg₁ and Def₂ project (by moving) into a numerical spine interrupting the verbal spine: they project a DegP_n immediately above

BgP. The result is LF (414), corresponding to L* formula (413).

(412) Najvišjo goro je videl JANEZ.(in the relative reading)
 highest mountain is seen John_{focus}
 ‘John has seen the highest mountain.’

(413) $\exists d: (\forall f \forall P [\text{agent}(P, f) \wedge \text{see}(f) \wedge$
 $(\exists x' [(\exists p' [\#(p', d) \wedge \text{height}(p')] \text{property}(p', x') \wedge \text{mountain}(x')])]$
 $\text{theme}(x', f))] f \checkmark e) \wedge \text{agent}(\text{john}, e) \wedge \text{see}(e) \wedge$
 $\exists x [(\exists p [\#(p, d) \wedge \text{height}(p)] \text{property}(p, x)) \wedge \text{mountain}(x)] \text{theme}(x, e)$



This analysis makes an interesting prediction. It is sensible to assume that both DegP, “counting” the property quanta, and NralP, counting the

individuals, cannot occur in the same numeric spine, since it is plausible that DegP and NralP constrain the value of a numerical variable in contradictory ways. Empirically this implies that a sentence cannot contain both an SD with the plurality reading and an SA with the relative reading. Specifically, since an SD can only have the plurality reading in Slovenian, an SA must have the absolute reading in such a sentence in Slovenian. The prediction is

confirmed by example (415).^{210,211}

- (415) Največ geologov je videlo najvišjo goro.
most geologists is seen highest mountain
'The plurality of geologists has seen the highest mountain.'

²¹⁰The non-existent relative reading of (415) would be the following. Let us partition the geologists into groups with respect to the height of the mountain they have seen. We can assign a unique number to every group: the height of the mountain, expressed in meters. The relative meaning of (415) would state that the largest among these groups is the one which has the largest number assigned.

²¹¹Actually, we only get the relative reading of an SA if the subject is interpreted as specific. The sentences in (i) can have the relative reading, while the sentences in (ii) only have the absolute reading of the SA. (So (1) can only mean that that boy has climbed the highest of all mountains somebody has climbed, while (1) cannot mean that all boys have climbed the highest of the mountains that have been climbed (unless all contextually relevant mountains have been climbed, of course). Furthermore, it seems that the relative meaning is more readily accessible if particle *še* 'even' is used, as in (iii).

- (i) 1. Tisti fant je splezal na najvišjo goro.
that boy is climbed on highest mountain
'The highest mountain was climbed by that boy.'
2. Na najvišjo goro je splezal en (določen) fant.
on highest mountain is climbed a (specific) boy_{focus}
'The highest mountain was climbed by a (specific) boy.'
3. Na najvišjo goro je seveda splezal najmočnejši plezalec.
on highest mountain is of course climbed strongest climber
'The highest mountain was climbed by the strongest climber.'
4. Kdo je splezal na najvišjo goro?
who is climbed on highest mountain
'Who has climbed the highest mountain?'
- (ii) 1. Vsak fant je splezal na najvišjo goro.
every boy is climbed on highest mountain
'Every boy has climbed the highest mountain.'
2. Večina fantov je splezala na najvišjo goro.
majority boys is climbed on highest mountain
'Most boys have climbed the highest mountain.'
3. Zagotovo je kdo splezal na najvišjo goro.
certainly is someone climbed on highest mountain
'Someone has certainly climbed the highest mountain.'
- (iii) Po Aljo je prišel še najboljši plesalec.
after Alja is come even best dancer
'Of all girls, Alja was invited by the best dancer.'

5.4.3 The non-superlative reading

The third possible goal of Deg head movement is above the sentential negation. This yields the non-superlative reading of SAs, mentioned in §2.1.5. Example (416) is analyzed the same as the non-superlative reading of SDs, see §5.3.3. L* formula and LF are given in (417) and (418) on the following page, respectively.

- (416) Lojzek ni kupil ravno najlepših rož.
 Leo not is bought exactly most beautiful flowers
 ‘Leo didn’t buy beautiful flowers.’

- (417) $\exists d: \neg(\exists e: \text{agent}(\text{leo}, e) \wedge \text{buy}(e) \wedge$
 $\exists x [\exists p [\#(d, p) \wedge \text{beauty}(d)] \text{property}(p, x) \wedge \text{flower}(x)] \text{theme}(x, e))$

5.5 Comparatives

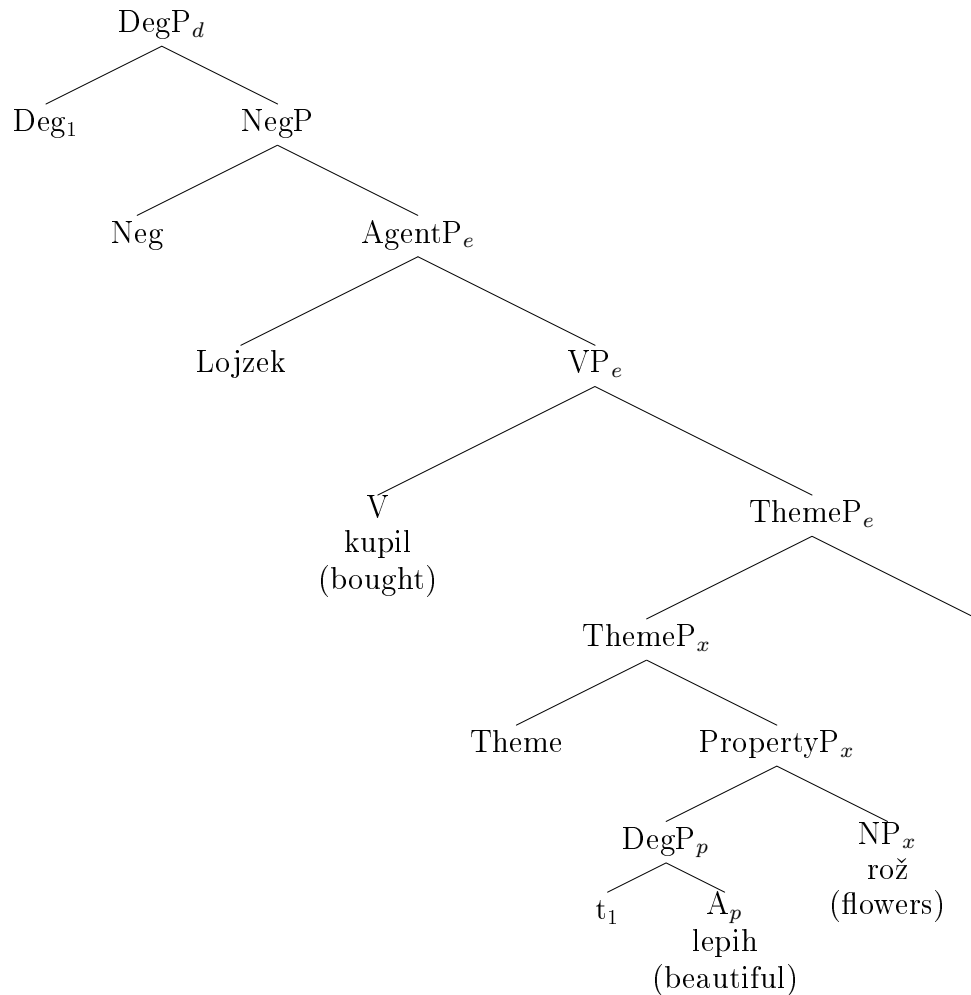
In Slovenian the comparison class²¹² can be introduced by *od* or *kot*; thus, both correspond to English *than*. Their complements are noun phrases and (partially elided) clauses. Thus, *od* is a preposition and *kot* is a complementizer.

- (419) a. Janko je višji od Metke.
 John is taller than Metka
 ‘John is taller than Metka.’
 b. Peter pleše bolje od Janka.
 Peter dances better than John
 ‘Peter dances better than John.’

²¹²A comparison class is the thing to which we compare something. It can be either a single thing (object, person, event, etc.) or a group of things. It is usually phonologically expressed, as in (420); however, this is not necessary: it can be implicit, as in (i). I distinguish the comparison class and the comparison standard. The latter provides a norm and does not refer to some particular thing(s). So, in some situation (i) can be true (e.g. because John is taller than Mary, who is the implicit comparison class), although (ii) is false (John is not tall, since it does not fulfil the normative requirements).

- (i) Janko je višji.
 John is taller
 ‘John is taller.’
 (ii) Janko je visok.
 John is tall
 ‘John is tall.’

(418)



- (420) a. Janko je višji, kot bo Metka kdajkoli.
 John is taller than will Metka ever
 ‘John is taller than Metka will ever be.’
- b. Peter pleše bolje kot Janko.
 Peter dances better than John
 ‘Peter dances better than John.’
- c. Peter pleše bolje, kot Janko poje.
 Peter dances better than John sings
 ‘Peter dances better than John sings.’

In English, the comparison class can also be introduced by either a preposition or a complementizer. However, the difference is harder to notice, since the two are homonyms: *than* is both a preposition and a complementizer

[von Stechow 1984].

In this section we will deal only with the comparative structures where the comparison class is introduced by the complementizer (*kot*-comparatives): in §5.5.1 I deal with comparative determiners (CDs) and in §5.5.2 with comparative adverbs and comparative adjectives (CAs); in §5.5.3 I compare the L* analysis to previous analyses. In §5.5.4 I shortly discuss the problems which arise at the attempt of analyzing the comparative adverbs in connection to preposition *od*, and argue that the problems are not limited to L* theory.

In this section we will introduce a notational shortcut to facilitate reading of the attribution of a property expressed by an adjective, and sometimes write $\text{high}(d, x)$ instead of $\exists p [\#(d, p) \wedge \text{height}(p)] \text{property}(p, x)$.

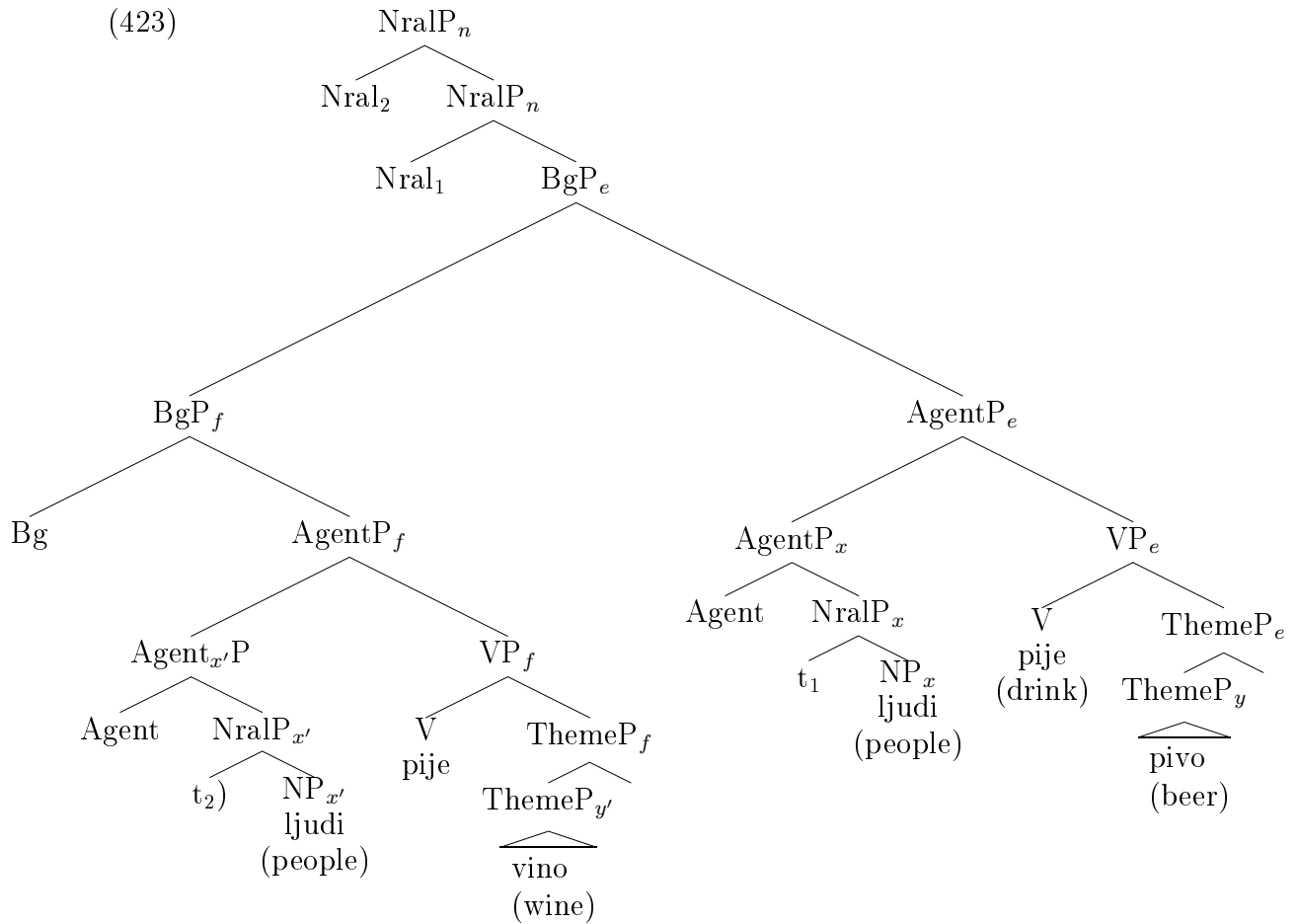
5.5.1 Comparative determiners

The unacceptability of using both CD and SD within the same sentence, (421), hints that comparative meaning arises by the same mechanism as (plurality) superlative meaning, i.e. that the same functional projections are involved. We shall see that indeed CDs can be analyzed in almost equal fashion as SDs. So, sentence (422a) receives L* formula (422b) and LF (423).

- (421) * Največ fantov je dalo več dekletom rožice kot bonbončke.
 most boys is give more girls flowers than candies
 ‘The plurality of boys gave more girls flowers than candies.’
- (422) a. Več ljudi pije pivo kot vino.
 more people drink beer than wine
 ‘More people drink beer than wine.’
- b. $\exists n: (\forall P \forall f [\exists x' [\#(x', n) \wedge \text{man}(x')] \exists y' [P \checkmark \text{ wine} \wedge P(y')]$
 $\text{drink}(f) \wedge \text{agent}(x', f) \wedge \text{theme}(y', f)] f \checkmark e) \wedge$
 $\exists x [\#(x, n) \wedge \text{man}(x)] \exists y [\text{beer}(y)]$
 $\text{drink}(e) \wedge \text{agent}(x, e) \wedge \text{theme}(y, e)$

The only difference between a comparative and superlative structure is that in the comparative structure the comparison class is explicitly given. Namely, the constituent of *kot*-clause parallel to the focused constituent in the matrix clause provides the comparison class. Therefore, the requirement $P = \text{wine}$ occurs within the common restrictor of quantifiers $\forall P$ and $\forall f$.

Let us show how the appropriate truth-conditions are encoded by (422b). Assume that more people drink beer than wine. If n is set to be the number of beer-drinkers, then it is true that for every event f and predicate P such



that n people drink $P =$ wine, event f equals event e . This is the case because an appropriate f is simply impossible to find.

If the number of wine-drinkers is greater than or equal to the number of beer-drinkers, we have to demonstrate that any choice of n leads to the falsity of (422b). (i) For n greater the number of beer-drinkers, this is the case since n beer-drinkers do not exist. (ii) Every n smaller than or equal to the number of beer-drinker is also greater than or equal to the number of wine-drinkers. Thus, we can find an event f (an event of n people drinking wine) and a predicate P (wine) such that n people are drinking P . No such event equals (any) event e where n people drinki beer, since less than n people drink beer. Thus, the parenthesized part of formula (422b), $\forall P \forall f [\dots]$, is false.

In formula (422b) the predicate variable P is bound by a universal quantifier $\forall P$, (implicitly) occurring in the same node as $\forall f$. At first sight this seems unnecessary: we would get the same truth conditions if P was bound by a quantifier having narrower scope, as predicate variables of non-focused

constituents are bound. I argue that our decision is nevertheless the right one: we have concluded that BgP is involved in the analysis of CDs (just as in the analysis of SDs), therefore the null hypothesis is that all processes involved in focusing in general also apply to comparative structures. Specifically, focus mapping applies, thus, by correspondence principle the scope of $\forall P$ must be the same as the scope of $\forall f$.

Finding out which functional projection is realized by CD *več* and which one by complementizer *kot* is out of scope of the dissertation. I assume that the content of comparative lexical items is such that it triggers the same movements as in the case of SDs.

5.5.2 Comparative adverbs and adjectives

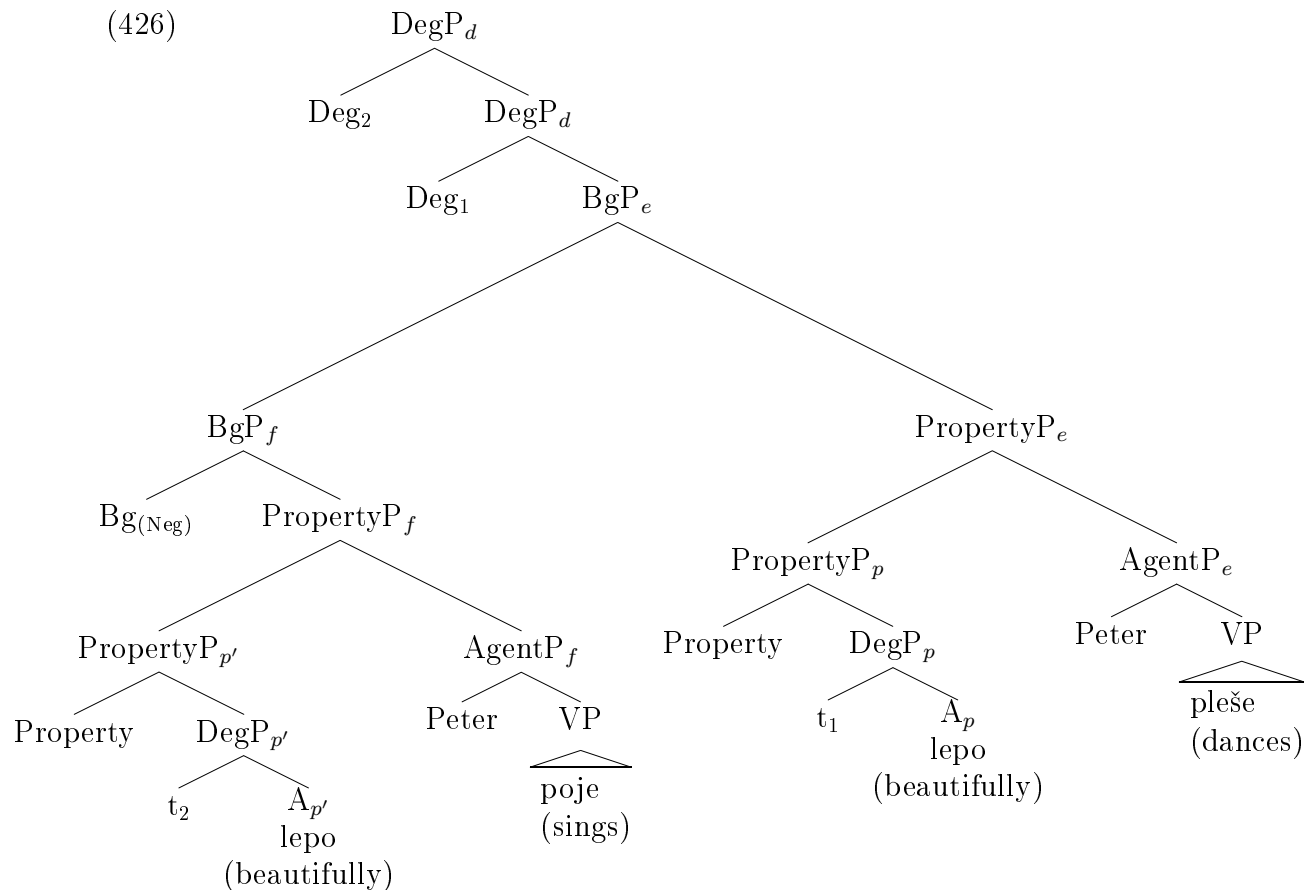
Comparative adverbs are event modifiers and are therefore a part of the verbal extended projection. Finding the identity of their functional projection is out of scope of the thesis; we will simply name it PropertyP, as in the case of adjectives. Examples of sentences with a comparative adverb are given in (424). Since both are analyzed in the same way, the L* formula and LF are provided only for the first one.

- (424) a. Peter lepše pleše, kot poje.
Peter more beautifully dances than sings
'Peter dances more beautifully than he sings.'
- b. Peter je skočil višje kot Janko.
Peter is jumped higher than John
'Peter jumped higher than John.'
- (425) $\exists d: (\forall P \forall f [\text{sing}(f) \wedge \text{agent}(\text{peter}, f)] f \text{ } \checkmark \text{ } e) \wedge$
 $\text{dance}(e) \wedge \text{agent}(\text{peter}, e) \wedge \text{beautiful}(d, e)$

CAs receive the parallel analysis, (427).

- (427) a. Peter je plesal z boljšo plesalko kot Janko.
Peter is danced with better dances than John
'Peter danced with a better dancer than John.'
- b. Peter piše boljše romane kot Janko pesmi.
Peter writes better novels than John songs
'Peter writes better novels than John writes songs.'

We will consider CAs in copular sentences in more detail, since in the literature these are most often dealt with. Copular sentences are based on small clauses; we have analyzed them in §5.2.2. For brevity, we will



abbreviate the L^* formulas corresponding to small clauses, and write (428b) instead of (428a).

- (428) Janko je visok meter sedemdeset.
 John is high meter seventy
 ‘John is one meter and seventy centimeters tall.’
- $\exists p: (\exists x [\text{janko}(x)] \text{property}(x, p)) \wedge$
 $(\exists d [1.7m(d)] \#(d, p)) \wedge \text{height}(p)$
 - $\text{high}(\text{janko}, 1.7m)$

(430) provides the truth conditions for (429a). As mentioned in §2.2.1, we construe the notion of event broadly enough to encompass states as well. (So we paraphrase the meaning of (374) as ‘there is an event of John being 1.7m tall.’) Then, this is how formula (430) yields the correct truth conditions: Assume that John is indeed higher than the last year. Then there are an event e and height d (say John’s actual height, $d = 1.7m$), such that for every event f and time t , it f is an event of John being 1.7m tall in time t , which

is the last year, then f equals d . By assumption, there is no such an event f and time t , so the parenthesized formula $(\forall t \forall f [\dots] f \checkmark x)$ is trivially true. Thus, (430) is true. On the other hand, if the last year, John was of the same height or heigher the now ($d \leq 1.7m$), then we can find time r (the last year) and an event f of John being d high, happening in time f . However, f does not equal e , since f occurred last year, while e occurs now (I assume that the absence of explicit temporal predicate in (429a) implies the present.) Therefore, the parenthesized formula is false, making the whole (430) false.

- (429) a. Janko je višji, kot je bil lani.
 John is taller than is been last year
 ‘John is taller than he was last year.’
- b. Janko je višji, kot je širok razpon njegovih rok.
 John is taller than is wide spread his arms
 ‘John is taller than the spread of his arms is wide.’
- c. Ta knjiga je debelejša, kot je moja beležka široka.
 this book is thicker than is my notebook wide
 ‘This book is thicker than my notebook is wide.’
- (430) $\exists e: \exists d: (\forall t \forall f [\text{high}(\text{janko}, d) \wedge (\text{last year}(t) \wedge \text{time}(t, f))] f \checkmark e) \wedge$
 $\text{high}(\text{janko}, d) \wedge \text{property}(p, x)$

Next, consider some examples where *kot*-clause contains a quantifier, (431a). In this case the whole DP *vsako dekle* ‘every girl’ is focused, so variable y has wider scope than usually.

- (431) a. ? Janko je višji kot vsako dekle (na tej milongi).
 John is taller than every girl (on this milonga)
 ‘John is taller than every girl (at the milonga).’²¹³
- b. $\exists e: \exists d: \exists x [\text{janko}(x)]$
 $(\forall f \forall y [\text{girl}(y) \wedge \text{high}(y, d)] f \checkmark e) \wedge \text{high}(d, x)$

The meaning of (431a) arises similarly as the the meaning of (429a). Assume that John is indeed taller than every girl. Then there are an event e and some height d (say John’s height) such that e is an every of John being d tall, such that the following holds. For every event f and a group of individuals y , if all members of y are girls and f is an event of the members of y being d -tall, then f equals e . Since John is taller than every girl, such

²¹³Sentence (431a) is somewhat less acceptable. This is probably due to the fact that a synonymous sentence using the preposition *od* exists: *Janko je višji od vsakega dekleta na tej milongi* ‘John is taller than every girl on this milonga’. For discussion on why this might be the case see Dobrovoljc [2005].

an event f and group y cannot be found, thus the formula is automatically true. On the other hand, if some girl is taller than or equally high than John, y can be chosen to stand for this girl, and f can be chosen to stand for the event that this girl is d -tall. However, f does not equal e , since e is an event of John being d -tall. Thus, the formula is false.

So far, all the examples were analyzed by assuming that the entire overt part of *kot*'s complement is an alternative to the focus, and that the corresponding implicit quantifier therefore occurs higher than usually. This is not necessarily the case: universal temporal adverb in (432) does not present an alternative to the focus. Thus, the focal mapping does not influence the scope of its implicit quantifier, which remains low. So, by (433) we correctly predict the meaning of (432): once per year, Peter drives a car which is better than Janko's usual car; it is not excluded that from time to time Janko might drive a car better than this Peter's car.

(432) Peter vozi enkrat letno boljši avto kot Janko vsak dan.
 Peter drives once per year better car than John every day
 'Once per year, Peter drives a car which is better than the car John drives every day.'

(433) $\exists e: \exists d: (\forall f \forall x [(\forall t [\text{day}(t)] \text{time}(t, e)) \wedge \text{agent}(\text{janko}, f) \wedge \text{drive}(f) \wedge \exists y [\text{car}(y) \wedge \text{good}(y, d)] \text{theme}(y, f)] f \checkmark e) \wedge (\exists t [\text{once-per-year}(t)] \text{time}(t, e)) \wedge \text{agent}(\text{peter}, e) \wedge \text{drive}(e) \wedge \exists y [\text{car}(y) \wedge \text{good}(y, d)] \text{theme}(y, e)$

5.5.3 A comparison to other approaches

The analysis of comparatives from §5.5 correctly predicts the truth conditions for all types of sentences discussed by Heim [2006].²¹⁴

In the semantic literature, the case of CAs with *than*+DP (i.e. in Slovenian, CAs with *od*) is usually taken to be the basic one (see §5.5.4). LF (434b) is assigned to sentence (434a); next, by using a separate computational system of formal semantics (see §3.2) the appropriate truth conditions are derived.

(434) a. John is taller than every girl.
 b. [every girl]₄ [John is taller than t₄]

In (434b), the universal DP *every girl* has moved, since its denotation in the base position has a wrong type (it is a generalized quantifier, and not a

²¹⁴All examples in this section are adapted from Heim [2006].

variable). Than the DP scopes over the comparative morpheme is expected: »there is just no lower possible scope-site [Heim 2006: 2]«.

For standard analysis, it is examples of the *than*+(partially elided) clause), i.e. examples corresponding to Slovenian *kot* CAs, that are problematic, (435a). The theory predicts the correct truth conditions only is—as in (434b)—the universal DP scopes above the comparative morpheme (435b). However, such a wide scope is unmotivated: the type mismatch could also be resolved by moving DP *every girl* immediately above the *than*-clause.

- (435) a. John is taller than every girl is.
 b. [every girl]₄ [John is taller than t₄ is tall].
 c. [k₅ [every girl is t₅]]₄ [John is taller than t₄].
 č. [k₁ [every girl is t₁ tall]]₄ [John is taller than t₄].

Heim [2006] writes that Larson [1988] suggests that *than*-clauses are actually implicate wh-clauses, and that the LF of (435a) is really (435c).

However, this kind of analysis cannot deal with examples of comparative subdeletion, (436a). This lead Heim to propose a generalization of the notion of a generalized quantifier (see §4.1.2): we can define not only GQs over individuals, but also GQs over degrees. For the proposal to work, she has to introduce a non-standard semantics for adjectives: in her approach, they do not denote the relation between individuals and degrees, but the relation between individuals and sets of degrees. (We shall not discuss the details of her analysis.) By doing this, LF (435č) can be assigned to sentence (435a), and example (436) can also be analyzed in the same fashion.

- (436) a. The desk is wider than some couch is long.
 b. [k₂ [some couch is t₂ long]]₁ [the desk is wider than t₁]

The analysis (since it is based on Larson’s insight, Heim dubs it *Larsonian*) predicts the correct truth conditions for (435a), although DP *every girl* never scopes over the comparative morpheme. It is crucial that it scopes over the elided clause (this happens by the (generalized) wh-movement within the clause) and that the whole *than* clause moves over the comparative morpheme (this movement is parallel to the movement of a DP in a sentence with a *than*+DP, so it is independently motivated).

The standard approach²¹⁵ retains the assumption that adjectives denote the relation between individuals and degrees. LF for (436) is similar to

²¹⁵Heim claims that most authors accept the standard analysis, among them von Stechow [1984] and Rullman [1995], the exceptions being Larson [1988] and Schwarzcild and Wilkinson [2002].

Larsonian LF; the difference hides is certain technical detail that we will not discuss.

(437) [more than k_1 [some couch is t_1 long]]₂ [the desk is t_2 wide]

Let us mention some disadvantages of the standard approach (without walking through the details of the semantic derivation). It cannot assign the correct truth conditions to sentences like (434a): it predicts that (434a) means that John is higher than the smallest girl. On the other hand, when it comes to examples containing modal operators (438)–(439), it fares better than Larsonian approach.

- (438) He was more cautious than he needed to be.
- a. * For every accessible world w it is the case that in the actual world he was more cautious than in w .
 - b. There is an accesible world w (in which a certain goal is achieved) such that in the actual world he was more cautious than in w . (I.e. in the actual world the desired goal could be achieved by a lesser degree of caution.)
- (439) He charged more than he was allowed to.
- a. * There is an deontically accessible (law-abiding) world w such that in the actual world he charged more than in w .
 - b. For every deontically accessible (law-abiding) world w it is the case that in the actual world he charged more than in w . (I.e. in the actual world, the law was broken.)

Need is a modal verb expressing necessity (when used epistemically). (440) is true if you have been cautious in every accesible possible world where you have not been robbed. Thus, we analyze *need* using a universal quantifier over possible worlds. However, as Heim points out, this does not mean that (438) has meaning (438a)—the correct meaning is stated in (438b), where the existential quantifier over possible worlds is used.

(440) To not get robbed, you need to be cautious.

Similar, but reversed situation is found in the case of (439). *Be allowed to* is a deontic possibility operator: (441) means that there is a deontically accessible possible world where he can charge 2 euros for a coffee. We analyze *be allowed to* by using the existential quantifier over possible worlds. However, to represent the meaning of (439), have have to use the universal quantifier (439b), not the existential one (439a).

(441) He is allowed to charge 2 euros for a coffee.

Heim emphasizes that there is a set of examples where the success of her and standard approach are complementary. She tries to solve the problem by tweaking the Larsonian approach so that it can simulate the standard one. She introduces a special operator Π ²¹⁶ and assumes that Π can raise: if Π remains in its base position, Larsonian analysis results, if it raises, we get the standard one. So, Heim unifies both analysis by parametrization. Note that she emphasizes that it is not her goal to explain why Π may or must move in certain cases (and thus achieve explanatory adequacy). She simply wants to provide a uniform system which can derive both types of meaning.

I believe postulation such a solution is a typical trap, especially for an approach assuming the existence of a special SF. The theoretical apparatus that modern semantic theories use to represent SF objects is powerful enough to represent almost anything. Specifically, by introducing a special operator (Π) the essence of the problem is obscured. I quote Heim [2006:13]: »It would be interesting to establish a generalization of some kind, to correlate the division between the two sets with some other ways in which they behave differently.« As Heim demonstrates practically, introducing new theoretical tools does not lead to the establishing of a new empirical generalization—simply because the tools are new and thus essentially unrelated to the existing theory.

I believe that in this case L^* theory can do better. The two sets of examples (the examples good for Larsonian and standard approach) are differentiated by the scope of the quantifier in the comparison class. Larsonian approach is successful when its scope is high; the standard approach is successful, when the scope is low. In L^* theory, we have a mechanism—focal mapping—which can raise the scope of a quantifier—but only the scope of a quantifier over alternative variable, which introduces the comparison class. In L^* theory we thus expect that the unusually high scope of certain quantifiers should be a consequence of focusing.

To repeat, both sets of examples should differ with respect to focusing. Indeed, Heim's examples can be partitioned to (442), which contain a constituent that can be focused, and (443), which do not contain such a constituent.²¹⁷

(442) a. JOHN is higher than every girl.

²¹⁶Heim adopts operator Π (p-i: point to interval) from Schwarzschild and Wilkinson [2002].

²¹⁷In the examples below, the comparison class is underlined. I note that focus and comparison class are not prosodically prominent in (442), at least not in parallel Slovenian examples. Focus is determined on semantic basis: there are alternatives to focus, comparison class being one of them.

- b. TODAY we have talked longer than we could have yesterday.
 - c. BILL did better than John predicted that most of the students would do.
- (443)
- a. He was more cautious than he needed to be.
 - b. He charged more than he was allowed to.
 - c. He was older than he needed to be (to get a kid’s ticket).

More precisely, the difference between the two sets of examples is the following. In (443), the “novel” part of the *kot* clause (*needed, allowed*) forms a part of the verbal extended projection. Therefore, it corresponds to the same (event) variable as the verbal spine. On the other hand, in (442), the “novel” constituent (*every girl, yesterday, most of the students*) is not a part of the verbal extended projection. It is a complex head (a specifier) of some functional projection of this extended projection. Therefore, it corresponds to a different variable than the verbal spine.

Assuming that parts of the verbal spine cannot be focused would yield the correct results. However, we know that such an assumption is false, since verb can be focused, cf. (48b) on page 36.

Correspondence principle 12 on page 183 from §4.5 states that focusing raises the scope of a quantifier over the alternative variable. If focus is a part of the verbal spine of an elliptical sentence introducing the comparison class, then the input and the output of the focal mapping are the same. The variable corresponding to the verbal spine is the event variable, whose quantifier already scopes (immediately) above the elliptical clause. In a nutshell, in this case focusing does not change the quantificational structure.

Larsonian approach forces quantifiers to have wide scope. Therefore it correctly analyzes sentences in (442), where the scope of the quantifier is indeed wide, due to focusing. However, the approach fails with examples in (443), where focusing does not change the quantificational structure. The reverse is true for the standard approach. With both approaches, there are certain exceptional cases: the standard approach (unexpectedly) yields correct results with (442b), while Heim’s approach (unexpectedly) works with (443c).

Let us provide L* formulas for sentences of both types: (444) and (445) provide representations for (442) and (443), respectively.

- (444)
- a. $\exists e: \exists d: (\forall f \forall y [\text{girl}(y) \wedge \text{high}(y, d)] f \text{ } \checkmark \text{ } e) \wedge \exists x [\text{john}(x)] \text{high}(x, d)$
 - b. $\exists e: \exists d: (\forall f \forall t [\exists w [\text{accessible}(w)] \text{in-world}(w, f) \wedge (\text{yesterday}(t) \wedge \text{time}(t, f)) \wedge \text{talk}(f) \wedge \text{length}(f, d) \wedge$

- $$\begin{aligned} & \text{agent}(\text{we}, f)]f \checkmark e) \wedge \\ & \text{talk}(e) \wedge \text{length}(e, d) \wedge \text{agent}(\text{we}, e) \wedge \text{today}(e) \\ \text{c. } & \exists e: \exists d: (\forall f \forall x [\text{agent}(\text{john}, f) \wedge \text{predict}(f) \wedge \text{theme} \\ & (\exists e': (\text{most-students}(x) \wedge \text{agent}(x, e')) \wedge \text{do}(e') \wedge \text{quality}(e', d)), f)]f \checkmark \\ & e) \wedge \\ & \text{do}(e) \wedge \text{agent}(\text{bill}, e) \wedge \text{quality}(e, d) \\ (445) \text{ a. } & \exists e: \exists d: (\forall f [\forall w [\text{accessible}(w) \wedge \text{goal-reached}(w)] \text{in-world}(w, f) \wedge \\ & \text{cautious}(\text{he}, d, f)]f \checkmark e) \wedge \text{cautious}(\text{he}, d, e) \\ \text{b. } & \exists e: \exists d: (\forall f [\exists w [\text{accessible}(w)] \text{in-world}(w, f) \wedge \text{charge}(f) \wedge \text{amount}(f, d)]f \checkmark \\ & e) \wedge \text{charge}(e) \wedge \text{amount}(e, d) \\ \text{c. } & \exists e: \exists d: (\forall f [\forall w [\text{accessible}(w) \wedge \text{get-kid's-ticket}(w)] \text{inworld}(w, f) \\ & \text{old}(\text{he}, d, f)]f \checkmark e) \wedge \text{old}(\text{he}, d, e) \end{aligned}$$

According to our classification, the standard approach unexpectedly predicts the correct meaning of (442b). The L^* representation is given in (444b). The standard approach does well in this case because formulas (444b) and (446) have the same truth-conditions. This follows if we assume that *yesterday* (442b) refers to yesterday as a whole and that atomic formula $\text{yesterday}(t)$ is true for a single value of t .²¹⁹

- $$\begin{aligned} (446) \quad & \exists e: \exists d: (\forall f [\exists w [\text{accessible}(w)] \text{in-world}(w, f) \text{talk}(f) \wedge \text{length}(f, d) \wedge \text{agent}(\text{we}, f) \wedge \\ & (\exists t [\text{yesterday}(t)] \text{time}(t, f))]f \checkmark e) \wedge \\ & \text{talk}(e) \wedge \text{length}(e, d) \wedge \text{agent}(\text{we}, e) \wedge \text{today}(e) \end{aligned}$$

Heim unexpectedly predicts the correct truth conditions with (443c). Let us compare it to (443a)—we know why her approach fails in this case. Intuitively, the difference between the two sentences is that in (443a), the goal was actually reached: if the purpose of caution is to not get robbed, then the truth of (443a) implies that you were not robbed on your way home. Contrary holds for (443c): if the sentence is true, then the goal—to get kid's ticket—was not reached.

The difference is a consequence of our world knowledge. We know that if by being d -cautious some goal is always reached, then by being more than d cautious, this is also the case: being more cautious cannot hurt. On contrary, it is not the case that if being (exactly) d years old is good for getting a kid's

²¹⁹Alternatively, we could assume that *yesterday* quantifies over all of yesterday's moments. Then, $\exists t$ in (446) has to be replaced by $\forall t$.

ticket, then being older is also good for this purpose. Quite the reverse, in this case being younger cannot hurt.²²⁰

To conclude, Heim succeeds with (443c) based on our world knowledge, which influences the truth-conditions via determining the meaning of the restrictor over w . (The restrictor requires not only that every w be accessible, but also that a specific goal be satisfied, via predicate goal-reached.) In (443c), goal-reached is not upward, but downward monotonous with respect to age d , yielding the unexpected meaning.

We conclude the section by discussing example (447). At first sight, this example constitutes a counterexample to the L^* theory. One of (447)'s meanings is that there is a girl such that John is taller than her. It is thus not enough if the quantifier over y scopes as in (447a). Its scope should be as in (447b); also, the quantifier must be existential. Focusing is thus unable to widen the scope of y 's quantifier enough.

- (447) JANKO je višji kot NEKO DEKLE.
 John_{focus} is taller than [some girl]_{focus}
 John is taller than some girl.
- a. $*\exists e\exists d: (\forall f\forall y [\text{girl}(y) \wedge \text{tall}(y, d)] f \text{ } \checkmark \text{ } e) \wedge \exists x [\text{john}(x)] \text{tall}(x, d)$
- b. $\exists y [\text{girl}(y)] \exists e\exists d: (\forall f [\text{tall}(y, d)] f \text{ } \checkmark \text{ } e) \wedge \exists x [\text{john}(x)] \text{tall}(x, d)$

The problem disappears once we realize that in this case, the indefinite DP is used specifically. *Neko dekle* ‘some girl’ contains feature [Specific], which is checked in the main clause. This way the quantifier over y gains even wider scope than the scope induced by focusing.

L^* theory can thus account for the data accounted for by both the standard and Heim’s theory. Note that no special assumptions were introduced in order to achieve this. Actually, this was why our theory had automatically lead us to the conclusion that the difference between the two types of data is caused by focusing.

5.5.4 Comparative structures with *od*

In this thesis we do not provide a semantic analysis of comparative structures having a nominal complement (*od*-comparatives). They present a hard problem for L^* theory. While using L^* language we can represent the meaning of adjectival *od*-comparatives, I do not see how the meaning of adverbial

²²⁰Thus the implicature is changed if we discuss tickets for retired people instead of kid’s tickets.

od-comparatives could be represented. Since I believe that the constructions call for a unified analysis, I conclude that the analysis of adjectival *od*-comparatives I have in mind must be wrong, and thus do not present it.

It is not hard to see that it is not trivial to transfer the analysis of adjectival *od*-comparatives to adverbial ones, if one desires a consistent syntax–semantics interface. The comparison class of *kot*-comparatives is given by a sentence, so the complement of complementizer *kot* repeats the base form of the adjective or the adverb (at LF): (449b) is derived from (450) by ellipsis (cf. to comparative subdeletion in §5.5.3). Contrary, in (448b) the comparison class is given by a DP, which does not repeat the base form of the adjective (at LF)—since we cannot motivate the ellipsis in the case of *od*-comparatives, cf. unacceptability of (451), we have to assume that LF also contains only the DP.

- (448) a. Janko je višji od Metke.
John is taller than Mary
'John is taller than Mary.'
b. Peter pleše bolje od Janka.
Peter dances better than John
'Peter dances better than John.'
- (449) a. Janko je višji, kot je Metka.
John is taller than is Mary
'John is taller than Mary is.'
b. Peter pleše bolje kot Janko.
Peter dances better than John
'Peter dances better than John.'
- (450) Peter pleše bolje [kot Janko dobro pleše].
Peter dances better [than John good dances]
- (451) * Peter pleše bolje od Metke poje.
Peter dances better than Mary sings
'Peter dances better than Metka sings.'

It follows from the above assumption on the comparison class that we cannot compare John's height to Mary's height. We might say that we compare John's height to Mary as such. However, this would imply that the comparison could be carried out with any Mary's property, e.g. her weight, which is false: our linguistic intuition is that only comparison to her height is possible. Maybe one could try to blame the pragmatics at this point, but a convincing formal analysis should be developed, which is out of scope of this thesis.

To the best of my knowledge this problem is usually not recognized in the semantic literature. Authors either (i) assume that *od*-comparatives are derived from *kot*-comparatives [cf. von Stechow 1984]—in this case, the syntax–semantics interface is not worked out—or (ii) do not discuss adverbial *od*-comparatives at all [Heim 2006].

5.6 Negative gradable adjectives

In antonymous adjectival pairs, one adjective is felt to be positive and the other negative. This is how also we shall call them: *positive* and *negative gradable adjectives*. In a antonymous pair such as *visok–nizek* ‘high–low’, *visok* and *nizek* are positive and negative, respectively. So far we have dealt with positive adjectives; in this section, we discuss negative ones.

The intuition that antonyms differ with respect to polarity seems appropriate. The meaning of negative adjective’s superlative can be represented using (452).

- (452) a. najnižja gora
lowest mountain
‘the lowest mountain’
- b. $\exists d: (\forall x' [-\text{high}(x', d) \wedge \text{mountain}(x')] x' \text{ } \wp \text{ } x) \wedge \neg \text{high}(x, d) \wedge \text{mountain}(x)$
There is a height d , such that (i) for every x' which is a group of mountains which are not at least d -high x and x' overlap, and (ii) x is a group of mountain which are not at least d -high.

We can show, using the same reasoning as for positive gradable adjectives in §5.5.2, that (452b) truly gives us the correct truth conditions. (i) Let there be exactly one mountain G having the smallest height in the context, and let x stand for G . Let d stand for some height greater than the height of G but smaller than or equal to the height of the second lowest mountain. Then only mountain G is not (at least) d -high. So every group of mountains x' not d' -high will include G . (ii) Assume that we wanted x to stand for a mountain (H) which is not the lowest mountain. On one hand, if we choose d to be smaller than or equal to the height of H , subformula $\neg \text{high}(x, d)$ is false, so the whole formula is false. On the other hand, if we choose d greater than the height of H , then we can choose x' to be some mountain G lower than H (G exists by definition of H). x' is then a mountain lower than d and different than x ($=H$). So it is not true that for every mountain x' whose members are mountains which are not d -high, x' and x overlap.

Formula also yields the correct results in the case of a plural DP. Intuitively, phrase *najnižje gore* ‘the lowest mountains’ then refers to all moun-

tains of the smallest height, which is exactly the interpretation the formula provides. (i) If we let x stand for all mountains of the smallest height (and no other mountains), we can let d be some height between the height of mountains in x and the second lowest height. Every group x' whose members are mountains lower than d will therefore contain some mountain from x . (ii) If we do not choose x to stand for all the mountains of the smallest height, then we can choose x' to stand for one of the smallest mountains not included in x , thereby making the formula false.

The general situation is also the same as in §5.5.2 for positive gradable adjectives. DP *najnižje gore* ‘the lowest mountains’ can refer to all the mountains lower than some height, i.e. the group of mountains the DP refers to must contain all mountains lower than or equally high as one of the highest mountains the DP refers to.

Also, we analyse the comparative degree of negative gradable adjectives (and adverbs) just as the comparative degree of positive adjectives in §5.5.

Formula (452b) implies that the negative member of the antonymous pair is a negation of the positive adjective, which is intuitively a welcome result. The negation must have the narrowest scope possible; if the meaning of adjective *visok* ‘tall’ is simplified to $\text{high}(x, d)$, the meaning of *nizek* ‘low’ results from directly negating this formula, yielding $(\neg\text{high}(x, d))$.

It is well known that the meaning of gradable adjectives is *vague*. In the semantic literature it is usually assumed that their meaning depends on a contextually given *comparision standard*, and that the meaning of the positive degree is implicitly comparative: an individual is tall whenever he is taller than the contextually given standard for tallness. Similarly, an individual is short, whenever he is shorter than the contextually given standard for shortness. It is important to note that the mentioned standards are different (the standard for shortness must be less than the standard for tallness), since gradable adjectives have a zone of indifference: an individual can be neither tall nor short. [cf. Kennedy 2001]

This leads to an old problem in semantics, the difference between pairs *visok–nizek* ‘tall–short’ (453) and *visok–ne visok* ‘tall–not tall’ (454). (453b) and (454b) are not synonymous, as can be seen from the fact that (455) is not contradictory.

- (453) a. Triglav je visok.
Triglav is high
‘Triglav is high.’²²¹

²²¹The estimates in (453)–(455) refer to the heights of the mountains mentioned with

- b. Kal je nizek.
Kal is low.
'Kal is low.'
- (454) a. Triglav je visok.
Triglav is high.
'Triglav is high.'
- b. Špik ni visok.
Špik not-is high.
'Špik is not high.'
- (455) Špik ni visok, vendar tudi nizek ni.
Špik not-is high but also low not-is
'Špik is not high, but is not low neither.'

Semantics must differentiate between these constructions. The analysis of (454b) is straightforward: Špik is not high iff it is not true that it is high: $\neg(\text{high}(x))$. The analysis of (453b) is more difficult, since it is not clear what scope the negation should have, so that "only the adjective" is negated. Sometimes it is assumed that the meaning of (453b) is represented by $(\neg\text{high})(x)$, where the interpretation of the complex predicate $(\neg\text{high})$ is left to the lexical semantics. We will show that using L* theory, the meaning of negative adjectives can be represented in the syntax.

Let us break down the meaning of gradable adjective *visok* 'tall' using the pattern (456), introduced in §5.2.1. When height is explicitly given, the dots in (456) are replaced by a predicate limiting the values of variable d , as in (457).²²² If height is not explicated we assume that (DegP is absent and) d is constrained by a contextually determined standard, as in (458).

- (456) $(\exists p [(\exists d [\dots] \#(d, p)) \wedge \text{height}(p)] \text{property}(p, x)) \wedge \text{mountain}(x)$
- (457) $(\exists p [(\exists d [5000\text{m}(d)] \#(d, p)) \wedge \text{height}(p)] \text{property}(p, x)) \wedge \text{mountain}(x)$
- (458) $(\exists p [(\exists d [\text{standard}(d)] \#(d, p)) \wedge \text{height}(p)] \text{property}(p, x)) \wedge \text{mountain}(x)$

It is usually assumed that the standard for tallness is a certain height, e.g. 3000m [Kennedy 2001]. We can thus define predicate standard as in (459).

- (459) $\text{standard}(d)$ iff $d = d_s$, where d_s is a contextually given standard for tallness.

respect to other Slovenian mountains higher than 2000m. Triglav (2864m), Špik (2472m), Kal (2001m) [Kern and Cuderman 2001].

²²²We will not deal with the internal composition of the measure phrase *pettisoč metrov* 'five thousand meters'.

As mentioned, the standard approach then assumes that variable d is compared to the standard value. In L^* theory we wish to avoid the claim that the positive degree is implicitly comparative. In a theory which assumes that syntax/morphology and formal semantics are tightly connected, this predicts that the comparative degree (being explicit or implicit) carries comparative form. However, in L^* theory we need not assume that positives are implicitly comparative, since (458) gives us the correct result: every mountain surpassing the standard height has d quanta of height, where d is the standard determined by the context.²²³

The meaning of negative adjectives is represented by formula (460). However, in this case we must assume that predicate standard determines the standard of lowness.

- (460) nizka gora
 low mountain
 $(\neg \exists p [(\exists d [\text{standard}(d)] \#(d, p)) \wedge \text{height}(p)] \text{property}(p, x)) \wedge \text{mountain}(x)$

Compared to the above-mentioned representation $(\neg \text{high})(x)$, formula (460) has an important advantage. While the former leaves the interpretation of the negation to the lexical semantics, \neg is a syntactic element in (460). This is important since in a complement of negative gradable adjectives, downward entailing is possible and NPIs are licensed [Kennedy 2001:35].

However, (460) is not unproblematic. First, where do we place \neg in LF? LF of *nizka gora* must be similar to LF of *visoka gora*, repeated in (461). Quantifier $\exists p$ occurs between PropertyP_x and A_p : if it is to be negated, as in (460), \neg must occur in PropertyP_x or higher, which is unacceptable, since it would then also negate $\text{mountain}(x)$. Second, formula for (454b) is (462). The only difference between (460) and (462) is that (462) also reflects the movement of *Špik* into subject position, which is irrelevant for our current discussion. Specifically, the position of \neg in both formulas is the same: \neg occurs immediately above $\exists p$. Thus, the formulas do not differentiate between a negative and negated positive adjective.

- (461) PropertyP_x
 $\swarrow \quad \searrow$
 $A_p \quad N_x$
 visoka gora
 (high) (mountain)

- (462) \check{S} pik ni visok.
 \check{S} pik not-is high

²²³I assume that the *exactly*-meaning is a pragmatic implicature, cf. to the discussion on (65) on page 44.

‘Špik is not high.’ $\exists x [\check{\text{špik}}(x)] \neg \exists p [(\exists d [\text{standard}(d)] \#(d, p)) \wedge \text{height}(p)] \text{property}(p, x)$

The truth conditions of (460) and (462) differ only because we stipulated that predicate standard has different denotations: it sets the standard of lowness in (460) and standard of highness in (462) [cf. Kennedy 2001]. However, standard occurs in the same (syntactic) environment in both formulas. Therefore, there is no reason that it should be interpreted differently.

Since \neg in (462) and (460) are L^* reflexes of sentential negation and negative adjective, the position of \neg in (462) is probably higher than its position in (460), although this cannot be read off the (simplified) formulas. In the end, the corresponding LFs thus differ, and it seems that different interpretation of standard could be motivated.

I believe this cannot be done. In neither case the negation operator is immediately above predicate standard (in LF, at least PropertyP_x intervenes). The trigger of the different interpretations of standard is thus not local. This is problematic, since usually syntactic principles *are* local.

If the scope of \neg in (460) could be narrowed, so that it would occur immediately above standard, the above objection could be avoided. We could assume that standard is interpreted as a standard for lowness iff it occurs immediately below the negation operator.²²⁴

In (463), the negation scopes immediately above standard. It only negates the subformula which determines the size of the group which variable p stands for.

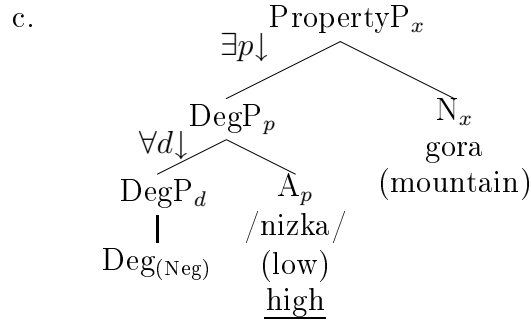
(463) nizka gora
 low mountain
 $(\exists p [(\neg \exists d [\text{standard}(d)] \#(d, p)) \wedge \text{height}(p)] \text{property}(p, x)) \wedge \text{mountain}(x)$

However, by correspondence principles given in §4, no LF corresponds to (463). By correspondence principle 9, \neg could only be introduced by a negative projection NegP. However, doing so we would also negate $\text{height}(p)$, yielding wrong truth conditions. We solve the problem by substituting for (463) the logically equivalent (464b), where universal quantification over d is used. By correspondence principle 10, the quantifier over d is universal if feature [Deg] is negative, [Deg_(Neg)], as shown in LF (464c).*

²²⁴Predicate standard must be sensitive to its syntactic environment in any case, since the standard must be set with regard to the adjective that is used: highness, heaviness, goodness, etc.

*Actually, there is another, even more appealing possibility of representing the meaning of the members of an antonymous pair, which uses one and the same predicate standard for both members. Assume that standard is true of the whole range of standard values, ranging from lower to upper end. (Or, alternatively, that it is at least true for both edges

- (464) a. nizka gora
 low mountain
 b. $(\exists p [(\forall d [\text{standard}(d)] \neg \#(d, p)) \wedge \text{height}(p)] \text{property}(p, x)) \wedge \text{mountain}(x)$



Still, the troubles do not end. If (464b) is to be logically equivalent to (463), it is necessary that \neg scopes immediately above $\#(d, p)$. However, this is unexpected with respect to our correspondence principles. Correspondence principle 9 tells nothing about the polarity of head predicates²²⁵. It only deals with the polarity of NegP's complement and the complex head of negative functional projections.

A detailed inspection of LFs used so far in the thesis shows that correspondence principles 9 and 10 were only used with overlap as head predicate and universal quantification. This makes it possible to adjust the theory in the following way, without rejecting any results it has yielded so far.

First, I replace the overlap predicate \bowtie as a head predicate with the disjointness predicate \asymp . From this point on, we assume that the head predicate of features which were so far regarded as having overlap as head predicate ([Def], [Bg] and [Def_A]) is actually the disjointness predicate. Second, correspondence principle 9 is adjusted in point (ii).

Correspondence Principle 9 (adjustment) *The negative operator in L^* can be introduced by (i) a functional projection NegP: then its complement is negated; or a (ii) final functional projection of a feature having negative value: then the complex head of its functional projection and the atomic formula of the head predicate are negated.*

²²⁵This is understandable, since it was postulated before discussing the interaction between quantification and predication.

and for nothing outside them.) Then *high mountain* and *low mountain* can be represented as in (i) and (ii), respectively.

- (i) $\forall d [\text{standard}(d)] \exists p [\text{height}(p) \wedge \#(d, p)] \text{property}(p, x) \wedge \text{mountain}(x)$
 (ii) $\forall d [\text{standard}(d)] \forall p [\text{height}(p) \wedge \#(d, p)] \neg \text{property}(p, x) \wedge \text{mountain}(x)$

The adjustment would be impossible if correspondence principles 9 and 10 were ever used with e.g. head predicate agent, since it would follow that the head predicate of [Agent] is \neg agent, which seems intuitively wrong. Since the correspondence principles were only used with the overlap predicate, no such problem arises: the linguistic intuition tells nothing about which predicate should be taken as basic, overlap or disjointness.

Since the atomic formula of head predicate is included in the L^* formula only at the final projection of a feature, the added requirement that the atomic formula of a head predicate is also negated confirms the appropriateness of the decision taken at the first formulation of the principle that the operator of negation is only introduced by the final projection of a feature.

5.7 Sentential negation

We have adopted the view, stemming from Pollock [1989], that sentential negation is (universally) introduced by a special functional projection NegP, which negates its complement. This is why we were forced to introduce a dichotomy in the formulation of correspondence principle 9: (i) operator \neg corresponding to sentential negation negates the complement of NegP; (ii) operator \neg introduced by a negative functional projection negates the complex head (in standard terminology, a specifier) of this functional projection.

In this section we shall show that in L^* theory the meaning of sentential negation can be represented by using the uniqueness pattern. It follows that the first point of correspondence principle 9 is superfluous. The final version of the principle is thus the following.

Correspondence Principle 9 (second adjustment) *The negative operator in L^* is introduced by a final functional projection of a feature having negative value. Operator \neg negates the complex head of its functional projection and the atomic formula of the head predicate.*

Consequently, correspondence principle 10 can also be simplified.

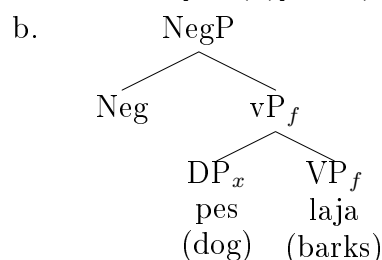
Correspondence Principle 10 (adjustment) *An implicit (restricted) quantifier is universal if it occurs in a functional projection introducing a negation; otherwise, it is existential. (The node where \forall occurs is interpreted as a disjunction.)*

5.7.1 Semantic decomposition of NegP

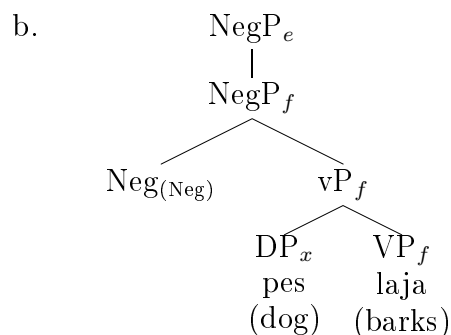
I suggest that we use formula (467a) instead of (466a).²²⁶

- (465) Pes ne laja.
 dog not barks
 ‘A dog does not bark.’

- (466) a. $\neg\exists f: \exists x [\text{dog}(x)] \text{bark}(f) \wedge \text{agent}(x, f)$



- (467) a. $\exists e: (\forall f [\exists x [\text{dog}(x)] \text{bark}(f) \wedge \text{agent}(x, f)] \neg(f \asymp e))$



In (467) it is crucial that event e is completely unspecified: agent, theme or any other theta role is unspecified; even the type of event is not determined. Let us call such an event a *null event*. A null event is of course different than any event which is specified in some way, e.g. by determining what action is going on and/or specifying the theta roles.

It follows that the negated atomic formula $\neg(f \asymp e)$ in (467a) (which is equivalent to $f \not\asymp e$) cannot ever be true: the action and theta roles of event f are specified, while this is not the case for e . Thus, formula (467a) can only be true if no event f satisfies the truth conditions given in the restrictor of $\forall f$. If there is an event f satisfying those conditions, the formula requires it to be the same as e , which is impossible. In other words, formula (467a) is true if and only if there is no event corresponding to the proposition of the sentence, thereby negating the proposition.

²²⁶In (466a) we adopt the result of §5.6 that a negative feature also negates the atomic formula of the head predicate. Thus we replace $f \not\asymp e$ by $\neg(f \asymp e)$.

The analysis of sentential negation conforming to the uniqueness pattern explains why the non-superlative usage of superlatives is possible, i.e. why superlatives can be associated to sentential negation (see §2.1.5, §5.3.3 and §5.4.3). In the analysis of the non-superlative usage of superlatives we had to assume that superlatives can also (besides [Nral]) realize either feature $[\text{Def}_{(\text{Neg})}]/[\text{Bg}_{(\text{Neg})}]/[\text{Def}_{\text{A}(\text{Neg})}]$ or NegP. By analyzing the sentential negation with conformance to the uniqueness pattern, the dichotomy is gone. The generalization is simply that the superlatives can realize any negative feature $[\text{f}_{(\text{Neg})}]$ having disjointness as a head predicate. (We take into account the result of §5.6 that disjointness is more basic than overlap.)

5.7.2 Negative concord and double negation

We have semantically decomposed the functional projection NegP of standard minimalism. We have assumed that a (negated) disjointness predicate is a head predicate of feature $[\text{Neg}_{(\text{Neg})}]$. It is important to note that on the outside, the resulting NegP behaves as in the standard approach. The constituent denoting the sentential proposition is a complement of the first projection of $[\text{Neg}]$, and the second projection of $[\text{Neg}]$ is a complement of some higher functional projection. Since the second projection of $[\text{Neg}]$ has no complement, the illusion is perfect. It seems that NegP “as a unit” (i) is a complement of some higher projection and (ii) negates its own complement.

The standard view that sentential negation is always introduced by NegP is the majority view in the literature, but not the only view. Zeijlstra [2004] concludes that there are two types of sentential negation: one is introduced by NegP, while the other is not. (i) Zeijlstra argues that languages where sentential negation is introduced by NegP have negative concord. (ii) In languages where sentential negation is not introduced by a special functional projection, the negation operator is introduced by a negative adverb, which is adjoined to some other (non-NegP) functional projection, e.g. vP in Dutch; these languages have double negation.

Zeijlstra furthermore assumes that n-words (in Slovenian *nihče* ‘nobody’, *nič* ‘nothing’, *nikjer* ‘nowhere’, etc.) are semantically non-negative. They contain an uninterpretable negation feature, $[\text{uNeg}]$, which must be checked in NegP which introduces the negation operator. This is why n-words take part in negative concord. On contrary, negative operators²²⁹ (like English *nobody*, *nothing* and *nowhere*) carry an interpretable negation feature, $[\text{iNeg}]$, and thus introduce a semantic negation, but do not take part in negative concord. The result of using a negative operator in a negative sentence is

²²⁹Note that negative operator is not negation operator, \neg .

double negation—the effects of both negations are cancelled.

We have shown how L* theory simulates the semantic effect of standard NegP. We will not transfer Zeijlstra’s theory of negative concord in to L* theory—I believe this should be a routing procedure, parallel to the transfer of other results from the x-bar theory with specifiers to the x-bar theory with complex heads. On contrary, his results on double negation cannot be directly transferred to L* theory.

As mentioned above, Zeijlstra assumes that in languages having double negation the sentential negation is introduced by a negative adverb, adjoined to vP. In L* theory, adjunction is an illegitimate operation, making the direct transfer of the result impossible. Furthermore, Zeijlstra assumes that (in our terminology) negative operators in languages with double negation contain logical features containing a negation operator. In L* theory this is impossible: the negation operator must be introduced into syntax. I leave the issue of transferring Zeijlstra’s results to L* theory for further research.

5.8 Conclusion

In this chapter we have used L* theory, developed in §4 for semantic analysis of gradable adjectives, copular sentences, universal determiners, definite determiners, superlative and comparative structures (determiners, adjectives and adverbs), negative gradable adjectives and sentential negation. I emphasize that the theory was motivated independently of the data discussed in this chapter.²³⁰ In this chapter, only the empirical domain of the theory was extended, and not the analytical apparatus.²³¹ The successful analysis of novel data thus confirms the developed theory.

The analysis of superlative and comparative structures forms a substantial part of this chapter. I believe that an important result is the conclusion that all these constructions can be analysed in a very similar fashion, by using a single LF/L* pattern we have called the uniqueness pattern. This conforms

²³⁰The exception is correspondence principle 13. In §4 we were only able to conclude that the global position of the atomic formula of some feature’s head predicate occurs immediately below some final functional projection of this feature. We have not determined whether it occurs below the “base-generated” or “moved” final projection, in case there are two final projections. The decision for the base-generated projection was not motivated until §5.1.2.

Another partial exception are universal determiners. We have motivated correspondence principle 10 by inspection of the meaning of *vsak* ‘every’. Other data from §5.2.3 (on universal determiner *vsi* ‘all’ and the interaction of universal determiners and cardinals) were not part of motivational data.

²³¹On contrary, the analytical apparatus was simplified, see §5.6 and 5.7.

to the linguistic intuition that there is a common semantic core to all superlative and comparative constructions. Thus on a terminological level, L* theory confirms the appropriateness of terms superlative and comparative as morphosyntactic and semantic category. Furthermore, the parallel analysis of comparative and superlative structures confirms the traditional assumption that superlatives and comparatives (along with positives) form a paradigm.

The present chapter also confirms the validity of the cross-linguistic prediction on correlation of the existence of definite determiners and majority superlative determiners from §2. Furthermore it explains an additional generalization given in §2 (based on data from §2.3.1) that any language having a definite determiner and a plurality superlative determiner must also have a majority superlative determiner.

We have also seen that the uniqueness pattern is not limited to the analysis of definite, superlative and comparative structures, but can be also used for sentential negation. The semantic and syntactic aspects of sentential negation in L* theory turn out to be much more complicated than in standard analyses. Is this necessarily bad? I believe not: if sentential negation was simply the introduction of the negation operator, the difficulties that speakers face when processing multiple sentential negations, (468), are unexpected. On the other hand, if we adopt the analysis developed in §5.7, these difficulties seem much more natural.

- (468) Janko ni vedel, da čarovnica ne mara otrok, ki jim starši niso zabičali, naj ne lezejo v peč, če jim tega nihče ne ukaže.
'Hansel didn't know that the witch does not like children, whose parents didn't tell them not to get into the oven if noone tells them to do so.'

Chapter 6

Further research

It is said that only a theory which opens more questions than it answers is a good theory. At least in this criterion, L* theory is probably a good one. In the course of development of the theory and in its application, we have hinted at many questions that require further research. Some of them require a more detailed analysis of the discussed data, other hint how other data might be analysed.

I consider L* theory to be a framework: once adopted, it influences the analysis of any phenomenon in syntax and semantics of natural language. The given correspondence principles are independent of the “content” of syntactic expressions: L* theory constrains the distribution of a feature and its interaction to other features regardless of its content. Furthermore the correspondence principles are supposed to be universal principles of the syntactic component of FL, meaning that the validity of L* theory can be checked in any natural language.

Most directions for further research presented in this chapter, follows the preaching of Jonathan Kaye, one of the fathers of Government phonology: »the theory tells you where to look.« Let us see where the L* theory leads us.

In §6.1 we discuss two possible generalizations of the cross-linguistic prediction from §2. The idea in §6.1 generalizes the prediction to the hypothesis on the correlation of the existence of a adjectival definite determiner (like Slovenian *ta*) and superlative degree of adjectives. The idea presented in §6.1.2 is not based on the L* theory, but on the cross-linguistic generalization of Bošković [2007], who claims that the existence of a definite determiner is correlated to a number of syntactic phenomena.

§6.2 asks, what is the meaning of positive features having disjointness as a head predicate. The hypothesis of §6.2.1 is that the positive value of feature [Bg] plays a role in (certain kinds of) topicalization. In §6.2.2 we

show that a positive feature having disjointness as a head predicate can be used to analyse coordination.

In §6.3 we discuss the possibility that L*'s positive and negative feature values are actually the values of binary features.

Based on our results on sentences containing focus, §6.4 tries to explain word-order and prosodic realization of focus sentences in Slovenian.

§6.5 presents less explicated ideas. We mention grammatical number, donkey anaphora, floating quantifiers, superlative and comparative determiners associated to cardinals, non-countable nouns and binding theory.

6.1 Generalization of the cross-linguistic prediction

6.1.1 Adjectival definite determiner

In chapter 2 we have presented a cross-linguistic prediction on the correlation of the existence of a definite determiner and a majority superlative determiner. We have claimed that languages having the latter also have the former.

In §5 we have shown that the definiteness pattern which is instantiated by both definite determiners and majority superlative determiner is only a special case of the uniqueness pattern, which arises from the presence of a negative functional feature having disjointness as a head predicate. Three such features were identified in the thesis: [Def] was used in the analysis of definite determiners and majority superlative determiners; [Bg] was used in the analysis of focus (and associated comparative and superlative structures); [Def_A] was used in the analysis of superlative adjectives.

The prediction presented in §2.3 only deals with the uniqueness pattern arising from feature [Def], i.e. the definiteness pattern. However, it can be generalized to features [Bg] and [Def_A].

In case of [Bg] the prediction is that languages having relative reading of superlatives or comparatives have focus. However, since relative reading of superlatives and comparatives was defined as the reading yielded by the association to focus, the prediction is circular. (Besides, I am not aware of any language without focus.)

The prediction seems more interesting in the case of [Def_A]. We have assumed in §5.4 that in Slovenian this feature is realized by so-called adjectival definite determiner *ta*. Further, the semantic analysis of superlative adjectives implied that they realize DegP having Def_AP as a complement. By the

same logic as in §2.3 we predict that languages having superlative adjectives also have adjectival definite article.

In the thesis, we have not discussed adjectival definite articles in any detail. Therefore we are unable to provide its operative definition which could be used to test the prediction. Testing is thus left to further research.

6.1.2 Parallel generalizations

Bošković [p.c.] notes that the absence of the majority reading of superlative determiners in languages without a definite article is but one of a wide spectrum of consequences of the absence of a definite article. Besides our generalization, Bošković [2007] lists the following consequences.²³² (As far as I see, my term definite determiner corresponds to Bošković's definite article.)

(i) Only languages without articles allow Left-Branch Extraction, (469).
 (ii) Only languages without articles allow extraction out of (traditional) noun phrases (470). (iii) Only languages without articles allow scrambling.²³³ (iv) Only languages with articles allow negative raising (from certain types of finite clauses), (471). (v) In languages having multiple wh-movement but no articles, the order of question words at the beginning of the sentence is free, (472). (vi) Only languages with articles have clitic doubling. (vii) Languages without articles do not allow transitive nominals with two genitives. (viii) Head-internal relatives are island sensitive only in languages without articles. (iv) Polysynthetic languages do not have articles.

- (469) a. *Expensive/That_i he saw [t_i car].
 b. Skupa/Ta je vidio kola. (srbohrvaščina)
 expensive/that is seen car
- (470) a. *From which city_i did Peter meet [girls t_i]?
 b. Iz kojeg grada_i je Ivan sreo djevojke t_i? (srbohrvaščina)
 'From which city did Ivan meet girls?'
- (471) a. John does not believe she is smart.
 b. Ivan ne vjeruje da bog postoji. (srbohrvaščina)
 'Ivan doesn't believe that God exists.' *Ivan believes that God doesn't exist.
- (472) a. Koj kogo vižda? / *Kogo koj vižda? (bolgarščina)
 who whom sees

²³²Bošković [2007] notes that these generalizations are only strong tendencies.

²³³Bošković uses the term scrambling in narrower sense than it is usual in the literature. He argues that semantic effects of Japanese and German "scrambling" are radically different, and narrows the reference of the term to the Japanese type.

‘Who sees whom?’

- b. Ko koga vidi? / Koga ko vidi? (srbohrvaščina)
 who whom sees

‘Who sees whom?’

6.2 Positive features having disjointness as head predicate

6.2.1 Topicalization

The crucial feature for the analysis of focus is $[Bg_{(Neg)}]$. Is there the positive counterpart of this feature. I believe that there is and that it has to do with topicalization. (Ad Neeleman [p.c.] suggests that this could be the case of contrastive topic. Topicalization divides a sentence into a *topic* and a *comment*.

L^* formula (474) and LF (475) are almost the same as the formula and LF for focus construction, only the value of $[Comment]$ is positive. Therefore (i) the disjointness predicate is not negated (see §5.6 for the adjustment of copr 9); (ii) quantifier over event variable f and alternative variable x' is not universal but existential.²³⁴ (We mark topic by double underline.)

- (473) (A: Ali veš, kaj počne Janez? B: Ne, vem pa, da) Peter
 A: or know what does John? B: no know but that $Peter_{topic}$
 pleše.
 dances

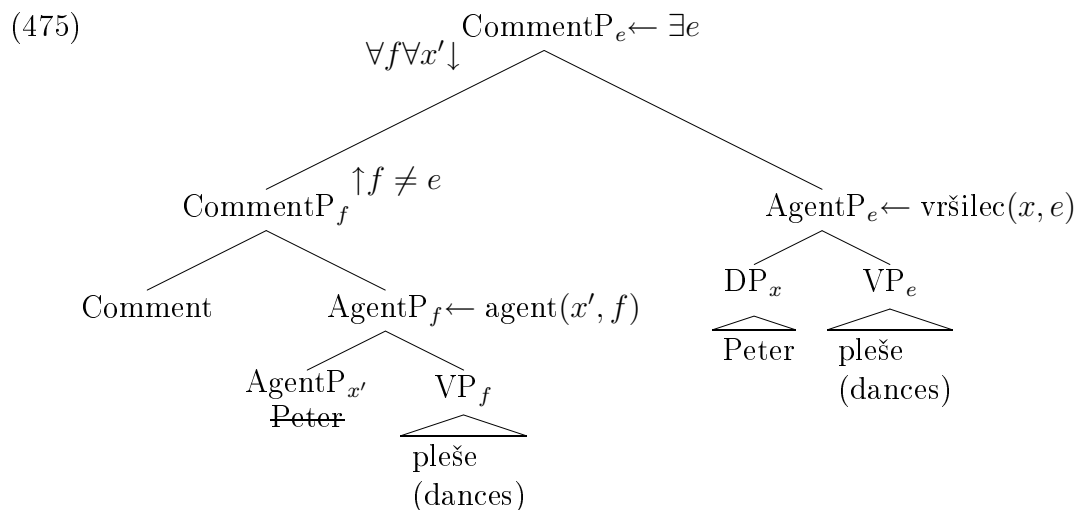
‘A: Do you know that John is doing? B: No, but I know that Peter is dancing.’

- (474) $\exists e: (\exists f \exists x' [agent(x', f) \wedge dance(f)] f \neq e) \wedge$
 $\exists x [peter(x)] agent(x, e) \wedge dance(e)$

There is an event e such that the following is true. There are event f and individual x' such that f is the event of x' dancing, and that f is not e . e is an event of Peter dancing.

Formula (474) asserts something about event e (that it is an event of Peter dancing) and also tells us that there is another event f , different than e , whose truth conditions are the same as truth conditions of e only that the agent could be some other individual. Such a structure might be usable for

²³⁴We ignore focus in (474) and (475). Sentence certainly contains focus, since it is an answer to question.



changing the topic of the talk, if we assume that the event in the comment is not necessarily an actual event, but only a “possible” event—an event which the flow of discourse suggest that might be discussed. Asserting the existence of this event, having no explicitly given agent, and simultaneously asserting the existence of an event where the agent is an previously unmentioned individual, might signal a change of topic.

Besides the problem that we cannot take f to be an actual event, formula (474) is also problematic since it allows that x' stands for the same individual as x in the proposition (Peter). If *Peter* is to be a contrastive topic, this should be impossible.²³⁵ This problem might be solved by assuming that the scope of the double quantifier $\exists e \exists x$ is not the atomic formula $f \neq e$, but the conjunction $f \neq e \wedge x' \neq x$. This would also explain the position of the implicit quantifier over alternative variable x' —instead of saying that elliptic structure raises the scope of this quantifier we would have to say that it “doubles” the atomic formula.

Such adjustment would of course influence our analysis of focus (and elliptic structures in general). However, as far as I see, there would be no negative consequences. Also, the position of variable x should be raised—this also does not seem bad, since topicalization and focusing can be accompanied by movement of the topic and focus, respectively.

I leave the research of topicalization and the influence of the necessary modifications of the theory to representations proposed in this thesis to fur-

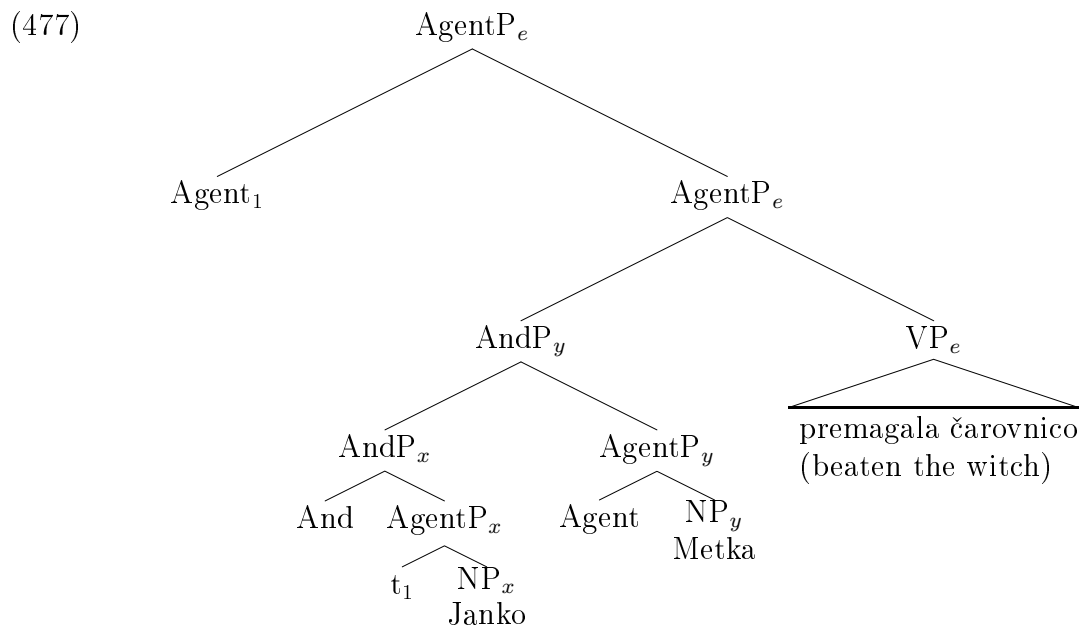
²³⁵The problem remains even if we consider not contrastive topic but topic as defined by Neeleman and van de Koot [2007: 3]: » We reserve the term topic for syntactic constituents that introduce a new discourse topic, narrow down the current discourse topic, or change it. We thus exclude constituents that are merely discourse-anaphoric.«

ther work.

6.2.2 Coordination

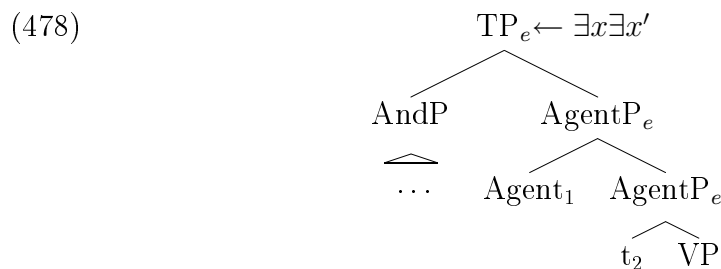
Positive feature with disjointness as head predicate can be used to analyse coordination. I suggest that conjunctive *in* ‘and’ realized a positive feature [And] having disjointness as head predicate. Let us observe the case where the agent is a coordinate structure.

- (476) Janko in Metka sta premagala čarovnico.
 Hansel and Gretchen are beaten witch
 ‘Hansel and Gretchen have beaten the witch.’



In (477) one of the features [Agent] projects twice in a row (AgentP_y and AgentP_e; no movement), while the second projection of the other feature is by movement (AgentP_x, AgentP_e is projected by movement).

In the derivation (476) the whole coordinated constituent moves into the subject position, (478).



This is why implicit quantifiers over x and x' have the same scope: both occur in TP. L* formula is given in (479).

(479) $\exists e: \exists x \exists x' [(janko(x') \wedge x' \neq x) \wedge metka(x)]$
 $agent(x', e) \wedge agent(x, e) \wedge beat\text{-the}\text{-witch}(e)$

I believe that many or maybe even all coordinate structures could be analyzed by using parallel projections of the above kind. A detailed analysis is out of scope of the thesis.

6.3 Binary features

§4.4.2 introduces the notion of a negative (and positive) feature. The (adjusted) correspondence principle 9 states that negative features introduce a negation operator: they negate the subformula corresponding to the complex head, and the atomic subformula of the head predicate.

The distinction between *privative* and *binary* features is well known in linguistics. A privative feature [f] is simply either present or absent in the representation. A binary feature, on the other hand, can take two values, usually marked as [+f] and [-f].²³⁶

If empirical data do not distinguish between systems using privative and binary features, linguists dealing with feature systems opt for privative features in principle [cf. Adger 2003: 26–31]. For example, there are phonological theories using exclusively privative features, e.g. Government Phonology mentioned in §3.3.1. However, to the best of my knowledge, there is no syntactic theory without binary features. Starke [2004: 266–7, fn. 5] argues that syntax *cannot* use (only) privative features since languages often realize “unmarked” features as well.

Although syntax cannot do without binary features, the two values of a binary feature are usually not treated on par. One of them is *marked* and the other *unmarked*, where the criteria for markedness [cf. Starke 2004: 260–1]

²³⁶Multi-valued features and scalar features are also employed sometimes.

are notoriously problematic. The marked and unmarked value of feature [f] are usually marked as [+f] and [-f], respectively.

Let us assume that positive and negative feature, as defined in L* theory, are actually the marked and unmarked feature, as usually understood. More precisely, let the negative feature ([f_(Neg)]) be marked ([+f]) and the positive feature ([f]) unmarked ([-f]).

Let us illustrate this by sentential negation. Usually it is claimed that negated sentences are marked with respect to non-negated sentences, i.e. that [+neg] contained in a negated sentence is marked and [-neg] contained by a non-negated sentence is unmarked [cf. Starke 2004: 260]. In §5.7 we have analyzed sentential negation by assuming that NegP is a negative projection. It follows that the negative value (of feature Neg) is the marked one.

The above criterion provides a non-problematic definition of markedness. Specifically, it is defined non-circularly. A negative feature introduces negation operator and universal quantification, whose presence can be independently detected, e.g. by directional entailment (see §4.1.2) or by quantifier-related tools [cf. Szabolcsi 1997].

If the above definition of markedness turned out to be compatible to the usual view,²³⁷ it would constitute—to the best of my knowledge—the first really non-circular definition of markedness, a definition which would not be based e.g. on language typology (which leads to circularity, in my opinion), but on an independently motivatable and checkable semantic analysis.

6.4 On realization of focus: word order and prosody

From the viewpoint to standard minimalism, the realization of focus is unexpected in its word order and prosodic properties. If focusing was simply assignment of feature [Focus] to a constituent and checking of the feature in spec-FocusP, focusing should behave on par with other syntactic processes. This is not the case, however: in Slovenian focus is either at the end of the sentence or some word has a special prosodic realization.²³⁸ It also seems surprising that the phonological realization of a sentence does not precisely determiner the focus, see footnote 19 on page 31. (It is unimaginable, for

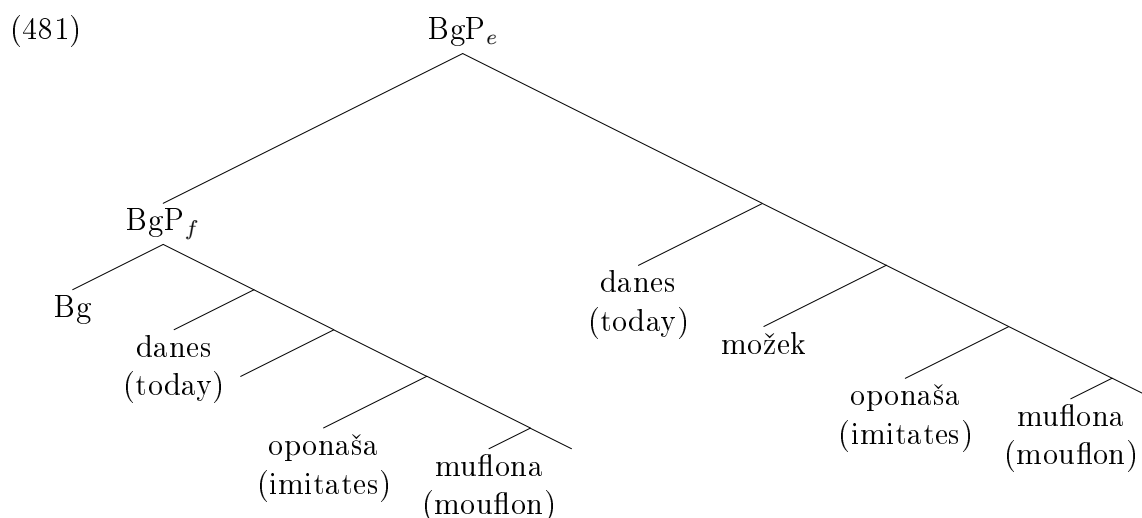
²³⁷Markedness is often associated to complexity: more complex expressions are marked. The above definition conforms to this view, since the value that is marked is the value that triggers both the head predicate *and* the negation operator, while the unmarked value only triggers the head predicate.

²³⁸We do not deal with focus associated to some operator in this section.

example, that we could not determine the agent in a sentence where it is overtly expressed.)

In this subsection I would like to argue why non-contrastive focus is at the end of a sentence in Slovenian, and show how it gets there. Following the discussion in §4.5, a sentence with focus has an LF such as (481). BgP_f and Bg_e are not exactly the same: subject *Možek* does not occur in BgP_f . This yields the meaning of (480) such that *Možek* is interpreted as focus.²³⁹

- (480) Danes oponaša muflona MOŽEK.
 today imitates mouflon Možek_{focus}
 ‘Today it is Možek who imitates a mouflon.’



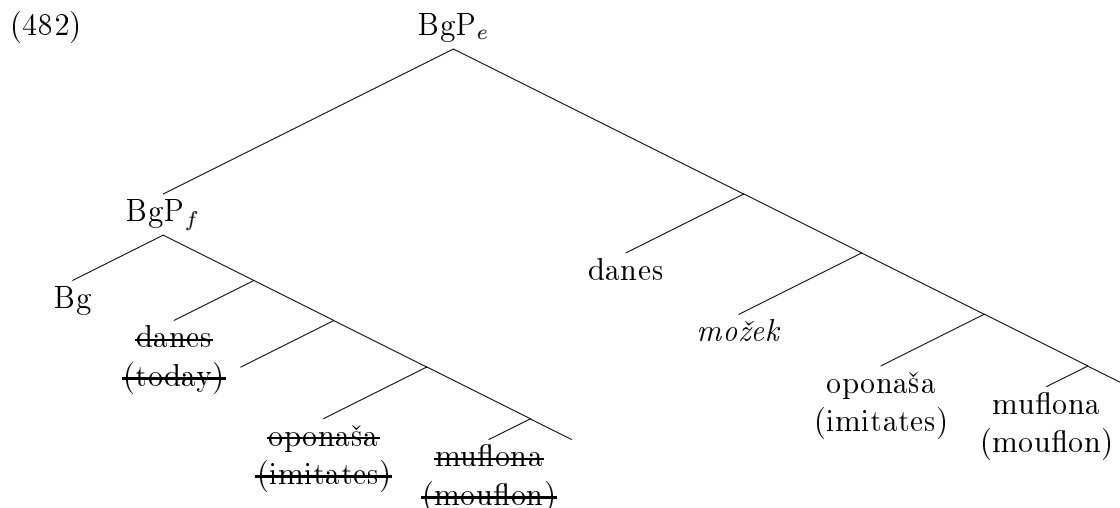
(481) is an elliptic structure. So far we have implicitly assumed that the complement of BgP_f is the elided part of the structure. In this case the elided (complement of BgP_f) and overt (complement of BgP_e) constituent are not completely isomorphic, the difference being in the focus, which is present only in the overt part. I assume that the position where the two parts are non-isomorphic (i.e. focus) is marked prosodically.

So, in Slovenian we get the contrastive focus when it is BgP_f that is elided, and the prosodic prominence of the contrastive focus is not unexpected. (i) We expect that the position where the two structures are non-isomorphic is marked phonologically, since elipsis is (at least partly) a phonological phenomenon. (ii) It is expected that focus is the point of non-isomorphism: it

²³⁹I have added a temporal adverb to the sentence to avoid the derivation which puts the verb at the beginning of the sentence. Sentence *Oponaša muflona Možek* ‘imitates mouflon Možek’ is ungrammatical for reasons independent of focusing.

follows from our semantic analysis that the constituent having no parallel constituent in complement of BgP_f is the one traditionally called focus.

(482) shows the phonological realization of a contrastive focus. (~~Strike through~~ words are not realized phonologically, *italic* words are emphasized.)



What happens if we complement of BgP_e is elided? First, the whole complement of BgP_e cannot get elided since it contains a constituent without a parallel in complement of BgP_f , i.e. focus. All the rest can be elided, though: such ellipsis is analogous to the ellipsis in (483) (so-called gapping structure). ((483) will not be semantically analyzed in the thesis. However, not that such ellipsis is very usual in Slovenian.) Then focus, as the only non-elided part of BgP_e 's complement, occurs in the (linearly) last position in the sentence. (We are assuming throughout the dissertation that the complex head (specifier in standard terminology) is phonologically realized before the complement, see Adger [2003], Radford [1997], Chomsky [1995], Brody [2003].)

- (483) Janko je Metki pomagal zažgati čarovnico, palčkom pa
 Hansel is Gretchen helped burn witch dwarfs but
 hudobno kraljico.
 mean queen
 'Hansel helped Gretchen to burn the witch and he helped the dwarfs
 to burn the mean queen.'

The contrastive focus in (482) is prosodically marked because it marks the position where the overt and elided structure are non-isomorphic. In

6.5 Other hints for further research

6.5.1 Grammatical number

In this subsection we discuss the meaning and syntactic position of grammatical number features.

The grammatical number cannot uniquely determine the size of the group of individuals which some objectual variable represents. The following examples illustrate discrepancies between the grammatical number and the size of the group.²⁴⁰

Let us first show that the size of a group of individuals cannot be determined by the grammatical number of the nominal. In (486) noun *zgodba* ‘story’ is singular, although the noun phrase refers to many stories (1001). In (487) the pluralia tantum noun *škarje* ‘scissors’ is plural although the noun phrase refers to a single object.²⁴¹

(486) Šeherezada je sultanu povedala tisočineno zgodbo.
 Scheherazade is sultan told 1001 story
 ‘Scheherazade has told 1001 stories to the sultan.’

(487) Na mizi ležijo (natanko) ene škarje.
 on table lie (exactly) one scissors
 ‘Exactly one pair of scissors is lying on the table.’

Next, the grammatical number of the cardinal also cannot determine the size of the group of individuals. As verbal agreement shows, all nominal cardinals (see §2.1.1 for the definition) are singular, although the noun phrase always refers to more than four individuals, see (488).

(488) Pet fantov je brcalo žogo.
 five boys-GEN is kicked ball
 ‘Five boys were kicking the ball.’

Finally, the grammatical number of the verb cannot determine the size of the group, see (487) and (488).

Although we have just shown that the grammatical number cannot determine the size of the group, we cannot claim the grammatical number and the size of the group to be completely independent. In the answers in (489)

²⁴⁰A detailed discussion of grammatical number is out of scope of the thesis. See e.g. Corbett [2000].

²⁴¹Since adverbial modifier *natanko* ‘exactly’ can be added to the noun phrase, it is clear that *ene* ‘one-PL,FEM,NOM’ can also function as a cardinal in (487), not only as an indefinite article.

the number of friends I am waiting for depends on the grammatical number of the noun.

- (489) Kaj počneš?
what do-2SG
'What are you doing?'
- a. Prijateljico čakam.
friend-SG,FEM,ACC wait-1,SG
'I am waiting for my friend.'
- b. Prijateljici čakam.
friend-DUAL,FEM,ACC wait-1,SG
'I am waiting for my two friends.'
- c. Prijateljice čakam.
friend-PL,FEM,ACC wait-1,SG
'I am waiting for my (three or more) friends.'

I adopt the analysis of grammatical number from Harley and Ritter [2002], who decompose it into two features, [Group] and [Min(imal)].²⁴² In their system, Slovenian grammatical numbers can be represented as follows: singular [Min] (the least possible number of individuals), plural [Group] (a group of individuals, where group is understood as 'not a single individual'), dual [Min, Group] (the smallest possible group).^{243,244}

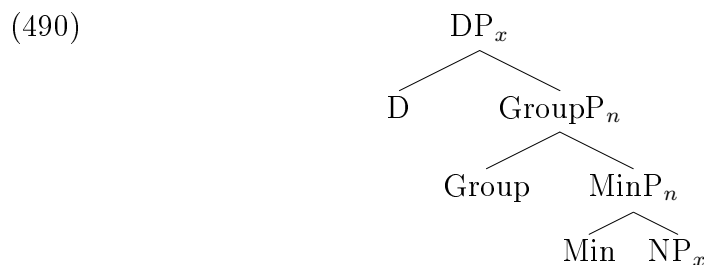
Thus, plural does not require that there are more than two individuals, but only that there is a group of individuals. Singular does not require that there is a single individual, but that the number of individuals be minimal. Dual does not require that there are exactly two individuals, but only that they form the smallest possible group.

I assume that features [Min] and [Group] are projected into a numerical spine. (I ignore the question whether $\text{MinP} > \text{GroupP}$ or $\text{GroupP} > \text{MinP}$ is their correct ordering in fseq.) In (490) I ignore the question how the numerical spine is associated to the nominal spine: by feature [Nral] or in some other way. I assume that the details of this association are relevant for explaining the discrepancies between the grammatical number and the size of the group that variable x stands for.

²⁴²More precisely [Min] has a subfeature [Aug(mented)] in their system, which we will ignore.

²⁴³Authors explain the absence of a grammatical number having no feature by an assumption that [Min] is the default feature.

²⁴⁴A formal definition of head predicates corresponding to features [Min] and [Group] is out of scope of the thesis. Let us only mention that it seems that, as disjointness and #, these predicates must be non-distributive.



6.5.2 Donkey anaphora

Donkey anaphora is an often-discussed issue. It is usually illustrated by (491).

(491) Every farmer who owns a donkey beats it.

Truth conditions for (491) are given by (492). The unusual aspect of the formula is that a universal quantifier corresponds to the indefinite phrase *a donkey*—it is characteristic for indefinite phrases that they introduce existential quantification.

(492) $\forall x \forall y [\text{farmer}(x) \wedge (\text{own}(x, y))] \text{beat}(x, y)$

L* theory offers a way to tackle the phenomenon. By correspondence principle 8 it follows from the positions of the occurrences of variables x and y that their quantifiers occur in the same position. Furthermore, the quantifiers must be of the same type, by correspondence principle 10. We have assumed in the discussion on universal determiners in §5.2.3 that *vsak* ‘every’ realizes some negative feature and that quantifier over x occurs exactly in the functional projection projected by that feature. Quantifier over x must therefore be universal. It follows that the quantifier over y is universal as well.

The problematic aspect of the above analysis is the assumption that variable y is within the scope of quantifier $\forall x$. (The position of $\forall x$ is determined without inspecting the positions of the occurrences of y .) In L* theory, where spines correspond to variables, it is not clear how spine y contained within the subject of the matrix clause can also be the object of the matrix clause. It is impossible that this is due to movement, since none of the positions c-commands the other.

6.5.3 Binding theory

Disjointness predicate has played a crucial role in the thesis. It is a head predicate of features [Def], [Bg], [Def_A], and perhaps also [Comment] and [And].

Disjointness is also very important in the binding theory. Assume that coindexed DPs correspond to the same variable. Principle C of the Binding Theory requires that subject and object are not coindexed—in our terms, that they correspond to different variables.

- (493) Včera_j so pred plesom tangerj_i obrili salserje*_{i/j}.
 yesterday are before dance tangueros shave salseros
 ‘Yesterday tangueros_i have shaved salseros*_{i/j} before the dance.’

(493) is unacceptable if someone is both a tanguero and a salsero. (Note that nothing is wrong with the intended meaning: such a dancer could even shave himself.) This means that the variables must stand for disjoint groups of individuals.

We will not suggest any formal mechanism linking L* theory and Binding Theory. However, given the fact that disjointness plays a crucial role in both, I strongly expect the link to exist.

6.5.4 Superlative and comparative determiners, and cardinals

I am currently at loss how to analyze superlative (494) and comparative (495) determiners containing a cardinal in their complement. (The sentences should be read without the emphasis on *pujsov* ‘pigs’.)

- (494) Jon je kupil največ pet pujsov.
 Jon is bought most five pigs
 ‘Jon has bought at most five pigs.’
- (495) Jon je kupil več kot pet pujsov.
 Jon is bought more than five pigs
 ‘Jon has bought more than five pigs.’

največ pet and *več kot pet* might be complex cardinals, cf. *največ pet* and *tisoč pet*. Then *največ pet* and *več kot pet* could be analyzed as coordinate structures, see footnote 189 on page 188 and §6.2.2.

6.5.5 Mass nouns

I believe that the analysis of mass nouns could be similar to the analysis of gradable adjectives.

Chapter 7

Conclusion

In the thesis, I have begun to develop a unified theory of syntax and formal semantics, which I call the L* theory. The necessity of unification stems from the finding of modern cognitive science that mind, and faculty of language in particular, is a modular system (chapter 3). Of course, the thesis could only deal with a limited amount of empirical data. However, L* theory is an analytic apparatus, which I believe could be used in the syntactic/semantic analysis of any linguistic expression of any language. Thus, I see the thesis as a beginning of syntactic–semantic research testing the hypothesis that syntax and semantics are one and the same module.

For clarity of exposition of the theory, both syntactic and semantic form were retained in the theory, while claiming that they are isomorphic. Logical Form (LF) of the Minimalist Program was adopted as the level of syntactic analysis; logical language L* was developed for the purpose of semantic analysis.

In chapter 2 I have tried to show (independently of the hypothesis that syntactic and semantic form are isomorphic) that formal language L* is a suitable tool for the semantic analysis. The argument is a cross-linguistic test of the hypothesis described below. Using L*, we have analysed the meaning of definite and superlative determiners, finding out that superlative determiners can have two readings: the majority reading (as *most* in English), and the plurality reading (as *največ* in Slovenian). Based on the comparison of the L* analysis of definite and majority superlative determiners we have postulated an original prediction to the effect that languages having a majority superlative determiner also have a definite determiner. The prediction was checked for twenty languages; no convincing counterexample had been found. The set of investigated languages included languages from various language families, excluding the possibility of genealogical explanation. That such an explanation is unsuitable, was further proved by comparison of Slavic lan-

guages: the only investigated Slavic language having a majority superlative determiner (Macedonian) is also the only investigated Slavic language having a definite determiner.

In chapter 4 we have constructed an isomorphism between LF and L*. The correspondence principles, used to formulate the isomorphism, are collected in the appendix A.

In the process of constructing the isomorphism we were forced to abandon the standard minimalist X-bar theory and adopt the X-bar theory without specifiers. The latter was derived (almost entirely) from the independently motivated assumptions on the semantic form, thus reducing the number of stipulations of the theory of syntax. Syntax could be thus based on three pillars, at least two out of which seem to be semantically motivated: (i) X-bar theory is motivated by L* theory; (ii) some linguists believe that fseq might be semantically derived. The principle of Relativized Minimality is thus left as the only purely syntactic principle.*

In chapter 5 we have employed the developed theory to analyse a range of independent data, focusing on comparative and superlative structures. To my best knowledge, this is the first unified analysis of all comparative and superlative structures. It encompasses all syntactic categories of comparatives and superlatives: adjectives, determiners and adverbs. Furthermore, it deals with both positive and negative gradable adjectives and analyses both absolute and relative reading of superlative constructions. Among other things, we have explained the source of meaning difference between the absolute and relative superlatives, and provided an explanation of the additional cross-linguistic generalisation, which was observed by inspecting the data shown in §2.3.1.

I have argued that focusing is tightly bound to the relative reading of superlatives. To the best of my knowledge, the thesis contains the first entirely syntactic analysis of (the meaning of) focus sentences. This is also why it has something to say about word order and prosody of these sentences (§6.4).

Focus also played a great role in the analysis of comparative adjectives, enabling us to overcome certain problems of the former approaches. The only class of comparatives which we were unable to analyse were comparative structures with a nominal complement. However, we have argued that the previous analysis of these structures are also incomplete (5.5.4).

We have provided a novel—and, at the first sight perhaps a bit strange—analysis of sentential negation. Without additional (and otherwise unmo-

*Even Relativized Minimality might not be limited to syntax (or even language), since similar restrictions seem to hold in other cognitive fields, for example vision. [Starke 2006: cf.]

vated) assumptions, in L* theory sentential negation cannot be simple the introduction of a negative operator. The suggested semantic analysis is more complicated than that. We have argued that, since sentence negation seems to be a relatively difficult processing task, this makes it more convincing from the psychologist's viewpoint.

One of the most pervasive syntactic phenomena is agreement. If we adopt the cartographic view, ϕ -phrases must be viewed as exceptional with respect to the hypothesis that extended projections are generated conforming to the universally fixed sequence of functional projections. We have adopted a (suitable formalization) of this exceptionality as one of the axioms of L* theory and used it as a crucial component in the analysis of comparatives and superlatives. Furthermore, it was also very important in the analysis of cardinal numerals. In the thesis, we have, using a unified set of assumptions, analysed nominal and adjectival cardinal numerals, cardinal numerals as heads of small clauses, and complex cardinal numerals.

L* theory contains no stipulation on the order of satisfaction of argument positions of head predicates (i.e. predicates corresponding to syntactic features). In the thesis, this fact was only used in the analysis of cardinal numerals and small clauses; however, I believe that it will turn out to be very important in analysis of further phenomena. The order of satisfaction is determined by the order of feature projection, therefore a feature can project in any order. So, the same meaning can arise from different orders, and different orders generate different syntactic configurations. For example, take feature [Property]: if it is first projected into an AP and then into a DP, we get an attributive usage of an adjective; if the order of projecting is reversed, we get a predicative usage (adjective is a head of a small clause). It follows that natural language couldn't have attributive adjectives without also having small clauses, and vice versa. The potential predictive power of order reversal, if used on all postulated syntactic features, seems enormous.

The analytical apparatus of L* theory is detailed only in its semantic aspects. Phonological realization is not discussed much, neither from the syntactic nor from the morphological perspective.

I thus believe that one of the priority tasks in the development of L* theory should be extension of its morphosyntactical aspects; I believe that using the tools of nanosyntax might be very fruitful. Furthermore I believe that in the process of integration, L* theory will not be simply a passive receptacle of morphosyntactic tools of other theories, since it imposes heavy restrictions on X-bar theory. I expect the cooperation to be particularly fruitful when it comes to ellipsis, since L* theory postulates elliptic structures in places where this is not usual practice. This broadens the empirical basis of the

theory of ellipsis and thus opens a path to new findings in this field.

Appendix A

Correspondence principles

Correspondence Principle 1 *The semantic component of FL preserves hierarchical structure. (page 131)*

Correspondence Principle 2 *Individual predicates (in L^*) correspond to conceptual features (in LF).²⁴⁵ (page 141)*

Correspondence Principle 3 *Logical connective \wedge (in L^*) corresponds to a branching node (in LF). (page 141)*

Correspondence Principle 4 *Truth value 1 (in L^*) corresponds to a terminal node (in LF). (page 142)*

Correspondence Principle 5 *A restricted (existential or universal) quantifier Q (in L^*) may correspond to a node X (in LF). If X is a maximal projection, i.e. an XP, then the restrictor and nuclear scope of Q correspond to the specifier and complement of XP, respectively. (page 142)*

Correspondence Principle 6 *Variables of L^* are in bijective correspondence to spines at LF. (page 147)*

Correspondence Principle 7 *Head predicates correspond to syntactic features. The arguments of head predicates are determined by projection: the variable corresponding to the spine which the feature is projected into becomes the argument of the head predicate of the feature. (page 152)*

Correspondence Principle 8 *The implicit quantifier Qx occurs in the lowest node dominating all occurrences of variable x in the L^* expression. (page 156)*

²⁴⁵This correspondence principle is a simplification, see 4.5.1.

Correspondence Principle 9 *The negative operator in L^* can be introduced by (i) a functional projection $NegP$: then its complement is negated; or a (ii) final functional projection of a feature having negative value: then the complex head of its functional projection is negated. (page 163)*

Correspondence Principle 9 (adjustment) *The negative operator in L^* can be introduced by (i) a functional projection $NegP$: then its complement is negated; or a (ii) final functional projection of a feature having negative value: then the complex head of its functional projection and the atomic formula of the head predicate are negated. (page 246)*

Correspondence Principle 9 (second adjustment) *The negative operator in L^* is introduced by a final functional projection of a feature having negative value. Operator \neg negates the complex head of its functional projection and the atomic formula of the head predicate. (page 247)*

Correspondence Principle 10 *An implicit (restricted) quantifier is universal if it occurs in the final projection of a negative feature; otherwise, it is existential. (The node where \forall occurs is interpreted as a disjunction.) (page 164)*

Correspondence Principle 10 (adjustment) *An implicit (restricted) quantifier is universal if it occurs in a functional projection introducing a negation; otherwise, it is existential. (The node where \forall occurs is interpreted as a disjunction. (page 247)*

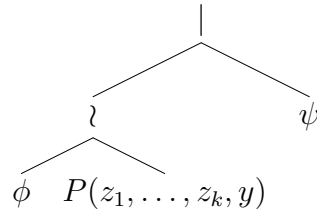
Correspondence Principle 11 *Let formula ϕ correspond to node X . Let X contain feature $[f]$, which is projected from X into fP , i.e. X is a head of fP . Let functional projection fP be a part of spine y : fP is a fP_y . Let head predicate P correspond to feature $[f]$. If fP has a complement, call it YP and call its corresponding L^* formula ψ .*

Assume that the global position of the atomic formula of head predicate P is next to functional projection fP_y . Further assume that feature $[f]$ is also projected in spines z_1, \dots, z_k : the atomic formula is thus of the form $P(z_1, \dots, z_k, y)$.

Then L^ formula $(\phi | P(z_1, \dots, z_k, y)) \wr \psi$ corresponds to LF expression (496), where $|$ and \wr are connectives determined by other correspondence principles. (A tree-like representation of the formula is given in (497).) (page 179)*

$$(496) \quad \begin{array}{c} fP_y \\ \wedge \\ X_{[f]} \quad (YP) \end{array}$$

(497)



Correspondence Principle 12 *Let XP and YP in (345) be isomorphic modulo ZP , i.e. they would be truly isomorphic if YP would also contain ZP , in the position, parallel to the position of ZP in XP . Then fP_x is an elliptic structure.*

Assume that variable w corresponds to the spine in YP in the position parallel to the position of ZP in YP . Then the implicit quantifier Q over w is positioned between fP_x and fP_y . (page 183)

Correspondence Principle 13 *The atomic formula of the head predicate of some feature is integrated between the lowest final projection of the feature and the head of this projection. (page 187)*

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