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Czech Negation from the Formal Perspective

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To the memory of my parents

Contents

Introduction

1 Acknowledgments

I am very grateful to my dear colleagues and students who read or heard large portions of this book and provided me with so much needed comments and feedback. Ivona Kučerová helped me to shape nearly every idea which appears in this book, so I want to thank her in the first place. My greatest intellectual debt is undoubtedly in Fred Landman's work, as I use his Language of Events and Plurality in every chapter of this book. I hope I didn't simplified his theories too much and I am very grateful to him for his kind explanation of more difficult parts of his framework to me. I also want to thank members of the Department of Linguistics and Baltic languages for providing me with a great working place, particularly I am grateful to Ondřej Šefčík for being the best boss which I ever had (honestly) and Václav Blažek for kindly reminding me that I should finish the book better sooner than later; finally all the others member of our department for making Brno a good place for the intellectual work.

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Some ideas in this book are based on earlier versions of my attempts to describe the formal properties of Czech negation. A previous version of chapter 3 was published as Dočekal (2011). Some of the ideas of chapter 4 appeared in Dočekal (2012b). The material presented in chapter 6 is a part of a joint work with Ivona Kučerová and is to some extent contained in our article Dočekal and Kučerová (2013). However, much of the text in these articles was rewritten and a lot of material was added. And the present book improves upon the analyses reported in the articles in many respects.

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The last three years in which I worked on this book were filled with major changes in my life. I became the father of my lovely twins, Mariana and Mojmír and even though I haven't looked like that all the time, I certainly know that nothing in Czech negation

is more important than their screaming *ne ne ne ne, tati*. I also want to express very special thanks to my wife Markéta, because without her support I wouldn't have written a single word of this book.

2 Introduction

This book deals with the meaning of Czech negation. The general framework is formal semantics, a model-theoretic style of explaining the meanings of natural language through the reference of its expressions. I build on the nowadays well established tradition which started 40 years ago with Montague (1973). I focus a lot on the formal analyses of negation (as already suggested by the title of the book), which necessarily means that some (very interesting) aspects of natural language negation lie beyond the grasp of my theories. This is the main reason I mostly just touch the issues which are concerned with the pragmatics of negation and which were of the central interest to Czech linguists dealing with negation (such as Hajičová (1973), Hajičová (1974) and Petr et al. (1986)).

In Chapter 1, I introduce the semantic theory developed in Landman (2000) and Landman (2004). Landman's Language of Events and Plurality will be the main framework I will use in the rest of the book as it offers very restrictive and heuristically extraordinarily useful formalization of natural language negation.

In chapter 2, I will be concerned with the formalization of the meaning of negative noun phrases in Czech. I will aim to establish their indefinite status and compare them with regular quantifiers which can be found in non-negative concord languages like English.

In Chapter 3, I will be concerned with the interaction between negation and lexical aspect. As negation seems to behave in some cases as a lexical aspect operator which is able to turn telic events into atelic ones. Regarding that issue, I will claim that the proper understanding of the natural language aspect allows us to retain the simple semantics for negation as the truth-reversing function and that natural language negation doesn't have any special aspectual properties.

In Chapter 4, I will be concerned with the scope preferences of negation in sentences with universal subjects. I will claim that the most decisive factor is the concurrence in natural language and that for most cases this concurrence results in the fixation of scope between the negation and the universal quantifier.

In Chapter 5, I will be concerned with two types of negative questions – negative degree and negative manner questions. Such questions were reported in some languages as ungrammatical which was theoretically explained as them being weak islands – schematically configurations from which wh-movement isn't possible. Czech negative manner and degree questions are grammatical though which I take as an empirical argument against the current theories of weak islands. An attempt to reduce the cross-linguistic variation of the negative degree and manner questions to the exhaustivity and intervention effects is accomplished in that chapter.

This book is not intended to play the role of the comprehensive guide to Czech negation

(or negation cross-linguistically – see Horn (1989) for the Book of that kind). The nature of the tools I use and my own intellectual limits restrict my linguistic enterprise so that it results in four case studies connected by the data and the method – Czech negation and formal semantics respectively. Nevertheless, at least for me the case studies reveal a nice and elegant grammar machine of Czech even if in small details. I can only hope that this impression will be at least partially shared by the potential readers of the book.

1 The Frameworks

The main topic of this book is the natural language negation and its interaction with various aspects of the grammar of natural language: the second chapter of the book explores how the morphological negation on verb and on noun phrases is interpreted in Czech (as a negative concord language) and English, in the third chapter I will explore the interaction between negation and grammatical aspect, in the fourth chapter I will look at various scope interactions between negation and different quantified and numerical noun phrases, and in the last chapter I will examine the interpretation of some types of negative questions.

But before I will go for the different topics I just mentioned, I will summarise two big frameworks for the treatment of natural language semantics. First, in the section 1.1 I will provide an introduction into the framework of generalized quantifiers, a framework that has proven its great use for the study of natural language quantification in the past three decades, see Barwise and Cooper (1981) for the classical reference.

Second, in the section 1.2 I will show the main ingredients of the Language of Events and Plurality (LoP henceforth). LoP is based on the work of Landman (2000) and Landman (2004) which on Landman's previous work on the plurality in natural language, as reported in Landman (1989) and Landman (1997). LoP is extensively used for the description of plurality interpretation in the current formal semantics. But LoP offers a very exciting perspective for treatment of negation in natural language, as it fixes the scope of the verbal negation in the formalization over the existential closure of the event variable as I will demonstrate in the section 1.2.

Second motivation for my usage of LoP is the simple fact that it represents one of the rare exceptions in the modern formal semantics: it is a full blown framework with formalization of many ideas which were treated just as intuitions before. And lastly, the usage of LoP allowed me to understand many subtle issues of the plurality and aspect interactions with negation which I think are not possible to handle in any alternative framework I am aware of. But before I will introduce LoP, let me go through one historical step – a summary of the main concepts of the Generalized Quantifiers framework, which I think allows us to understand comparatively what is so important and beautiful about LoP.

1.1 NPs as generalized quantifiers

The article by Barwise and Cooper (1981) can be considered a cornerstone in the field of formal semantic treatment of noun phrases meaning. Barwise and Cooper (1981) draw on Montague (1973) in building an unified semantics of any kind of NPs, be they

as different as definites, indefinites, quantified noun phrases or noun phrases headed by cardinals. We can interpret this style of theory as the followers of Montague's idea that one syntactic category should be allways translated as the same semantic object. Even if this unification can be required from the methodological point of view, its realisation colides with some empirical data as we will see. But let's put this aside and for now I will provide a brief introduction into the framework of Generalized Quantifiers.

Barwise and Cooper (1981) start with two critical comments regarding the predicate logic treatment of quantification in natural language. First, the syntactic structure of quantified formulas in predicate logic and the syntactic structure of quantified sentences in natural language are according to Barwise and Cooper unsatisfactorily different. As an illustration, let's look at the following examples with the predicate logic formalization. The quantifiers *every/some* must be translated as "discontinuous" constituents made of predicate logice operators $\forall ... \rightarrow$ and $\exists ... \wedge$ respectively. This of course renders the truth conditions of the sentences right but goes a lot against the well established assumption that there's a correspondence between "constituent" structure of natural and formal language. Which means that if we have one phrase in natural language, we would expect that there's one unit in the formal language which will correspond to it.

(1) a. Every student is lazy.
a' $\forall x[student(x) \rightarrow lazy(x)]$
b. Some students are lazy.
b' $\exists x[student(x) \wedge lazy(x)]$

Second, Barwise and Cooper proved, that an NP such as *most N* isn't expressible the predicate logic of the first order. The natural language sentence like (2) cannot be formalized in the first-order predicate logic, even if we enrich its vocabulary with a third quantifier M corresponding to the natural language *most*. There are two possible translations of *most* into predicate logic – (3-a) and (3-b) – parallel to the existential and universal quantifiers as the formal logic translation of *some* and *every*.

(2) Most students are lazy.

(3) a. $Mx[student(x) \wedge lazy(x)]$
b. $Mx[student(x) \rightarrow lazy(x)]$

Consider a situation in which there are 20 people, 5 of them are students. If 4 of these students are lazy, sentence (2) is uncontroversialy true. But the truth conditions of (3-a) would output falsehood, as it's not true that most of the individuals (20) in the universe of discourse are both students and both lazy. In other words: the formalization in (3-a) doesn't render the truth conditions of the natural language sentence right.

But (3-b) doesn't fare better – it would output true in a first scenario but in a different scenario with 20 people, 5 students and only one of the students being lazy, (3-b) would be true unlike its natural language counterpart. Why? Because implication returns truth for any case where its antecedent is false, so 15 non-students would make the whole formula true, regardless of the number of lazy individuals among the students. Again a wrong result.

The discussion above indicates some of the problems that are met when one tries to define the first-order version of *most*. The main problem with the predicate-logic formalization of natural language quantification is that predicate logic does allow unrestricted quantification (e.g. predicate-logic formula $\forall x P(y)$ is syntactically and semantically well-formed in predicate logic) but every natural language quantifier comes with a restriction. This restriction can be a bit slopily emulated with the predicate-logic connectives in case of the quantifiers like *all/some/two/...* but this strategy fails in the case of the quantifier *most* e.g. I refer the diligent reader to Barwise and Cooper (1981) for further details and for the formal proof of unusability of the first order logic for the treatment of natural language quantifiers like *most*. This is one of the main reasons why Barwise and Cooper introduce a more robust and more efficient framework – generalized quantifiers. The main ideas of generalized quantifiers will be discussed in the next section.

1.1.1 NPs as sets of sets

The theory of generalized quantifiers brings a solution to both problems of predicate logic mentioned in the previous section – it is able to formalize the meaning of any natural language determiner (and moreover in a uniform fashion) and it assigns the non-discontinuous meaning to the determiners, making the formal language closer to the surface of the natural language. It achieves this goal by going beyond the boundaries of the first order logic: the intuitive meaning of the generalized quantifiers formalization of *most* in (4) is: *most* noun denotes the set of all properties which the most instantiations of noun bear. In other words, a generalized quantifier like *most sailors* denotes such set of properties which most sailors exemplify, e.g. the set of rum-drinkers, the set of swimmers and the set of scary songs singing individuals would be some of the sets in the set of sets denotation of the generalized quantifier *most sailors* (at least if we stick to the conventional image of a sailor). (4) (I follow the set notation which can be found in de Hoop (1992) e.g. as it seems to me more readable than the usual λ functional notation of generalize quantifiers) formalizes just this: $[\![mostN]\!]$ denotes such set of sets (X) over the universe of discourse ($X \subseteq E$) where each set member of X contains most Ns. The logical type of a generalized quantifier reflects this: its type is the $\langle\langle e,t\rangle,t\rangle$, the function from sets ($\langle e,t\rangle$) to the truth values ($\langle t\rangle$).

(4) $[\![Most\,\mathrm{N}]\!] = \{X \subseteq E : X \text{ contains most Ns}\}$
(E stands for the domain of discourse)

Generalized quantifiers offer a natural unification for the denotation of all types of NPs – the format is so rich that any type of NP meaning can be treated like a set of sets. This goes pretty well with the old Montague's impetus for the uniform mapping of the syntactical categories to the semantic types. In the generalized quantifiers framework all NPs are treated at the $\langle\langle e,t\rangle,t\rangle$ type. This seems rather unintuitive at the first sight at least for the proper names, which were at least since Frege's (1892) seminal paper treated like entities (hence of the $\langle e\rangle$ type). But in generalized quantifiers the proper

names can be represented as sets of properties which the respective entity instantiates.

If we accept a well established rule which constraints the conjunction only to the expressions of the same semantic type (and of course of the same syntactic category), we must admit that a proper name like *Peter* in (5) is of the same type as the generalized quantifier *some students.*

(5) I met Peter and some students.

Montague's solution to the conjunction problem was following from his uniform treatment of noun phrases semantics. As was already mentioned, it's straightforward to represent meaning of proper names as set of sets (type $\langle\langle e,t\rangle,t\rangle$), namely the as the set of all properties which the individual denoted by the proper name has. Then the logical type of proper name and quantifier like *some students* in (5) match and conjunction can apply. The Montague's strategy, even though formally coherent, was the generalization to the worst case: if some expression from natural language must be represented as a higher type in some context, then the expression must be represented as the higher type in all contexts. In that case, even the sentence *Peter smokes* is true if the set of smokers is one of the sets in the set of sets of properties which Peter has; and the sentence isn't formalized as a memeber-set relation between individual Peter and set of smokers. It is if course more natural to think about the denotation of a proper name like *Peter* as of an individual of the type $\langle e\rangle$ then as of set of sets of his properties but that doesn't make any argument against the Montague's theory; nevertheles we will see soon some real empirical problems which generalized quantifiers theory (following Montague in this respect) encounters. Partee and Rooth (1983) started a different tradition in dealing with this phenomena but I will introduce their type-shifting framework later.

Let's look at some examples of the generalized quantifiers treatment of the natural language determiners. (6-a) represents the meaning of *all* – *all N* is such set of sets, where each set contains all members of the N denotation ($[\![N]\!] \subseteq X$). (6-b) represents the meaning of *no*: *no N* is such set of sets which don't have any intersection with the denotation of N ($[\![N]\!] \cap X = \emptyset$). The generalized quantifier *no sailors* would denote set of sets like set denotation of the following VPs: *live on Mars*, *be a hamster*, *be a prime number*. The last example: numerical generalized quantifier in (6-c) denotes such set of sets which has the n-numerous intersection with the denotation of the N – a generalized quantifier like *at least two presidents of the Czech Republic* would represent a set of sets with the members like $\{x \in E$: x's first name is Václav$\}$, $\{x \in E$: x wears glasses$\}$, ... The generalized quantifier denotations in (6) correspond to total functions.

(6) a. $[\![\text{all N}]\!] = \{X \subseteq E : [\![N]\!] \subseteq X\}$
b. $[\![\text{no N}]\!] = \{X \subseteq E : [\![N]\!] \cap X = \emptyset\}$
c. $[\![\text{atleast n N}]\!] = \{X \subseteq E : |[\![N]\!] \cap X| \geq n\}$
d. $[\![\text{mostN}]\!] = \{X \subseteq E : |[\![N]\!] \cap X| > |[\![N]\!] - X|\}$

But the interpretation of some NPs in natural language is better treated as partial functions, the prime example are definite NPs such as *the N* or *both N*. Their denotation is given in (7): they are built on the semantics of generalized quantifier *all* but output un-

defined truth-value if the cardinality of the noun denotation doesn't meet the respective criterion. So NP like *the president of the Czech Republic* outputs undefined (unless the domain of quantification is contextually restricted to the present president or whoever else), because the Czech Republic had more than one representant of the role.

(7) a. $[\![\text{the n N}]\!] = [\![\text{all N}]\!]$ iff $|[\![\text{N}]\!]| = \text{n}$, otherwise undefined
b. $[\![\text{both N}]\!] = [\![\text{all N}]\!]$ iff $|[\![\text{N }]\!]| = 2$, otherwise undefined

Even if the generalized quantifiers framework works with sets of sets, there is a concept of witness sets introduced by Barwise and Cooper to go down in order: from sets of set to sets. Intuitively, we think about sentences like *John is a sailor* in terms of set membership: the sentence is true if John is the member of the set of sailors (formally: $\text{j} \in \{\text{x} \mid \text{x is a sailor}\}$). But Barwise and Cooper (1981), following Montague (1973), argue exactly for the opposite perspective with respect to what is the function and what is its argument: a sentence like *John is a sailor* is true in their framework if and only if the property of being a sailor is one of the properties (family of sets) which John has (formally: $\{\text{x} \mid \text{x is a sailor}\} \in \{\text{X} \subseteq \text{E} \mid \text{j} \subseteq \text{X}\}$). The idea of witnesses (or witness sets) can be understood as restoring the former intuition: the witness set for John is a singleton set $\{\text{j}\}$, and the sentence John is a sailor is true if and only if the witness set for John is a subset of the set of sailors. Similarly for quantifiers: the witness set of the quantifier *every sailor* is the set of sailors, the witness set of the quantifier two sailors is the set of sets containing as members sets of two sailors and so on.

1.1.2 Classification of determiners in the generalized quantifiers framework

The generalized quantifiers framework lead to many fruitful outcomes: one of them is the search for formally meaningful semantic universals. The basic idea defended by Barwise and Cooper is that natural language determiners are constrained to form just a subset of logically possible relations between sets. In other words, no natural language contains determiners which wouldn't satisfy all basic constraints as Extension, Conservativity and Quantity discussed in detail in Barwise and Cooper (1981) and sketched shortly below. Because the issue of semantic universals is tangential to the purposes of my book, I will just shortly mention two of the semantic universals: extension and conservativity.

The extension constraint is formalized in (8) and in a nutshell it says that enlarging the universe of discourse ($E \subseteq E'$) shouldn't change the truth value of the determiner ($D_E AB \leftrightarrow D_{E'} AB$). Consider a natural language sentence like (9). This sentence (if true) in a universe of discourse containing just entities in the Czech Republic should remain true even if we enlarge the universe of discourse to all European countries; this holds of course only if the denotation of A (sailors) and B (smokers) is kept fixed as stated in the formula ($D_E AB \leftrightarrow D_{E'} AB$).

(8) *Extension*
$\text{A, B} \subseteq \text{E} \subseteq \text{E'} \rightarrow (\text{D}_E\text{AB} \leftrightarrow \text{D}_{E'}\text{AB})$

(9) All sailors smoke.

Another universal of Barwise and Cooper is conservativity, as defined in (10), it says that the truth-values of any determiner remain the same, if we substitute its second argument for the intersection of the second argument with the first argument ($B \cap A$). It can be demonstrated in natural language with the equivalences in (11).

(10) *Conservativity*
$D_E AB \leftrightarrow D_E A(B \cap A)$

(11) a. Some students smoke.
≈ Some students are smoking students.
b. All students are lazy.
≈ All students are lazy students.
c. Two students are smart.
≈ Two students are smart students.

Conservativity claims that we can ignore all entities outside of the intersection of A and B. Compare this with a focus sensitive particle like *only* in (12). For inspection of the truth conditions of (12) we must take into account individuals outside of A and B, because if (12) is true, then no other entity than sailors can smoke. From this it follows that *only* doesn't obey conservativity and isn't natural language determiner which is hardly surprising for a linguist, as *only* can modify any syntactic constituent, unlike regular determiners which can attach only to NPs.

(12) Only sailors smoke.

Besides the universal constraints on the denotation of natural language determiners as extension and conservativity, Barwise and Cooper examined some other formal properties of the binary relations between sets, which are satisfied only by some subsets of natural language determiners. These conditions thus yield classification of determiners into subclasses distinguished by these different semantic properties. I will discuss one such property: *Monotonicity*.

1.1.3 Monotonicity

The only property of generalized quantifiers which I will discuss in this book allows us to classify the natural language determiners according to their monotonicity. Monotonicity is imported to the natural language semantics from mathematics where monotone increasing are such functions which preserve the given ordering. For natural numbers, example can be a function like $f(x) = x * 2$, because for any x and y such as $x \leq y$, $f(x) \leq f(y)$. Monotone decreasing are such functions, which reverse the ordering, so if again $x \leq y$, $f(x)$ is monotone decreasing, if $f(x) \geq f(y)$, again an example from arithmetic would be a function like $f(x) = 10/x$.

In natural language and particularly in the generalized quantifiers framework, the monotonicity is determined with respect to both arguments of the determiner: nominal

– A and verbal – B. The monotone increasing and monotone decreasing determiners with respect to the first argument are in (13) and monotone increasing and monotone decreasing determiners with respect to the second argument are defined in (14).

(13) a. MON↑: If D_EAB and A $\subseteq$ A', then D_EA'B
b. MON↓: If D_EAB and A' $\subseteq$ A, then D_EA'B

(14) a. MON↑: If D_EAB and B $\subseteq$ B', then D_EAB'
b. MON↓: If D_EAB and B' $\subseteq$ B, then D_EAB'

Let's demonstrate the monotonicity properties of some determiners on examples. In natural language the ordering is usually reducible to entailment and because if x is a dog, the we can entail that x is an animal, we can classify the determiner *some* as monotone increasing on its first argument, as witnessed by the validity of an implication in (15-a). The determiner *all* is monotone decreasing on its first argument, as the implication in (15-b) shows, because the implication goes in the opposite direction: from sets to subsets.

(15) a. Some dogs bark.
→ Some animals bark.
b. All animals sleep.
→ All dogs sleep.

Some preserves the ordering also on its second argument, see (16-a), as ⟦long books⟧ $\subseteq$ ⟦books⟧, but *no* reverses the ordering on its second argument, as ⟦live in this town⟧ $\supseteq$ ⟦live in the suburbs of this town⟧, see (16-b)

(16) a. Some linguists write long books.
→ Some linguists write books.
b. No linguists live in this town.
→ No linguists live in the suburbs of this town.

Besides the monotone increasing and monotone decreasing determiners, there is a lot of determiners which are non-monotone in any of their arguments, good example is the determiner *exactly two* in (17).

(17) a. Exactly two students came.
$\nrightarrow$ Exactly two people came.
b. Exactly two people came.
$\nrightarrow$ Exactly two students came.
c. Exactly two students came late.
$\nrightarrow$ Exactly two students came.
d. Exactly two students came.
$\nrightarrow$ Exactly two students came late.

The property of monotonicity has been famously first used by Ladusaw (1980) to describe the distribution of negative polarity items, expressions like English *ever* or *any*

which occur primarily in the scope of negation and generally in the scope of monotone decreasing quantifiers (also called downward entailing quantifiers). This is the reason, why (18-a) is ungrammatical – *someone* is monotone increasing on both its arguments. (18-b) is grammatical, because *all* is monotone decreasing on its first argument, but monotone increasing on its second argument – see ungrammatical (18-c), unlike *no* which is monotone decreasing on both arguments, see (18-d).

(18) a. *Someone has ever been to Mars.
b. All students, who have ever been to Prague, love it.
c. *All students love anything.
d. No student loves anything difficult.

1.2 Formal framework

1.2.1 Language of plurality

In this section I will introduce the tool which I will use as the main formal instrument in the rest of the book. I presented the generalized quantifiers framework in the last section as an foreword to the main theoretical tool presented now for two reasons:

1. Generalized quantifiers framework represents a very robust and generally acclaimed framework which works pretty well in many cases. Although especially for indefinites it predicts behaviour not attested in natural language. And because I will describe Czech negative noun phrases which seem (at least in Slavic languages) to act as indefinites, I will comment on the generalized quantifier framework mostly critically. But if the generalized quantifiers didn't exist, then neither of the competing frameworks which are now so popular in formal semantics, wouldn't be on the market either. So I take generalized quantifiers to be a necessary step in our understanding of the noun phrases meaning. The step against which I will differentiate Landman's framework introduced below.

2. In this section I will introduce the framework of Fred Landman which he calls the Language of Plurality (hence LoP) – the details of the approach can be found in Landman (1989, 2000, 2004). And I think the main ingredients of LoP can be very well grasped just on the background of the generalized quantifiers (hence GQ) approach.

Landman's LoP is one of the frameworks which erode the uniform treatment of semantics of Noun phrases. So unlike GQ, where all noun phrases are represented as sets of sets (of course, there is a classification of NPs according to criteria like monotonicity, weak/strong force, ... but this classification isn't reflected in the lexical entries and types of various determiners and NPs), LoP treats various types of NPs not uniformly. My motivation for using LoP is the following:

1. LoP offers a very restrictive interpretation of verbal and nominal negation in the full blown framework, where each step in the derivation is controlled by the formal definition of the framework – see Appendix. So every formalization of a natural language sentence can be rigorously built step by step according to the rules of LoP. I consider this property of LoP very important as it offers a way how to control sometimes very subtle meaning differences expressed by different formulas. And I will provide the schematical derivations of the logical forms in LoP for the most important sentences under scrutiny.

2. LoP integrates formal semantics of number, unlike the GQ, where e.g. both denotation of singular universal and plural NPs like *every boy* and *all boys* get the same type and denotation – the set of all supersets of the set of boys. This is empirically wrong for many reasons – one of them is the incompatibility of singular universal quantified NPs with collective predicates like *gather*. Compare the unacceptability of sentence like **Every boy gathered* with grammaticality of a sentence like *All boys gathered*. It seems that the reason of ungrammaticality of the first sentence lies in semantics – intuitively collective predicate cannot be applied to atoms and singular universals quantifier like *every boy* cannot produce anything higher than atoms – GQ faces a problem if it represents the meaning of both quantifiers identically. Of course there are attempts to bring the semantics of number in Montague's framework (like Bennett (1976)) but I think that full integration of the plurality phenomena would lead to such dramatical changes in the GQ theory that the result would be (overall) quite close to LoP.

As I discussed above, LoP treats various types of NPs differently. We can distinguish three criteria which cut the landscape of NP semantics:

1. The distinction between scopal noun phrases and non-scopal noun phrases: non-scopal noun phrases can be entered into event types, scopal noun phrases not. It's the distinction between e.g. quantified NPs like *every boy* and indefinites like *a boy/three boys*. The former is obligatory quantified-in, resulting in a wide scope interpretation with respect to the event variable , the later can be quantified-in but can also be interpreted under the event variable resulting in a semantics close to the weak indefinites discussed above. I will address this distinction in detail in section 1.2.3.

2. The distinction between quantificational noun phrases, definites and indefinites: Landman (2004) distinguishes these three types according to their **starting type of interpretation**:

   a) quantificational noun phrases start out as type $\langle\langle d,t\rangle,t\rangle$. A short note on types: Landman differs from the traditional Montague typing because he uses his $\langle d\rangle$ type instead of Montague's $\langle e\rangle$ type for entities and $\langle e\rangle$ type for events. I usually use Landman's typing but if I do not, it should be clear from the context and hopefully will not confuse the diligent reader.

b) definites start out at type $\langle d \rangle$

c) indefinites start out at the predicative type $\langle d, t \rangle$.

So NPs (representing the three classes respectively) like *every boy*, *the boy* and *a boy* would have the same type in GQ framework: $\langle \langle d, t \rangle, t \rangle$ and the following interpretations:

a) *every boy* in GQ: {X ⊆ E: ⟦BOY⟧ ⊆ X }

b) *the boy* in GQ: {X ⊆ E: ⟦BOY⟧ ⊆ X } iff |⟦*BOY*⟧|=1

c) *a boy* in GQ: {X ⊆ E: ⟦BOY⟧∩ X ≠ ∅}

In LoP the three NPs would obtain the following interpretations (and the types discussed above):

a) *every boy* in LoP: λP.∀x ∈ BOY:P(x); the type $\langle \langle d, t \rangle, t \rangle$

b) *the boy* in LoP: $\delta(\lambda x.\text{BOY}(x))$ – δ is defined as the maximality operator picking up the supremum in the denotation: for singular NPs it is consequently defined only if there is one atom in the denotation of the predicate; the type $\langle d \rangle$

c) *a boy* in LoP: $\lambda x.\text{BOY}(x)$; the type $\langle d, t \rangle$

3. The distinction in scalar maximalization properties of non-scopal noun phrases: the distinction between downward entailing maximalization triggers and other NPs. I will discuss this distinction in the following section.

Before I present the different interpretation of NPs in LoP, I will end this section by presenting the basic machinery of LoP. Let us assume a Boolean domain with three individuals in it, as shown in (19). The individuals at the bottom line are singularities, the atoms of the model; the entities above the singularities are plural entities. In the Boolean semi-lattice, the domain is partially ordered by ⊑, the part-of relation, and closed under ⊔, the sum or join operation. The formal axioms of the model can be found in the standard accounts of singular/plural distinction (Link (1983), Landman (1989)), where semi-lattices like (19) are used to model denotations of count expressions. Concerning the denotation of singular and plural nouns, the singular count nouns (like DOG) denote a set of atoms or, as in (19), the elements at the very bottom of the semi-lattice, hence, here a,b,c. The plurals (like DOGS) denote the set of atoms closed under the sum, that is the set of elements a,b,c, a ⊔ b, a ⊔ c, b ⊔ c, a ⊔ b ⊔ c in (19).

(19)

	a ⊔ b ⊔ c	
a ⊔ b	a ⊔ c	b ⊔ c
a	b	c

In Link's semantics, a singular predicate like BOY denotes a set of singular individuals only, hence a set of atoms. Pluralization is a closure under sum: *BOY adds to the extension of BOY all the plural sums that can be formed from the elements of BOY,

as formalized in (20). Besides the pluralization operator * (which is a theoretical tool for description of plural on nouns), let us assume the group-forming operation ↑, which is an operation that maps a sum onto an atomic (group) individual in its own right. Landman (2000)'s definition is shown in (21) and in the tables under I give mechanics for it to work. The group-forming operation packages pluralities into atoms. According to (21), ↑ operates in the domain of sums of individuals (assembled from individuals, henceforth called SUM-IND), and its output belongs to the domain of groups (GROUP in (21)). The same process can be observed in the behavior of bunch denoting nouns like *team, committee* or *government*. Bunch nouns, despite their morphological singularity, denote plurality.

(20) *BOY = d ∈ D: for some non-empty X ⊆ BOY: d = ⊔ X

(21) a. ↑ is one-one function from SUM into ATOM such that:
(i) ∀ d ∈ SUM-IND: ↑(d) ∈ GROUP
(ii) ∀d ∈ IND: ↑(d) = d

b. ↓ is function from ATOM onto SUM such that:
(i) ∀d ∈ SUM: ↓(↑(d)) = d
(ii) ∀d ∈ IND: ↓(d) = d

The framework is illustrated in two tables – (22) and (23), the first table (INDIVDUAL) shows how sums are assembled from atoms, the second table (GROUP) demonstrates how group-atoms are closed under the sum operation too, the pluralization operation works in the same vein as in the INDIVIDUAL part, but this time it ranges over semantical opaque "impure" atoms to use Link's terminology. The top row of both sub-domains represents kinds (more about that special ontological part of the universe later) which are basically taken as the maximal extension of a property (kind of dogs with three individuals would be their sum a ⊔ b ⊔ c). The second row (in the universe with three individuals) show sums of atoms and the bottom row is the level of atoms. Kinds of course belong to sums also but have the maximality distinguishing property unlike other sums.

(22)

	a ⊔ b ⊔ c		KIND
a ⊔ b	a ⊔ c	b ⊔ c	SUMS
a	b	c	ATOM
INDIVIDUAL			

(23)

	↑(a ⊔ b) ⊔ ↑(a ⊔ c) ⊔ ↑(b ⊔ c)		KIND
↑(a ⊔ b) ⊔ ↑(a ⊔ c)	↑(a ⊔ b) ⊔ ↑(b ⊔ c)	↑(a ⊔ c) ⊔ ↑(b ⊔ c)	SUMS
↑(a ⊔ b)	↑(a ⊔ c)	↑(b ⊔ c)	ATOM
GROUP			

1.2.2 Maximalization of different NPs

In this section I will briefly discuss the relationship of LoP and pragmatics of implicatures. It is one of the established hypotheses of current formal semantics, that implicatures (like scalar implicatures connected to numerals) are cancellable unlike entailments

and (at least some) presuppositions (see Portner (2005, 203) for a textbook overview). So the meaning of sentence like (24) comprises of at least two parts: asserted (semantical, entailed) and implicated (pragmatical) meaning. Both of them are paraphrased in (24-a) and (24-b). The asserted meaning is robust and cannot be changed without drastical revision of the whole discourse, implicatures on the other hand are defeasible and open to corrections. Both claims are again demonstrated below (the style of presentation follows Portner's textbook):

(24) I drank five beers.

a. entailment: I drank at least five beers.

b. implicature: I didn't drink six beers.

a' ??I drank five beers, but I didn't drink four. (failed cancellation of entailment)

b' I drank five beers and in fact I drank six. (cancellation of implicature)

The implicatures are derived Grice's Maxims and because speakers can obey different maxims, the implicatures are cancellable (see Grice (1989)).

How about LoP and implicatures? First notice that LoP delivers the basic meaning for sentences with numerical NPs without implicatures, so non-downward, non-upward entailing numerals are treated without maximalization and consequently their truth conditions are too weak. Sentence like (25) obtains logical form like (25-a) which claims that there was an event of leaving with a sum of three boys as its plural agent. LoP is a neo-Davidsonian framework working with the explicit event variables (of type $\langle e \rangle$) and thematic roles (Agent, Patient, Theme, ... which are usually used in the shortcut form in the formulas) which are taken as functions from events to entities, see Appendix to the current chapter and Landman (2000) for details. Such sentence is compatible with four, five, six, ... boys leaving because in such a situation, there of course is an event of leaving with three boys as an agent. I will address this problem in the rest of the present section but let's look at another problem first.

(25) Three boys left.

a. $\exists e[LEFT(e) \wedge \exists x \in {}^*BOY \wedge |Ag(e)| = 3]$

It is a problem which faces any Davidsonian theory like Landman's LoP. It stems from the fact that existential closure over an implicit event variable (which is part of any Davidsonian theory) entails existence of something (event or set of some sort if the theory is translated into second-order logic). But downward entailing quantifiers are compatible with there being nothing. So e.g. (26) entails the existence of a leaving event, and there is no such entailment. There are at least two solutions of the problem: easy and hard solution. Easy solution follows the way of allowing null object into the semilatice denotation of thematic roles – see Landman (2004) for the implementation. The hard solution can be found in Landman (2000). As this issue of choosing between the two options will be not important in my investigations, I leave it aside and will tacitly assume the null object in the denotation of thematic roles.

(26) At most three boys left.

a.???$\exists e[LEFT(e) \wedge \exists x \in {}^*BOY \wedge |Ag(e)| \leq 3]$

But back to the problem with non-downward, non-upward entailing numerals, which will be important in the last chapter of the book where we will consider interpretation of negative manner and especially degree questions. (Landman, 2000, 231) discusses the issue and follows the established fact that implicatures are cancellable, so the maximality requirement shouldn't be part of the semantics proper. Landman's reasoning can be demonstrated by the following example. Imagine a scenario with departments competing for the most rigorous attitude to students – there is a threshold – if during examination period three professors reject ten students (cumulatively – for the definition of cumulativity see 1.2.3.1), the department is rigorous enough. In such a context you can say something like (27).

(27) Our department is rigorous. Three professors rejected ten students, in fact four professors rejected fifteen students at our department.

But for Landman the maximalization is local, not global as in the classical Grice's approach to implicatures. He builds his idea on examples like (28) which show that the global (Gricean) approach to implicatures results in an inadequate implicated meaning, especially if we take into account also sentences with numerical NPs in the scope of quantifiers like *every*. Gricean implicatures of (28) would mean (as shown in (28-a)), that there are some professors who didn't reject three students. (28) doesn't have such implicature which signals that the local approach to implicatures would be maybe more appropriate. In the next section we will see that quantifiers like *every* obligatory quantify-in over the event variable and if the implicatures are calculated at the event type, the local implicatures for (28) are (28-b) which seems to reflect our intuitions correctly.

(28) Every professor rejected three students.

a. Grice (global) implicature: It is not true, that every professor rejected three students.
= Some professors didn't reject three students.

b. Local implicature: for every professor x: x rejected not more then three students.

Landman (2000, 236) defines his maximality implicatures in form of the Implicature Construction Principle (ICP) – see (29). With respect to the local implicatures of numerical noun phrases, we apply the second point of ICP: in examples like (28) it delivers us the local negation of stronger alternatives on the scale.

(29) **Implicature Construction Principle**

1. The core of the *exactly*-implicature, triggered by a numerical noun phrase, is constructed at the event type that that noun phrase is in, relative to the scale constructed there.
2. From the core of the *exactly*-implicature, the actual implicature of the sentence asserted is built up, following the semantic composition of the sen-

tence.

3. It becomes an implicature at the sentence level, unless, in the process of building up, there is a stage where the implicature built up at that stage is incompatible with or entailed by the semantic meaning built up at that stage.

But what is the most important point for the purposes of the current book is that the local approach to implicatures (coded via ICP) predicts that implicatures can be cancelled during the derivation of the sentence meaning (see point 3 of ICP). Consider a sentence like (30) where the numerical NP is in the scope of verbal negation. The schematic derivation of implicatures according to ICP is in (30-a-c). The most important part is (30-b) where negated entailed meaning contradicts the maximality implicature of numerical NP and because of that, the implicature vanishes. That again conforms the intuitions about meaning of sentences like (30), where I think nothing like the maximality implicature detected in the affirmative sentences arises. This finding will be crucial in the chapter about negative questions and also in the chapter about the interaction of scope between negation and other logical operators in the sentence.

(30) There weren't four boys at the party.

a. Local implicature (at the level of the event type):
meaning: There were four boys at the party.
implicature: There weren't more than four boys at the party.

b. we add negation scoping over event:
meaning: There weren't (at least) four boys at the party.
implicature: It is not the case that there weren't more than four boys at the party.
= There were more than four boys at the party.

c. the assertion is cancelled because it contradicts the meaning

1.2.3 Scopal and non-scopal NPs

Landman's theory treats non-quantificational noun phrases differently from the quantificational ones. In that respect it is again one of the theories which erode the uniform treatment of all types of NPs, as we know it from Generalized Quantifiers framework of Barwise and Cooper (1981). Beside the technical implementation of the cut between quantificational and non-quantificational NPs discussed below, the main empirical motivation for the non-uniformity is the empirical finding that genuine quantifiers like *every* or *no* are obligatory distributive, as witnessed by the ungrammaticality of sentences like (31) where the distributivity of the quantifier clashes with the collectivity semantics of the predicate.

(31) *Every student met in Prague.

Non-quantificational NPs like definites, indefinites, numeral headed NPs and proper names on the other hand are ambiguous between the distributivity and collectivity in-

terpretation, consider sentence like (32): definites in (32-a), indefinites in (32-b), numerical noun phrases in (32-c) and proper names in (32-d) all allow both distributive and collective interpretation.

(32) a. The boy and the girl wrote the letter.
b. A boy and a girl wrote the letter.
c. Two boys and three girls wrote the letter.
d. John and Mary wrote the letter.

Let's continue with the formal treatment of the non-quantificational/quantificational split. For Landman, non-quantificational NPs can shift their interpretation from the plural to the group freely. NPs like *John and Mary* and *three boys* have thus two interpretations: both non-quantificational NPs can be interpreted either as the set of properties that a sum of three boys (or the sum of John and Mary) have, or, alternatively, the NPs can be interpreted as the set of properties that a group of three boys (or group of John and Mary) has. The first interpretation is called sum interpretation and is responsible for the distributive reading of sentences containing such NPs; the second interpretation is called group interpretation and is the interpretation of the non-quantificational NPs in sentences with collective predicates. Unlike the non-quantificational NPs, quantifiers get their standard interpretation (as in (33)) and their standard interpretation is obligatory atomic, resulting in the obligatory distributive interpretation of the whole sentence.

(33) John and Mary
a. $j \sqcup m$
b. $\uparrow (j \sqcup m)$

(34) three boys
a. $\lambda P.\exists x \in {}^*BOY : |x| = 3 \wedge P(x)$ (sum)
The set of properties that a sum of three boys has.
b. $\lambda P.\exists x \in {}^*BOY : |x| = 3 \wedge P(\uparrow (x))$ $(group)$
The set of properties that a set of three boys has.

Quantifiers get their standard interpretation, but in the process of composition with verb they must scope over the event variable. Negative noun phrases will eventually be interpreted as indefinites (because negation cannot scope over predicates in the full fledged LoP) but let us postpone that for a moment.

(35) every girl
a. $\lambda P.\forall x \in GIRL : P(x)$

(36) no girl
a. $\lambda P.\forall x \in GIRL : \neg P(x)$

In the next section I will show how LoP works on some model cases of sentences with plurality denoting NPs. For the full demonstration of the system see Landman (2000) and for the discussion how LoP can be fruitfully applied to various classes of Czech

numerals see Dočekal (2012a).

1.2.3.1 Cumulativity, collectivity and distributivity

In LoP different types of NPs are more or less able to denote different plural meanings. But the indefinite numerical NPs are ceteris paribus able to denote all three types of meanings mentioned in the title of the current section. The literature on plurality unanimously distinguishes between the **distributive** and **collective** plurality interpretations. In some frameworks the distinction is further refined and the third reading called **cumulative** is established. Landman (2000) and Scha (1981) are proponents of the three way ambiguity, unlike Winter (2001) and Roberts (1987) who try to reduce the cumulative reading to the collective interpretation. I will show in further chapters that Czech negative noun phrases directly support the three way ambiguity. But before that let me demonstrate the three types of meanings along with their formalizations in LoP. Let's consider now nearly a classical type of sentence like (37) with the three logical forms in LoP formalizing the three readings. I will comment on each of them in the rest of the current section.

(37) Three boys kissed four girls.

a. cumulative:
$\exists e : {}^*KISS : \exists x \in {}^*BOY : |x| = 3 \wedge {}^*Ag(e) = x \wedge \exists y \in {}^*GIRL : |y| = 4 \wedge {}^*Th(e) = y$

b. distributive:
$\exists x \in {}^*BOY : |x| = 3 \wedge \forall a \in ATOM(x) : \exists y \in {}^*GIRL : |y| = 4 \wedge \forall b \in ATOM(y) : \exists e \in KISS : Ag(e) = a \wedge Th(e) = b$

c. collective:
$\exists e \in KISS : \exists x \in {}^*BOY : |x| = 3 \wedge Ag(e) =\uparrow (x) \wedge \exists y \in {}^*GIRL : |y| = 4 \wedge Th(e) =\uparrow (y)$

Let's first focus on (37-a) – **cumulative reading** – which in LoP can be paraphrased as: there is a sum of kissing events that has a sum of three boys as plural agent and a sum of four girls as plural theme. The logical form (37-a) predicts that the reading should be the most natural and salient among the other readings when we consider such sentence out of the blue. The cumulative (scopeless) reading is basic reading of such sentences because no operator and no additional rule (quantifying-in and etc) is applied. One of the situations which would make such reading true is depicted below. By small letters a, b, c I symbolise different boys (one boy per each letter), by the numerals I symbolise different girls. As we see, this is scopeless reading in the sense that it's not true that for each boy there were four girls and also for no girl there were no three boys kissing her. The event is pluralized (as formalized by the * operator over event variable) and both Agent and Theme theta roles are pluralized as well. Although the number of kissing events isn't constrained as far as there were three boys and four girls involved in the pluralized event.

```
a  ----- 1, 2

b  ----- 2, 4

c  ----- 3
```

(37-b) is the **distributive reading** which in LoP arises due to scoping the object, then scoping the subject over it. And we can paraphrase the reading as: there are three boys such that for each boy there are four girls such that the boy kisses each of those four girls. This is the totally distributive reading in the sense that both numerical NPs are scoped over the event variable and they are scopally dependent with respect to each other – in this interpretation the subject scopes over the object. The reading is depicted below

```
a  ----- 1, 2, 3, 4

b  ----- 5, 6, 7, 8

c  ----- 9, 10, 11, 12
```

Last type of the reading is the (37-c) – **collective reading** – which can be paraphrased as: there is an event of a group of three boys kissing a group of four girls. This is again scopeless reading but this time the event isn't pluralized, its atomic arguments are two groups of three boys and four girls. One of the situations making such formulas true is depicted below. It's a bit hard to imagine a situation which would satisfy the truth conditions of (37-c) with the predicate like *kiss*. Maybe something like a scenario where a group kissing event of seven teenagers is taking place in a car would fit best.

```
(a+b+c) ----- (1+2+3+4)
```

So there are three basic types of readings for indefinite noun phrases (and numerical NPs as one of the major representatives of indefinites). Besides the three readings, we can also think (for the two NPs containing sentences) of their possible combinations: Landman (2000) distinguishes eight such readings. I will offer some arguments for distinguishing collectivity and cumulativity in later chapters, but let's demonstrate the distinction in further example. Recall that in LoP cumulativity isn't a kind of collectivity, it is a distributive reading without scoping the arguments. (38) sounds weird because its subject argument cannot be easily interpreted collectively (*give birth* is very distributive). But if cumulativity was a subcase of collectivity, then the sentence should be OK, because it would describe a scenario where a group of fifteen women gave birth to a group of seven children – this would make sense if we include into the group of women also nurses, women doctors, ... where the the whole group would be responsible

for giving birth to seven children. But even though I think (38) could be read in such a context, it's a bit weird, anyway. And that seems to show that the cumulative reading (being basic) here leads to the strange flavour of the most salient interpretation.

(38) ?Fifteen women gave birth to only seven children

The last remark in this section concerns the obligatory distributive interpretation of quantifiers. They are obligatory distributive with respect to the rest of their formula which doesn't mean that some other plurality NPs in the formula cannot be interpreted collectively or cumulatively. Such mixed reading can be one of the interpretations of (39) (and I assume it's the most salient interpretation). So because **quantifiers** like *every boy* are able to have only the distributive reading, depending on the interpretation of object argument, one of the situation verifying (39) is depicted below the formula.

(39) Every boy kissed four girls.

a. $\forall x \in BOY : \exists e \in {}^*KISS : Ag(e) = x \wedge \exists y \in {}^*GIRL : |y| = 4 \wedge {}^*Th(e) = y$

```
a  ----- 1, 2, 3, 4

b  ----- 3, 4, 5, 6

c  ----- 5, 6, 7, 8
```

1.2.4 Negation in LoP

One of the reasons why I adopted LoP is that the scope of negation in LoP (like in any neo-davidsonian theory – see e.g. Schein (1993)) is fixed. Negation must outscope the event variable, otherwise the sentences with negation would have tautological truth conditions. This can be seen in (40-b), the logical form for sentence like (40-a) which would arise if we allow negation to scope freely in LoP. The logical form in (40-b) describes a situation in which there is a walking event which doesn't have a girl as the agent, since this is most likely true in any situation, the result is a tautology. But of course (40-a) doesn't have tautological interpretation in natural language at all (compare it with prima facie tautologies like *Girls are girls. Either you sleep or you don't sleep, ...* This problem does not arise only if negation has wide scope, as in (40-c). This reading is scopeless (with respect to the interpretation of negative NP) which contradicts the empiry of English but let's ignore that aspect for now.

(40) a. No girl walked.

b. $\exists e[{}^*WALK(e) \wedge \neg\exists x[{}^*GIRL(x) \wedge^* Ag(e) = x]]$

c. $\neg\exists e[{}^*WALK(e) \wedge \exists x[{}^*GIRL(x) \wedge^* Ag(e) = x]]$

Let me conclude this section with a short comparison of LoP with predicate logic, the comparison with respect to how each of the theories handles negation. LoP is more restrictive as to the position of negation and also is different in the way it formalizes

ambiguities of NPs and negation. In predicate logic the ambiguities of negation and NPs are formalized as various scopes of negation: the negation can scope either over the whole formula – the usual $\langle t,t\rangle$ type, or over a predicate – type-shifted variant of negation with the $\langle\langle d,t\rangle,\langle d,t\rangle\rangle$ type. In LoP it is the NP which scopes above or below the negation which remains before the existential closure of the event variable. Compare the different logical forms for an ambiguous sentence like (41).

(41) All students didn't come.

a. predicate logic:
   (i) $\forall x[STUDENT(x) \rightarrow \neg COME(x)]$
   (ii) $\neg\forall x[STUDENT(x) \rightarrow COME(x)]$

b. LoP:
   (i) $\forall x \in STUDENT \rightarrow \neg\exists e[COME(e) \wedge Ag(e) = x]$
   (ii) $\neg\exists e[COME(e) \wedge [\forall x \in STUDENT \rightarrow Ag(e) = x]]$

Note that both (i) readings in predicate logic and in LoP are the 'empty room' meanings, while (ii) – again in both frameworks – represent the everything between empty room and 99% of coming students scenario. The relative scopes in both frameworks are the same: $\forall > \neg$ means the empty room for sentences like (41) if you quantify over individuals as arguments of a predicate (as in predicate logic) or over events like in LoP. And similarly $\neg > \forall$ would be true/false in the same situations, irrespective of the framework.

1.2.4.1 Verbal negation

Now when we settled the issue of formal properties of negation in LoP, let's focus on how the natural language negation fits into the framework. Landman's answer is: auxiliary negation must take scope over the event type, while it syntactically is located on verb (V or T), its semantics is that of a sentence operator of type $\langle t,t\rangle$. That means that he dissociates the scope of the natural language negation in syntax and semantics. In other words, even if the verbal negation is outscoped by subject and some adverbials (in the syntactic structure of English), its semantic scope is different. This style of interpreting natural language negation is independently postulated in syntactico-semantic theories of negation and negative concord by Penka (2007a) and Zeijlstra (2004). But even though I don't want to compare the mentioned theories with LoP, one thing is pretty clear: Landman's motivation for treating natural language negation in this dissociation manner is different from the Penka/Zeijlstra reasoning. It follows from two independent sources: first source is the neo-davidsonian framework which forces the scope of negation to be over the event variable despite its syntactic realization in the scope of subject NP. The second one is the maximal simplicity of negation – such solution can have negation with the only type $\langle t,t\rangle$, instead of multiple types for negation like in predicate logic or in type shifting theories like Partee (1987).

Technical implementation of the idea is then executed as follows: as the negation is of the $\langle t,t\rangle$ type, when it merges with verb (or auxiliary verb as in English), the local type mismatches (in case of verb: $\langle d,\langle e,t\rangle\rangle$). That leads to the type-driven scope mechanism

which consists of a type-driven storage mechanism. The stored element is carried along in the derivation in a store and there is a type-driven retrieval mechanism:

(42) **Auxiliary negation** *niet (not)* $\rightarrow \neg$ of type $\langle t, t \rangle$

(43) **Storage of negation by type mismatch**: Negation gets stored if there is a type mismatch with its complement.

(44) **Retrieval of negation by type matching**: Negation gets retrieved from store **as soon as** the input type matches.

Little illustration of the system: consider a sentence like (45), where we negate a sentence containing manner adverbial *slowly*. LoP correctly predicts that the logical form for such a sentence should be (45-a) where negation outscopes the whole formula and consequently even the adverb. This has a welcome prediction that something like (45-b), as a logical form for (45), is impossible. (45-b) corresponds to the reversal of scope between negation and the adverbial – it would be true in a situation where Peter was an agent of some slow event which wasn't the event of walking, e.g. it was an event of swimming or driving a car. It's hard to judge only from intuition whether (45) has such a reading but at least for me this doesn't seem to be the case.

(45) Peter didn't walk slowly.
   a. $\neg\exists e[WALK(e) \wedge Ag(e) = p \wedge SLOW(e)]$
   b. $*\exists e[\neg WALK(e) \wedge Ag(e) = p \wedge SLOW(e)]$

Note that in predicate logic nothing prevents both scopes and if we treat *slowly* as a predicate taking adjunct (probably the easiest and close to the empiry option), it's even surprising that negation should take wide scope with respect to the adverbial. Predicate logic formalizations of both scopes would be as in (46-a) and (46-b). This contrasts with the restrictiveness of LoP: in LoP manner adverbials must modify the event type, the negation on the other hand scopes over the existential closure of the event type, so (45-b) isn't an option unlike in predicate logic.

(46) a. $\neg SLOWLY(WALK(p))$
   b. $SLOWLY(\neg WALK(p))$

LoP, as I use it here, predicts that generally all adverbs should scope under negation. This is a wrong prediction though, as Landman (2000) acknowledges and is invalid at least for subject/object oriented adverbials and also for speaker oriented adverbials. Consider (47) and subject oriented adverb in (47-a) and speaker oriented adverb in (47-b). While (47-a) is ambiguous, (47-b) is I think only interpretable with the wide scope of the adverbial. This shows that some adverbials can scope even over the negation and some of them must scope over the negation, unlike manner adverbials.

(47) a. Peter deliberately didn't kiss Jane.
   b. Peter surprisingly didn't kiss Jane.

Landman (2000, 306) proposes a solution which relies on quantifying-in into scopal properties. In a nutshell he claims that subject oriented adverbials modify states which correspond to the events type shifted into states. So sentence like (47-a) would have logical form like (48) which we can paraphrase as: what Peter was deliberately about is his having the property/state of not kissing Jane. Because of this event to state type shifting possibility in LoP also the obligatory wide scope of negation with respect to manner adverbials weakens – I think we can interpret it as the default strategy: ceteris paribus (if linearity, focus, ... doesn't say otherwise) negation scopes over the adverbial. But there is always the option of switching the events into states and then negation can be in the scope of adverbials e.g.

(48) $\exists s \in [\alpha] : A_1(s) = p \wedge DELIBERATE(p, s, C)$
where $\alpha = \lambda x.x \in AT \wedge \neg\exists e \in KISS : Ag(e) = x \wedge Th(e) = j$

1.2.5 Quantifiers and negation

Let's repeat: the scope of negation in LoP is fixed, ambiguities arise because of various scopes of NPs/adverbials. But because various types of NPs do have different treatment in LoP, scoping possibilities of various quantifiers depend on their type. So let's focus on different types of NPs, their predicted behaviour and let's see whether the theory and the empiry meet.

First, let's consider **indefinites**: indefinites in LoP can be interpreted with wide or narrow scope (corresponding to their sum/group status). That seems to work well – wide scope of the indefinite corresponds to a specific interpretation (there is a pipe which John didn't smoke), the narrow scope corresponds to a non-specific reading (John can be non-smoker in this scenario e.g.).

(49) John didn't smoke a pipe.
a. $\exists x[PIPE(x) \wedge \neg\exists e[SMOKE(e) \wedge Ag(e) = John \wedge Th(e) = x]]$
b. $\neg\exists e[SMOKE(e) \wedge Ag(e) = John \wedge PIPE(Th(e))]]$

Second class of NPs I consider in this section are unambiguous **quantifiers**. Recall that they must scope over the event variable, which results in their obligatory distributive interpretation. I think this prediction isn't totally right, at least for English *every* it seems that both scopes are available. But for *each* the prediction seems to be correct.[1] So while (50) can both have logical form (50-a) and (50-b), where the former represents the quantifying-in of the universal quantifier over negation (as expected) and the later represents the universal quantifier in situ (unexpected), (51) seems to have only the reading where *each* scopes over the negation leading to the obligatory wide scope interpretation of the quantifier.

(50) Every boy didn't come.
a. $\exists x[\sqcup(BOY(x)) \wedge \forall a \in ATOM(x) : \neg\exists e[COME(e) \wedge Ag(e) = a]]$

[1] Thanks to Louise McNally (p.c.) for helping me to sort the data.

b. $?\neg\exists e[COME(e) \wedge Ag(e) =\uparrow (\sqcup(BOY(x)))]]$

(51) Each boy didn't come.

a. $*\neg > \forall$

b. $\forall > \neg$

It seems that obligatorily distributive quantifiers like *each* really scope only over negation but for *every* this isn't so clear. One of the options how to handle this problem in LoP is to weaken the obligatory distributive treatment of the quantifier *every*. This seems to be correct, because at least in object positions it's not hard to find examples of *every NP* being interpreted collectively, see (52), where the adverb *slowly* modifies the maximal event of the destruction of all shops in the neighborhood, so the object NP must be interpreted collectively, as in the LoP formalization in (52-a)

(52) TESCO slowly destroyed every shop in our neighborhood.

a. $\exists e[DESTROY(e) \wedge SLOW(e) \wedge Ag(e) = TESCO \wedge \exists x \in {}^*SHOP \wedge Th(e) =\uparrow (\sqcup(x))]$

1.3 Summary

This chapter provided the introduction into Language of plurality – the tool which I will use most often in the following chapters where I will look at particular problems concerning negation in different environments of Czech. The formal face of LoP is shown in the section 1.4, Appendix to the current chapter, and it literarily follows the definitions from Landman (2000, 179-183).

1.4 Appendix

1.4.1 The Language of Events and Plurality

1.4.2 Syntax of the Language of Events and Plurality

TYPES:
TYPE is the smallest set such that:

1. d,pow(d),e,pow(e),n,t ∈ TYPE
2. if a, b ∈ TYPE then <a,b> ∈ TYPE

- d is the type of individuals, pow(d) of sets of individuals
- e is the type of events, pow(e) of sets of events
- n is the type of numbers
- t is the type of truth values

- <a,b> is the type of functions from a-entities into b-entities

EXPRESSIONS:
We start by specifying the special constants:
Constants
We have the following kinds of constants:

CONd: j, m, ...	individual constants
CONpow(d): BOY, GIRL, ...	nominal constants
INDd, GROUPd, SUMd, D	sortal constants
CONpow(e): WALK, KISS, ...	verbal constants
ATOMe, E	sortal constants
CONn: 0, 1, 2, ...	numeral constants
CON<e,d>: Ag, Th, ...	thematic constants

Variables: we have a countable set of variables VARa for every type a.
EXPa, the set of expressions of type a, is the smallest set such that:
EXPa:

1. **Constants and variables**:
   CONa $\cup$ VARa $\subseteq$ EXPa
2. **Functional abstraction**:
   If x $\in$ VARa and $\beta \in$ b then $\lambda x.\beta \in \langle a, b\rangle$
3. **Functional application**:
   If $\alpha \in \langle a, b\rangle$ and $\beta \in a$ then $(\alpha(\beta)) \in b$
4. **Connectives**:
   If $\phi, \psi \in t$ then $\neg\phi, (\phi \wedge \psi), (\phi \vee \psi) \in t$
5. **Identity, inequaility**:
   If $\alpha, \beta \in d$ then $(\alpha = \beta) \in t$
   If $\alpha, \beta \in e$ then $(\alpha = \beta) \in t$
   If $\alpha, \beta \in n$ then $(\alpha = \beta), (\alpha < \beta) \in t$
6. **Set formation**:
   If $x \in$ VARd and P $\in$ pow(d) and $\phi \in t$ then $\{x \in P : \phi\} \in pow(d)$
   If $x \in$ VARe and P $\in$ pow(e) and $\phi \in t$ then $\{x \in P : \phi\} \in pow(e)$

   With this we can introduce other sortal expressions like:
   SUMd - INDd, ATOMd = INDd $\cup$ GROUPd
   I will usually drop the type indices.

7. **Set application**:
   If $\alpha \in d$ and P $\in$ pow(d) then $(\alpha \in P) \in$ t
   If $\alpha \in e$ and P $\in$ pow(e) then $(\alpha \in P) \in$ t

8. **Quantification**:
   If x $\in$ VARd and P $\in$ pow(d) and $\phi \in t$ then $\forall x \in P : \phi, \exists x \in P : \phi \in t$
   If x $\in$ VARe and P $\in$ pow(e) and $\phi \in t$ then $\forall x \in P : \phi, \exists x \in P : \phi \in t$

9. **Plurality**:
   Part-of and sums:
   If $\alpha, \beta \in d$ then $(\alpha \sqsubseteq \beta) \in$ t
   If $\alpha, \beta \in e$ then $(\alpha \sqsubseteq \beta) \in$ t

10. If $\alpha, \beta \in d$ then $(\alpha \sqcup \beta) \in$ d
    If $\alpha, \beta \in e$ then $(\alpha \sqcup \beta) \in$ e

11. If P $\in$ pow(d) then $\sqcup(P) \in d$
    If P $\in$ pow(e) then $\sqcup(P) \in e$

12. If P $\in$ pow(d) the $\sigma(P) \in d$

13. **Groups**:
    If $\alpha \in d$ then $\uparrow \alpha, \downarrow \alpha \in d$

14. **Atoms and cardinality**:
    If $\alpha \in d$ then AT(α)$\in$ pow(d)
    If $\alpha \in e$ then AT(α)$\in$ pow(e)

15. If $\alpha \in d$ then $|\alpha| \in n$

16. **Singularization and pluralization**:
    If P $\in$ pow(d) then AT(P), *P $\in$ pow(d)
    If P $\in$ pow(e) then AT(P), *P $\in$ pow(e)

17. **Plural roles**:
    If R $\in \langle e, d \rangle$ then *R $\in \langle e, d \rangle$

(12), (13) and (15) do not have a corresponding event clause. These could of course be introduced, but at the moment we will have no need of them.

1.4.3 Semantics of the Language of Events and Plurality

MODELS:
A **model for the language of events and plurality** is a tuple
M=$< \mathbf{D}, \mathbf{E}, \mathbf{N}, R, \perp, i >$
where:

1. **D** is a domain $< D, \mathtt{u}, ATOMd, INDd, GROUPd, \uparrow, \downarrow >$ of singular and plural individuals with groups. D is the domain of individuals.
2. **E** is a domain of $< E, \mathtt{u}, ATOMe >$ of singular and plural individuals. E is the domain of events.
3. **N** is $< N, <>$, the set of natural numbers with the standard order $<$.
4. These domains don't overlap and $\perp$, the undefined object, is an object not in D, E or N.
5. i, the interpretation function, is a function from CONa into Da.

Domains based on model M:

- $Dd = D \cup \{\perp\}$
- $De = E \cup \{\perp\}$
- $Dn = N$
- $Dt = \{0, 1\}$
- $Dpow(d) = pow(D)$
- $Dpow(e) = pow(E)$
- $D < a, b >= (Da \rightarrow Db$, the set of all functions from Da into Db.

6. R, the set of thematic roles, is a subset of $D < e, d >$ (see below).

Constraints on interpretation function i:
Sortal constants:

- $i(INDd) = INDd$
- $i(GROUPd) = GROUPd$
- $i(D) = D$
- $i(SUMd) = [INDd]$, the i-join semilattice generated by IND.
- $i(ATOMe) = ATOMe$
- $i(E) = E$

Numerals:

- $i(n) = n$

Next we will be concerned with constraints on nominal constants, verbal constants and role constants. These constraints capture the assumptions about plurality and thematic role that I have discussed in the previous lectures:

Nominal and verbal constants are sets of atoms:

- Nominal constants: if $c \in CONpow(d)$ then $i(c) \subseteq ATOMd$
- Verbal constants: if $c \in CONpow(e)$ then $i(c) \subseteq ATOMe$

Finally, we constrain thematic role constants. Roles, thematic or non-thematic, are functions from $E \cup \{\perp\}$ into $D \cup \{\perp\}$, partial functions from events into individuals. Hence, I assume that **all** roles satisfy the Unique Role requirement:

Unique Role Requirement:
Thematic and non-thematic roles are partial functions from events into individuals.

We have sums both in the verbal domain (sums of events) and in the nominal domain (sums of individuals). In both domains, sums indicate plurality. I will assume that roles taking plural events as argument or plural individuals as value are **non-thematic**.

R is the set of thematic roles. I assume that **thematic** roles are only defined for **atomic events**, not for sum events. And I assume that **thematic** roles take only **atoms**, individuals or groups, as value, not sums. This is summarized as the Thematic Role Requirement:

Thematic Role Requirement:
if ROLE $\in$ R then:

1. If e $\notin$ ATOMe then ROLE(e)=$\perp$
2. if e $\in$ ATOMe and ROLE(e)$\neq\perp$ then ROLE(e) $\in$ ATOMd

Finally, thematic role constants are interpreted as thematic roles:

Thematic role constants:
if ROLE $\in$ CON$< e, d >$ then i(ROLE) $\in$ R

This completes the constraints on the interpretation function.

Assignment functions are functions from VARa into Da, and g[x:d] is, as usual, the assignment at most differing from g in assigning d to variable x.

SEMANTICS:
We define $[\![\alpha]\!]$M,g, the interpretation of α in M relative to g.

1. **Constants and variables**:
   If c ∈ CONa then $[\![c]\!]$M,g = i(c)
   If x ∈ VARa then $[\![x]\!]$M,g = g(x)

2. **Functional abstraction**:
   $[\![\lambda x_a.\beta]\!]$M,g=$\lambda d \in Da.[\![\beta]\!]M, g[x_a : d]$

3. **Functional application**:
   $[\![(\alpha(\beta))]\!]M, g = [\![\alpha]\!]M, g([\![\beta]\!]M, g)$

4. **Connectives**:
   $[\![\neg\phi]\!]M, g = 1$ iff $[\![\phi]\!]M, g = 0$; 0 otherwise.
   $[\![\phi \wedge \psi]\!]M, g = 1$ iff $[\![\phi]\!]$M,g =1 and $[\![\psi]\!]M, g = 1$; 0 otherwise
   $[\![\phi \vee \psi]\!]M, g = 1$ iff $[\![\phi]\!]$M,g =1 or $[\![\psi]\!]M, g = 1$; 0 otherwise

5. **Identity and inequality**:
   $[\![\alpha = \beta]\!]M, g$ iff $[\![\alpha]\!]M, g = [\![\beta]\!]M, g$ and $[\![\alpha]\!]M, g, [\![\beta]\!]M, g \neq \perp$; 0 otherwise
   $\alpha < \beta M, g = 1$ iff $[\![\alpha]\!] < [\![\beta]\!]$, 0 otherwise

6. **Set formation**:
   $[\![\{x \in P : \phi\}]\!]M, g = \{d \in [\![P]\!]M, g : [\![\phi]\!]M, g[x : d] = 1\}$

7. **Set application:**
   $[\![\alpha \in P]\!]M, g = 1$ iff $[\![\alpha]\!]M, g \in [\![P]\!]M, g$; 0 otherwise

8. **Quantification**:
   $[\![\forall x \in P : \phi]\!]M, g = 1$ iff for every $d \in [\![P]\!]M, g : [\![\phi]\!]M, g[x : d] = 1$; 0 otherwise
   $[\![\exists x \in P : \phi]\!]M, g = 1$ iff for some $d \in [\![P]\!]M, g : [\![\phi]\!]M, g[x : d] = 1$; 0 otherwise

   Plurality:
   Part of and sums:

9. $[\![\alpha \sqsubseteq \beta]\!]M, g = 1$ iff $[\![\alpha]\!]M, g \sqsubseteq [\![\beta]\!]M, g$; 0 otherwise

10. $[\![\alpha \sqcup \beta]\!]M, g = [\![\alpha]\!]M, g \sqcup [\![\beta]\!]M, g$ if $[\![\alpha]\!]M, g \neq \perp, [\![\beta]\!]M, g \neq \perp$; $\perp$ otherwise

11. $[\![\mathtt{u}(P)]\!]M, g = \mathtt{u}([\![P]\!]M, g)$ if $[\![P]\!]M, g \neq \emptyset$; $\perp$ otherwise

12. $[\![\sigma(P)]\!]M, g = \mathtt{u}([\![P]\!]M, g)$ if $\mathtt{u}([\![P]\!]M, g) \in [\![P]\!]M, g$; $\perp$ otherwise

    Groups

13. $[\![\uparrow \alpha]\!]M, g =\uparrow ([\![\alpha]\!]M, g)$ if $[\![\alpha]\!]M, g \in SUM$; $\perp$ otherwise
    $[\![\downarrow \alpha]\!]M, g =\downarrow ([\![\alpha]\!]M, g)$ if $[\![\alpha]\!]M, g \in ATOM$; $\perp$ otherwise

    Atoms and cardinality:
    Let $\alpha \in d$ or $\alpha \in e$:

14. $[\![AT(\alpha)]\!]M, g = AT([\![\alpha]\!]M, g)$ if $[\![\alpha]\!]M, g \neq \perp$; $\emptyset$ otherwise
    Where AT(x)=$\{a \in ATOM : a \sqsubseteq x\}$

15. $[\![|\alpha|]\!]M, g = |[\![AT(\alpha)]\!]M, g|$

Singularization and pluralization:

16. $[\![AT(P)]\!]M, g = AT([\![P]\!]M, g)$ where $AT(X) = ATOM \cap X$
    $[\![^*P]\!]M, g = [[\![P]\!]M, g]$ where [X] is the i-join semilattice generated by X (and [X]=$\emptyset$ if X = $\emptyset$).

All this is completely as before. The new part comes with the plural roles:
Plural roles

17. $[\![^*R]\!]M, g = \lambda e. \begin{cases} \sqcup(\{[\![R]\!]M, g(a) : a \in AT(e)\}) \text{ if } \forall a \in AT(e) : [\![R]\!]M, g(a) \neq \perp \\ \perp \textit{ otherwise} \end{cases}$

If e is an event in E, and for every atomic part a of e, **thematic role** R is defined for a, then **plural role** $^*R$ is defined for e, and maps e onto the sum of the R-values of the atomic parts of e.

If thematic role R is not defined for every atomic part of e, then $^*R$ is not defined for e, and $^*R$ maps e onto $\perp$.

2 The nature of negative noun phrases

2.1 Introduction

The goal of this chapter is to argue that in contrast to n-words in English, Czech n-words are not quantifiers but they should be analyzed as indefinites in the scope of sentential negation. One of the most reliable diagnostics for determination of quantifier status in natural language expression is the ability to appear in so called predicative position. In contrast to APs and PPs only some nominals may appear in the predicative position; quantifiers are generally banned from this position (for one of the early formulation of this constraint see Doron (1983)) as is exemplified in (1) and (2):

(1) John is $[_{AP}$ tall$]/[_{PP}$ in the room$]/[_{NP}$ a teacher]

(2) a. *John is every member of the club.
b. *John is each man.
c. *John and Mary are most students.
d. *John is exactly one teacher.

This ban on quantifiers in predicative positions can be explained quite easily if we assume classical Montague typing of quantifiers and proper names: quantifiers are of the $\langle\langle d,t\rangle,t\rangle$ type and proper names are also of the same type (proper names denote principal ultrafilters, sets of properties which a given individual has). We cannot combine these two types $\langle\langle d,t\rangle,t\rangle$ X $\langle\langle d,t\rangle,t\rangle$ by functional application as neither of them can be a function or an argument of the other type.

What is crucial for my argumentation is that we can use the predicative position as a test for whether something is a quantifier. Interestingly, there are exceptions to this generalization. Notably, *no*-NP ('n-words') may be predicative as in (3).

(3) John is no friend of mine.

According to Partee (1987) quantifiers can appear in predicative position if reanalyzed as involving lowering of the standard generalized quantifier (e.g. *no friend of mine* $\rightarrow$ set of entities disjoint from the set of my friends). The type-lowering operation is realized by the type-shifting operator BE: $\langle\langle d,t\rangle,t\rangle \rightarrow \langle d,t\rangle$.

(4) BE$[\alpha]$=$\lambda y.\alpha(\lambda x.x = y)$ $(= \lambda y.\alpha(\{y\}))$

Consequently, the shifted quantifier can appear as a predicative NP. The meaning of (3) in Partee's system is that John doesn't have the property BE_FRIEND_OF_MINE among the set of his properties, which seems to fit.

(5) John is no friend of mine.

What I want to show is that this type shifting solution gives wrong predictions and we will get better results if we assume that (at least for Czech and probably generally Slavic) n-words are not quantifiers but their semantic type is predicative ($\langle d, t\rangle$ type).

This chapter is organized as follows. Sections 2.2 to 2.5 outline the basic assumptions concerning type shifting mechanisms, choice functions and the syntactic structures corresponding to the different semantic types. Sections 2.6, 2.7 and 2.8 discuss predictions made by the introduced assumption for the analysis of different phenomena, including n-words in the predicative and argument positions, the collective interpretation of n-words and their semantics in the scope of intensional predicates. In section 2.9 I discuss some open questions. Finally, the section 2.10 offers a review of the arguments presented in the paper.

2.2 The puzzle

As it stands, Partee's proposal makes some incorrect predictions. Mainly, as it is clear from the data, only some quantifiers can appear in predicative position but the proposal predicts that BE could apply to *any* quantifier. Partee herself acknowledges this problem and proposes a remedy in terms of pragmatic restrictions on type-shifting. For a general critique of her account see Winter (2001) and the next section. As we will see, however, Partee's solution cannot account for data from negative-concord languages. Crucially, the original type shifting strategy overlooks the fact that quantifiers banned from the predicate position cannot have a collective interpretation and an opaque reading under intensional predicates (among other things). Czech n-words (as well as English negative quantifiers as in (3)) are grammatical as predicate nominals:

(6) *Petr není žádný můj student.*
Petr not-AUX no my student
'Petr is no student of mine.'

But (at least in Czech and at least not in English, although the distinction probably holds between Slavic and Germanic languages generally) they can have a collective interpretation:

(7) a. *Žádní mí studenti nejsou dobrá parta.*
no my students not-AUX good team
'#No students of mine are good team.'
b. *No students are a good team.

A de dicto reading in the scope of an intensional verb is grammatical for them which

holds for both Germanic – (8-b) from Landman (2004) – and Slavic – (8-a) and (9) from Błasczak (2001, p. 224) – languages.

(8) a. Petr nehledá žádné jednorožce.
'Petr is seeking no unicorn.'
b. *Dafna zoekt geen griffioens.*
Dafna seeks no griffins.
'Dafna doesn't seek any griffins.'

(9) *Janek nie szuka żadnego jednorożca.*
Janek NEG seek-3.SG.PRES no-ACC unicorn-ACC
'Janek does not seek any unicorns.'

Moreover Slavic n-words in the scope of intensional verbs allow only de dicto readings but Germanic languages allow both de dicto and the de re readings. I will show more about this prediction in next sections. Beside that, uncontroversial quantifiers like *ani jeden student* 'not a single student', despite having the same truth-conditional import, contrast with n-words in the way they behave in the mentioned contexts (no collective reading, ungrammatical in predicative position and only the de re reading in intensional contexts).

(10) *Petr není ani jeden můj student.
'*Petr is not a single student of mine.'

(11) *Petr nehledá ani jednoho jednorožce.*
Petr not-seeks not one unicorn
'Petr is seeking not a single unicorn.'

This shows that there are systematic differences between n-words and quantifiers in Slavic languages (more differences than in Germanic languages) and moreover that the difference between n-words and quantifiers cannot stem from semantics only, as clear from the minimal contrast between quantifier *ani jeden student* and negative noun phrase *žádný student*. In the section 2.3 and 2.4 I will introduce some generally shared assumptions about types of different noun phrases first and then present two frameworks formalizing the type-shifting machinery.

2.3 Type shifting

The canonical view on the syntax and semantics of NPs can be summarized as follows: NPs denote properties (they are semantically of $\langle d, t\rangle$ type) type and as such cannot be straight arguments of predicates. On the other hand they can pretty well stand in the predicative position and as set denoting expressions can be used to assign some property to the argument in subject position:

(12) a. *[$_{\text{NP}}$ Dog] was sleeping.
b. Fido is [$_{\text{NP}}$ a dog].

DPs denote generalized quantifiers (they are semantically of $\langle d \rangle$or $\langle\langle d,t\rangle,t\rangle$type. Because of that they can be of course arguments but they usually aren't well in predicative positions:

(13) a. [$_{\text{DP}}$ Every dog] was sleeping.
b. *Fido is [$_{\text{DP}}$ every dog].

In languages like Czech where the distinction between NP and DP isn't morphosyntactically coded by determiners, it's not so easy to say when some phrase is really NP or DP if no determiner is a part of it. I will have more to say about that later but for now let's assume that indisputable quantifiers are usually ungrammatical in predicative positions and and grammatical in argumental ones:

(14) a. *[$_{\text{DP}}$Každý pes] spal. (=(13-a))*
Every dog slept
'Every dog was sleeping'
b. **Fido je [$_{\text{DP}}$každý pes]. (=(13-b))*
Fido AUX every dog
'Fido is every dog.'

Usual picture which connects syntax and semantics (see Longobardi (1994, 1996)) follows an intuition that somehow nouns need determiners to be made into arguments. For determinerless language like Czech that means that syntactic structure of bare NPs depends on their function in sentence. If they are arguments then their phrasal status must be DP and we must postulate some silent determiner turning denotation of $< d,t >$ type into the right argumental type (either $\langle d \rangle$ or $\langle\langle d,t\rangle,t\rangle$ type). If they are in predicative position then their type can remain basic $\langle d,t\rangle$.

(15) a. [$_{\text{DP}}$ Pes] spal. pes ... $\langle\langle e,t\rangle,t\rangle$
'The dog was sleeping.'
b. Fido je [$_{\text{NP}}$ pes]. pes... $\langle e,t\rangle$
'Fido is a dog.'

We can propose that bare NPs in languages like Czech are ambigous with respect to definiteness/indefiniteness also. The hypothesis would be then that bare NP like *pes* is three ways ambigous:

(16) $\|pes\|$=
a. DOG(x)... predicate of $\langle d,t\rangle$ type
b. $\lambda P \exists x[DOG(x) \wedge P(x)]$... indefinite NP, quantifier of the $\langle\langle d,t\rangle,t\rangle$ type
c. $\sigma DOG(x)$ ... definite NP of the $\langle d\rangle$ type;

2.4 Two Theories of Type Shifting between Arguments and Predicates

Let me briefly introduce two frameworks which systematically map different types of noun phrases depending on their argument/predicate position in the sentence and also depending on their determiner type shifting capabilities (especially in determiner heavy languages like English, where the second option is deeply grammaticalized). The two frameworks are Barbara's Partee type shifting approach as describe in Partee (1987) and Landman's adjectival theory of indefinites as defined in Landman (2004).

2.4.1 Partee's Type Shifting Triangle

First type shifting theory was proposed by Barbara Partee in her influential Partee (1987) paper. It departs from the uniform treatment of noun phrases semantics (discussed in the first chapter) in one very important aspect – Partee claims that the basic type of noun phrases is the simplest (lowest) type which fits the type demands of the sentence, where the noun phrase occurs. She basically proposes that the three types for noun phrases we discussed in the previous section – two for argument positions: $\langle d \rangle$ (singular and plural) individuals and $\langle\langle d,t\rangle,t\rangle$ of generalized quantifies; the third type available for the interpretation of noun phrases in predicative positions is type $\langle d,t\rangle$ of sets of individuals. The three types are demonstrated in (17) respectively.

(17) a. **Peter** was sleeping. ... type $\langle d \rangle$
b. **Three girls** were sleeping. ... type $\langle\langle d,t\rangle,t\rangle$
c. The visitors were **three girls**. ... type $\langle d,t\rangle$

Landman (2004, 20) summarises Partee's position by the following postulate (the name reminds us that Partee in fact builds her theory of predication on top generalized quantifiers theory reaching back to Montague (1973) and Barwise and Cooper (1981)).

(18) **Montague–Partee (MP)**:
MP-principle A – the Generalized Quantifier Theory of determiners:
All noun phrase interpretations are born at argument types.

That means that in Partee's framework quantificational and indefinite determiners start their type at $\langle\langle d,t\rangle,\langle\langle d,t\rangle,t\rangle\rangle$ type and quantificational and indefinite noun phrases are born at the argument type $\langle\langle d,t\rangle,t\rangle$ without any need for type-shifting. Schematical derivation of the meaning of noun phrases like *every dog* and *three dogs* follows in (19) and (20).

(19) a. *every* $\rightarrow \lambda Q\lambda P.Q \subseteq ATOM \wedge \forall x[Q(x) \rightarrow P(x)]$... type $\langle\langle d,t\rangle,\langle\langle d,t\rangle,t\rangle\rangle$
b. *dog* $\rightarrow DOG$ ... type $\langle d,t\rangle$
c. *every dog* $\rightarrow \lambda P.DOG \subseteq ATOM \wedge \forall x[DOG(x) \rightarrow P(x)]$
type $\langle\langle d,t\rangle,t\rangle$

(20) a. *three* $\rightarrow \lambda Q\lambda P.\exists x \in Q : |x| = 3 \wedge P(x)$... type $\langle\langle d,t\rangle,\langle\langle d,t\rangle,t\rangle\rangle$

b. *dogs* $\rightarrow {}^*DOG \ldots$ type $\langle d, t\rangle$
c. *three dogs* $\rightarrow \lambda P.\exists x \in {}^*DOG : |x| = 3 \wedge P(x) \ldots$ type $\langle\langle d, t\rangle, t\rangle$

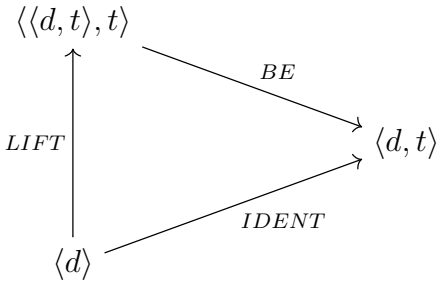
The same holds also for Partee's analysis of definite noun phrases which are semantically composed by the application of the definite determiner to the predicate meaning of NP, see (21).

(21) *the* $\rightarrow \lambda Q.\sigma(Q)$
The function that maps Q onto the sum of its elements if that is in Q, and is undefined if not.

The overall principle behind Partee's analysis is that noun phrases are born at argument types and if we find them in predicative positions, this results from their type-shifting into the set type. Landman (2004, 20) subsumes this line of reasoning as MP-principle-B, here in (22).

(22) **MP-principle B – the Partee triangle**
Predicate interpretations of noun phrases are derived from argument interpretation with type lowering operation BE.

ARGUMENTS *PREDICATES*



There are three type-shifting operations used by Partee:

(23) a. LIFT: LIFT[α]=$\lambda P.P(\alpha)$
b. IDENT[α]=$\lambda x.x = \alpha$ $(= \{x\})$
c. BE[α]=$\lambda y.\alpha(\lambda x.x = y)$ $(= \lambda y.\alpha(\{y\}))$

Noun phrases can shift from $\langle d\rangle$ to $\langle\langle d, t\rangle, t\rangle$ with type raising operation LIFT – e.g. when $\langle d\rangle$ denoting proper name conjoins with a generalized quantifier. They can shift from $\langle d\rangle$ to $\langle d, t\rangle$ with type raising operation IDENT – e.g. if proper names are used predicatively as in sentences like *Peter is* ***Napoleon*** *in his office.* And finally if we find quantificational or indefinite noun phrases in predicative position, for Partee that necessarily means that it was type lowered with the operation BE.

2.4.2 The Adjectival Theory of Indefinites

The second approach to type shifting is proposed by Fred Landman in Landman (2004). This is the framework which I will use heavily in this chapter. There are many other approaches to type shifting, see Chierchia (1998) for a neo-Carlsonian approach, Winter (2001) for choice function approach and discussion of its merits, and of course Partee and Rooth (1983) and Partee (1987), where the ideas of type-shifting were laid. I cannot compare the differences of these frameworks here, so let me pragmatically choose the Landman's, because for the purposes of my book it fits best.

Landman modifies Partee's type shifting framework in one important aspect. His main idea with respect to the type shifting of noun phrases is explicated in his Adjectival theory principle (see Landman (2004, 21)) where he reverses the type shifting strategy for indefinites as proposed by Partee. He calls his approach to type shifting adjectival theory because his main idea is to treat indefinite determiners and numerals similar to adjectives. As he acknowledges, this idea isn't particularly new in formal semantics and various pieces of inspiration can be found in Link (1983), van Geenhoven (1998), Krifka (1999) among others. But as far as I can see, Landman is the first to seriously incorporate the idea into full fledged framework. His adjectival theory principle is stated in (24).

(24) **The Adjectival Theory (AT)**:
AT=principle A – the adjectival semantics of indefinites:
Indefinite noun phrases are born at the predicate type.

So quantificational and definite determiners are interpreted identically in MP and AT, as relations between sets and functions from sets to individuals respectively. But as for indefinites, they start at type $\langle d,t\rangle$ in AT, the type of sets of individuals, instead of $\langle\langle d,t\rangle,t\rangle$ type of MP. And also indefinite determiners, as well as numerals are interpreted at type $\langle d,t\rangle$, the same type as the type of adjectives and bare nouns. The composition of indefinite determiners/numerals with nouns proceeds via intersection operation defined below in (25). The illustrative derivation of (predicative) meaning for noun phrase like *three girls* is in (26).

(25) $[_{\text{NP}}$ ADJ NP$] \rightarrow$ ADJ $\cap$ NP $(\lambda x.ADJ(x) \wedge NP(x))$

(26) a. *three* $\rightarrow \lambda x.|x| = 3$ of type $\langle d,t\rangle$
The set of plural individuals consisting of three atoms.
b. *girls* $\rightarrow$ *GIRL of type $\langle d,t\rangle$
The set of all plural individuals that consist solely of girls.
c. *three girls* $\rightarrow \lambda x.{}^*GIRL(x) \wedge |x| = 3$
The set of all sums of girls each consisting of three individuals.

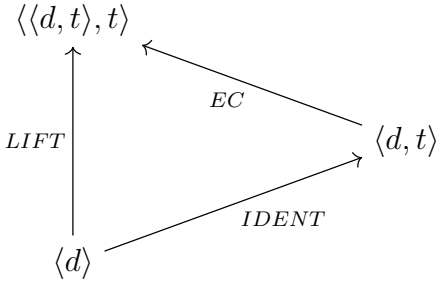
That means that unlike quantificational and definite noun phrases, indefinites (and numerical noun phrases as a subkind of indefinites) must undergo type shifting when they occur in argument positions. This is core of **Principle B** of AT:

(27) **AT-principle B – the Existential Closure Triangle**
Argument interpretations of indefinite noun phrases are derived from predicative interpretations through type lifting with Existential Closure.

AT comprises of three operations, where two are identical to MP (LIFT and IDENT) but instead of BE, there is the Existential Closure (EC) operation which reverses the shifting – instead of type-lowering the argument, we type raise the basic $\langle d, t\rangle$ indefinite type.

(28) a. LIFT: LIFT[α]=$\lambda P.P(\alpha)$
b. IDENT[α]=$\lambda x.x = \alpha$ $(= \{x\})$
c. EXISTENTIAL CLOSURE[α]=$\lambda P.\exists x[\alpha(x) \wedge P(x)]$

ARGUMENTS *PREDICATES*



In AT then indefinite noun phrases have two basic interpretations: basic which reveals in the predicative positions and type raised (via existential closure) which appears in argument positions – see (29-a) and (29-b) respectively.

(29) a. *three girls* $\rightarrow \lambda x.^*GIRL(x) \wedge |x| = 3$
the predicative interpretation
b. *three girls* $\rightarrow \lambda P.\exists x[^*GIRL(x) \wedge |x| = 3 \wedge P(x)]$
the argument interpretation

2.4.3 Partee's pragmatic restriction on type shifting

In this section I will only briefly repeat Partee's pragmatic argumentation which should restrict the application of the BE operator. Her argument is aimed at the inability of *every* quantifier to appear in predicative position. I think that Winter (2001) quite conclusively shows that this cannot work, but let's repeat Partee's proposal first.

Partee (1987) claims that applying the BE operator to generalized quantifier semantics of a DP like *every student* would produce a trivial interpretation (an empty set) unless the interpretation of the noun *student* is a singleton set. Partee argues that this clashes with the presupposition of universal quantifiers in natural language. As according to her DPs of the form *every* NP presuppose that their NP complements denote non-singleton sets. This looks like a plausible interpretation of the ungrammaticality of sentences like

(30) where the BE operator cannot be used to lower the generalized quantifier to set interpretation for the following reasons. DP *every student of mine* presupposes non-singleton interpretation of the set denoted by the NP *student of mine*, so applying the BE to the DP *every student of mine* would lead to presupposition failure (if we cancel the presupposition) or to a trivial interpretation (if the presupposition is accepted and the BE operator is applied anyhow). A generalized quantifier is of incorrect type to combine with a proper name, so not applying the BE operator leads to a semantic incompatibility in a third imaginable scenario.

(30) *Peter is every student of mine.

The trouble with this account, as Winter (2001) shows, is that it isn't able to explain the argument/predicate asymmetry of the presupposition defeasibility. As the following example (31) shows, in argument position the non singleton presupposition of the *every* NP phrase is defeasible but in predicate position the same presupposition cancellation doesn't work. The example shows the singleton interpretation of *every* NP is available (even if pragmatically strange) when the DP is in subject position. Moreover both sentences denote the same situation but the acceptability of (31-a) is based solely on the argument syntactic position of the quantifier. That means that the non singleton meaning constraint for the big quantifier is probably only conversational implicature, not from the presupposition, as presuppositions cannot be generally suspended this way as in (31-a).

(31) a. If John and Mary failed entry exams, and Peter didn't, then every student of mine is Peter.
b. *If John and Mary failed entry exams, and Peter didn't, then Peter is every student of mine.

The grammaticality of (31-a) is predicted if we assume that in predicative position the proper noun can be type lifted to set type ($\langle d, t\rangle$ – the set of all things called 'Petr') which is then fed as an argument to a generalized quantifier in the subject position. This strategy isn't available when the proper noun is in subject position.

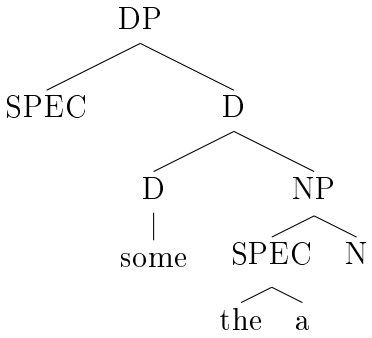
I will show in the next section how the ungrammaticality of *every* NP in predicative positions can be explained without the type shifting operator BE. The solution will also explain the puzzles mentioned at the beginning of section 2.2.

2.5 Linking Syntax and Semantics of Type Shifting

In the rest of the current chapter I will mix Landman's general approach to type shifting with Winter's Flexible Boolean Semantics. The motivation for this move is the sensitivity to syntactic status of the determiner in noun phrase. Such sensitivity is built into Flexible Boolean Semantics (hence FBS further). Recall the different behaviour of *žádný* and *ani jeden* in (6) and (10) – the first type of determiner can head noun phrase occurring in predicative position, the later not. The reason for this lies in the syntactical complexity

of two types of determiners. But let me introduce FBS now. FBS is developed in papers Winter (2001) and Winter (2005), a.o.,FBS uses ideas about the semantic layers within DP that distinguish between a predicate denoting layer and a quantifier denoting layer. My main assumptions are the following: there are three syntactic layers in DP, for English from Winter (2005, Figure 1), see (32).

(32)



Nominals are classified into three types according to the portion of the NP/DP structure they fill:

1. Nominals that contain a full spec-DP position. These nominals can only be analyzed as DPs. They appear only in *argument* positions.

2. Nominals that contain an empty spec-DP and a full D position. These nominals can be analyzed as either DPs or D′s. They can only appear in predicate positions with overt copula.

3. Nominals where both spec-DP and D are empty. These nominals can be analyzed as DPs, D′s or NPs. They can appear only in predicate positions.

There is syntax-semantics matching for these layers:

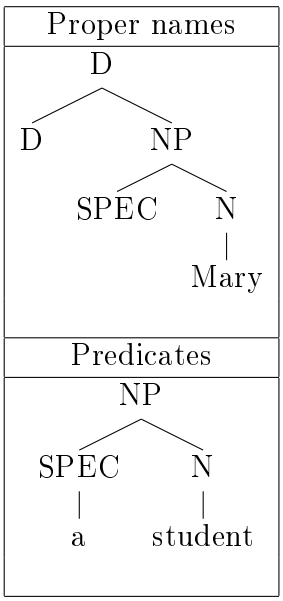
1. Under their NP analysis, nominals unambiguously denote predicates (type $\langle d, t\rangle$).

2. Under their DP analysis, nominals unambiguously denote generalized quantifiers (type $\langle\langle d, t\rangle, \langle\langle d, t\rangle, t\rangle\rangle$ before adding a NP argument to a determiner and $\langle\langle d, t\rangle, t\rangle\rangle$ after applying the determiner to the NP argument).

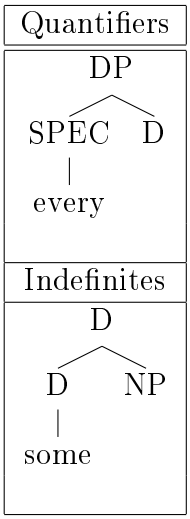
3. Under their D′ analysis, the interpretation of nominals is free to move back and forth between predicates and quantifiers. The example (34), table *Indefinites*, represents an instance of such a D′-level predicate (a good example from English is e.g. an NP headed by an unstressed determiner *some*).

Some illustrations of the system are the following:

(33)

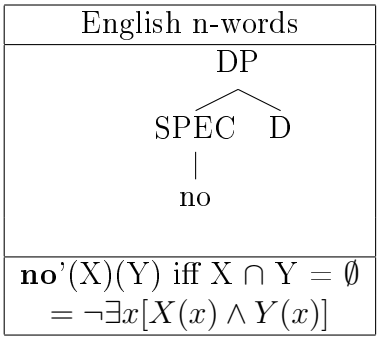


(34)



For English n-words Winter (2001) assumes that in argument positions they are negative quantifiers (generalized quantifiers) and that they are syntactically rigid nouns. Their syntax and semantics is the following:

(35)



Compare this with Landman's treatment of English negative noun phrases in chapter 1. For now I will simply assume that it's right to assume that English negative noun phrases are quantifiers, but see Penka (2007b) for careful discussion pointing to another solution.

2.5.1 Choice functions

The flexible interpretation of the D′ level is by virtue of phonologically covert operators that apply at this level and map predicates to quantifiers and vice versa. These operators are called category shifting principles.

Winter (2001) proposes two such principles: the *choice function* (CF) operation that maps predicates to quantifiers, and the *minimum* operator that maps quantifiers to predicates. Let's assume the following common definition of CFs, where they are used as category shifting principles from predicates to entities (Winter (2001) proposes a more general framework where CFs are operators from predicates to generalized quantifiers, but for simplicity I adopt a more intuitive definition from Winter (2005, def. 1)):

(36) For any set E, a *choice function* over E is a function that maps every non-empty subset A of E to a member of A.

The opposite of the choice function is the Minimum operator which maps quantifiers to predicates (it produces e.g. the minimal set from conjunction of two principal ultrafilters – min(M⊓J) = {{**m**',**j**'}}):

(37) **Minimum sort**
$\min_{(\tau t)(\tau t)} = \lambda Q_{\tau t}.\lambda A_{\tau}.Q(A) \wedge \forall B \in Q[B \sqsubseteq A \rightarrow B = A]$

The main motivation for using CFs is more systematic treatment of the wide scope behavior of indefinites.

(38) If some relative of mine dies, I will inherit a house.
a. $[\exists f[CH(f) \wedge DIES(f(RELATIVE\_OF\_MINE))]] \rightarrow INHERIT(I, HOUSE)$
b. $\exists f[CH(f) \wedge [DIES(f(RELATIVE\_OF\_MINE)) \rightarrow INHERIT(I, HOUSE)]]$

As is well known, indefinites give the appearance of scoping out of syntactic islands, as in the example (38), cited in Reinhart (1997) with two readings: in (38-a) the existential closure takes place withing the antecedent of the conditional and we get the „narrow scope" reading, but in (38-b) the existential closure takes scope over the conditional and this results in a „wide scope" reading.

Existential closure is a mechanism for interpreting indefinites in argument positions and the logic behind it is a second order quantification over choice functions. According to Reinhart (1997) and Winter (2001) this closure can take place at any level of syntactic structure. This leads to apparent wide scope effects with indefinites.

If we compare Landman's AT with Winter's FBS right now, we see that FBS is more liberal – there is the minimum sort operator which maps quantifiers to predicates, in this respect it is parallel to Partee's BE type lowering operator. Unlike Partee, Winter restricts the usage of minimum sort syntactically as we will see immediately. I will use Landman's Existential Closure type shifting operator instead of the mechanism of choices functions, because the power and the glory of choice functions lies in its ability to describe wide scope reading of indefinites. And as the issue of wide scope reading isn't main topic of my investigation, I will use more conservative Existential Closure formalisation further.

2.5.2 Czech n-words

For Czech (and I assume generally for Slavic but that would need of course careful research) I assume basically an indefinite structure for n-words and corresponding to that indefinite semantics. In the Flexible Boolean Semantics of Winter there's a question if Czech n-words are more like English *some* indefinites (D′) or like (NP) *a/the* (in)definites.

Winter (2005) proposes a criterion to distinguish between the D′ and the NP level: conjunctions of singular D′ are plural, whereas conjunctions of singular NPs inherit their number features. This is parallel to conjunctions of other predicative categories such as VP/TP, PP and AP. In (39) we see that Czech negative noun phrases can be conjoined in argument position with singular agreement on the verb and that they both can be interpreted as attributes of one individual (unlike *jeden* indefinites in (39-b) which are parallel to *some* indefinites in English). We can interpret (39-a) as (40), which shows that Czech n-words are NP indefinites.[1]

(39) a. *Žádný velký básník a žádný národní hrdina dnes nepronesl řeč.*
No big poet and no national hero today not-gave speech
'#no big poet and no big national hero gave a speech today.'

b. *Jeden velký básník a jeden národní hrdina dnes *pronesl/pronesli řeč.*
one big poet and one national hero today *give-sg/give-pl speech
'A big poet and a national hero gave a speech today.'

(40) $\neg\exists x[BIG\_POET(x) \wedge NATIONAL\_HERO(x) \wedge GIVE\_SPEECH(x)]$

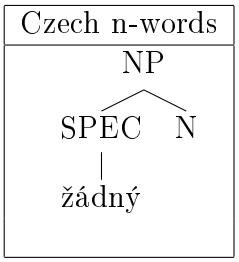
[1] The singular agreement with conjoined NPs is a suggestive piece evidence but not a sufficient argument for NP nature of n-words. One of the tests which would offer insight into the DP/NP status of n-words is opaqueness for extraction: DPs are usually taken as opaque for left branch extraction but NP's are transparent in this respect, see Bošković (2005) for Slavic languages. But as Abels (2003) convincingly shows, the left branch extraction data can be explained by remnant movement analysis, which unfortunately means that locality effects cannot be used as test for DP/NP status of n-words. And as I'm not aware of any other syntactic tests which can prove or refute the NP status of n-words, I will stick to the assumption that n-words are NPs even if we are still missing conclusive evidence for this claim.

Let's start with a hypothesis that Czech n-words have indefinite NP syntax and the indefinite semantics of a determiner is simply zero; the only semantics is set denotation contributed by NP and see how far this can lead us. There is of course the need of Czech n-words to be licensed by verbal negation and I assume that some version of syntactic agreement theory of n-words in the style of Penka (2007a) is on the right track.

Under Winter's approach indefinites are flexible nominals (predicates) and as such can be type-shifted into quantifiers in some syntactic constructions. This shifting is obligatory every time when n-words are in argument positions, as their set $\langle d, t\rangle$ type would lead to type incompatibility in any argument position. As said at the end of 2.3, I will use Landman's Existential Closure type shifting operation for this purpose, instead of Winter's choice function approach, because as far as I can see, both approaches give the same truth conditions at least for the cases I will consider in this chapter. And because Landman's Existential Closure is lighter in terms of formal machinery involved, I prefer it for simply parsimonious reasons.

As predicates we would expect n-words to appear in predicate positions. In contrast, quantifiers of the 'not a single one' type are rigid nominals and cannot be shifted into predicates in Winter's framework. There is no type lowering operator in Landman's framework, so both approaches give the same predictions with respect to the *ani jeden/žádný* distinction. The distinction between n-words and 'not a single one' quantifiers is at least partially syntactic, as n-words belong to the flexible nominals type and quantifiers to the rigid nominals type in Winter's system. I think that this is the right hypothesis as there's no semantic distinction between both types in Generalized quantifiers theory. From the point of view of truth conditions, both n-words and negative quantifiers of the 'not a single one' type can be correctly represented as an operation of an noninteresction of any two sets. But if we look more carefully at the syntactic and semantic behavior of n-words in different environments, we will see that predicate semantics and NP syntax, as is depicted in (41), predicts their properties much more correctly. And this is exactly what I will show in sections 2.6, 2.7 and 2.8.

(41)



2.6 Prediction I: predicative positions

Let's repeat my main assumption: n-words in the negative concord languages are restriction predicates ($\langle d, t\rangle$ type) and their type does not change in predicative position. From that it follows that their appearance in predicative position is expected as their type is similar to other predicates like syntactic APs, PPs, etc. If n-words were be generalized quantifiers (sets of sets), it would be predicted that they shouldn't appear

in predicative positions.

N-words in argument position are interpreted through type shifting via Existential Closure into the type of generalized quantifiers. So n-words are indefinites of a special sort (for a closely related proposal see Penka (2007a); Zeijlstra (2004); Błasczak (2001)).

N-words can appear in the predicative nominal constructions (they are not quantifiers there) but the question is why quantifiers of the *every* type cannot occur in this position as well if the flexible Boolean semantics has the minimum operator as in (37). In Winter's system this follows from a syntactic ban on type shifting rigid DPs. The min operator can shift quantifiers to predicates (e.g. principal ultrafilter) if they are flexible. In Landman's framework the possibility of lowering quantifiers to predicates is entirely absent.

On the other hand, quantifiers of the 'not a single one' type are rigid nominals, so in predicative position they would need min operator to turn them into set type; but this type shifting is forbidden as they are rigid nominals, they are DPs and their logical type cannot be shifted.

Czech n-words are grammatical in predicative positions and moreover they can have a distributive reading there as in the following example. As they are interpreted as predicates, they can be conjoined by boolean conjunction and the proper name *Petr* in the subject is interpreted as a set of sets (type shifted by the LIFT type raising operator from the simple $\langle d \rangle$ type to the $\langle\langle d,t\rangle,t\rangle$) and is applied to them. The result then is logically equivalent to the conjunction of two predicates applied to a term denoting the atom individual Petr. If the n-words in (42) would be quantifiers, then the boolean conjunction of them would assemble the set of properties common to both quantifiers and this set would be applied to the subject. This would lead to the same type problems discussed in Section 2.2 for simple quantifiers in predicative position.

(42) *Petr není žádný můj kamarád ani žádný můj soused.*
Petr not-AUX no my friend neither no my neighbor
'Petr is no friend of mine and no neighbor of mine.'

a. $\neg\lambda P.P(Petr)(FRIEND\_OF\_MINE \wedge MY\_NEIGHBOUR)$
$\Longleftrightarrow \neg FRIEND\_OF\_MINE(petr) \wedge \neg MY\_NEIGHBOUR(petr)$

2.7 Prediction II: collectivity

My basic hypothesis is that n-words in negative concord languages like Czech are simply indefinites which must syntactically agree with verbal negation and this negation is the locus of the logical negation interpretation.

As indefinites, n-words denote set(s) of objects (depending on their morphological number) and we should expect them to be grammatical with collective predicates which demand plural arguments. On the other hand if n-words would be generalized quantifiers (at least in classical Montague typing) we wouldn't expect them to be grammatical with genuine collective predicates. Recall that in LoP unambiguous quantifiers like *every/each* must scope over the event variable which leads to the obligatory distributive

interpretation.

In this section I will look at behavior of n-words with collective predicates. There are two sentence types which are important in this respect. The first one (example (43)) will be dealt with in the subsection 2.7.1 and the second one (example (44)) in the subsection 2.7.2. (43) is an interesting sentence because predicates like *be a good team* are a good testing ground for the quantifier/set type of their arguments. Basically all quantifiers are banned as their arguments, as (45-b) shows, which is behavior not shared by all collective predicates (e.g. the collective predicate *meet* allows as its arguments quantifiers if they are plural – see (45-a)). Once the empirical claim that Czech n-words are capable of collective and cumulative interpretation is established, I will further explore the differences between English and Czech negative NPs and also formalize the distinction in LoP – see 2.7.3.

(43) Žádní mí studenti nejsou dobrá parta.
no my students not-AUX good team
'#None students of mine are good team.'

(44) *Žádný můj student a žádný můj učitel se v Praze nesešli.*
no my student and no my teacher REFL in Prague not-met
'No student of mine and no teacher of mine met in Prague.'

(45) a. All the students are meeting in the hall.
b. *All the /exactly four/between four and ten/at least ten/many/no/most of the students are a good team.

2.7.1 Groups

Recall that Landman (1989) proposes that nouns referring to sets can be shifted to group denoting atoms in a way that the former plurality is interpreted as an atom element representing the relevant group of objects, and as such they can be arguments of collective predicates, as in (7-a). Their denotation then is similar to singular noun phrases like *the group of students* or *the committee*. Formally this is represented by $\uparrow$ operator in LoP.

As everybody working on plurality agrees, predicates in natural language vary as to what kinds of plural objects they take in their extension. Let's first look at what Landman's framework predicts in this respect. Then I will focus on the question how the basic picture can be refined by Winter's ideas.

First, let's look at three basic types of predicates in singular number, reflecting the singular number of their arguments if they appear in syntactically predicative position:

1. distributive predicates like *sleep*, *have blue eyes* or *walk* take only individual atoms;
2. collective predicates like *gather* or *meet* take only group-atoms;
3. mixed predicates like *write the book* or *touch the ceiling* take both individual atoms and group atoms, which results in their ambiguous distributive/collective interpretation depending on the semantics of argument they take;

As for nominals, their denotation can be divided into individual atoms and group atoms:

1. nominals like *student* or *boy* denote only individual atoms;

2. nominals like *team*, *crowd* or *library* denote only group atoms;

This classification is quite intuitive and is able to explain basic incompatibilities of predicates and their arguments in sentences like *#The crowd had blue eyes* (group atom as an argument of individual atom taking predicate) or *#The boy gathered* (individual atom as an argument of group atom taking predicate).

I assume (again with most of the researcher, see Sauerland (2003) for discussion of this issue) that the grammatical number on nouns is interpreted semantically (I use Landman's pluralization star * operator for this purpose) but the grammatical number of verbs is purely a syntactical reflex of agreement between the subject and the verb. So if we pluralize the arguments of three mentioned predicates, the closure under sum assembles pluralities depending on the former type of the arguments. And that must be reflected also in the denotation of the predicate. Let's illustrate the working of the system on some sample denotations of the mentioned classes of predicates and nominals. First let's look at singular predicates and nominals:

(46) a. *sleep* = {a,b,c}
b. *gather* = {↑(a⊔b),↑(b⊔c)}
c. *write the letter* = {a,b,↑(a⊔c)}

(47) a. *student* = {a,b}
b. *team* = {↑(a⊔b⊔c),↑(a⊔b)}

Now let's look at the plural version of the predicates and nominals:

(48) a. **sleep*={a,b,c,a⊔b,a⊔c,b⊔c,a⊔b⊔c}
b. **gather*={↑(a⊔b),↑(b⊔c), ↑(a⊔b)⊔ ↑(b⊔c}
c. **write the letter*={a,b,↑(a⊔c),a⊔b,a⊔ ↑(a⊔c),b⊔ ↑(a⊔c),a⊔b⊔ ↑(a⊔c)}

(49) a. *student* = {a,b,a⊔b}
b. *team* = {↑(a⊔b⊔c),↑(a⊔b), ↑(a⊔b⊔c)⊔ ↑(a⊔b)}

Now, when the basic assumptions behind the plurality interpretation of predicates and nominals were introduced, let me continue to Winter's ideas about refining this hypothesis (note that Winter (2001) doesn't agree with Landman's two domains approach – Winter tries to do without group subdomain of pluralities, that will be reflected by different formalizations below).

The basic assumptions about collective predicates like *be a good team* in Winter's flexible Boolean semantics is that they are atom predicates where each atom denotes a plural entity. And according to him, these predicates are genuine collective predicates. The distinction between collective predicates like *be a good team* and distributive predicates like *laugh* is that distributive predicates are atom predicates as well but in their uninflected denotations they range only over regular individuals.

Winter's typology of semantic number classifies predicates according to their behavior in sentences like the following.

(50) a. all the/no/at least/many students/committees PRED
b. every/no/more than one/many a student/committee PRED

PRED is a predicate (verb, noun or adjective) like *be a good team* or *laugh*. If the sentences in (50-a) and (50-b) are equally acceptable and, if acceptable, are furthermore semantically equivalent, then PRED is called an *atom predicate*. If the sentences differ in either acceptability or truth-conditions, then PRED is called a *set predicate*.

According to this criterion, a collective predicate like *meet* is a set predicate but collective predicate like *be a good team* is an atom predicate, compare (51-a) and (51-b) with different acceptability and (52-a) and (52-b) with similar (un)acceptability. All distributive predicates (like *laugh*, *smile*, *sleep*) are of course atom predicates. What is the crucial distinction between Landman's and Winter's typology of plurality denoting expressions? From the point of view of collective nouns, it's Winter's observation that not all collective predicates behave similarly – while both *be a good team* and *meet* would be classified as group denoting nominals by Landman, only the first is genuine collective predicate for Winter, because the second nominal can take also sums in its denotaion (next to group atoms).

(51) a. All the/no/at least two/many students met.
b. *Every/*no/*more then one/*many a student met.

(52) a. *All the/*no/*at least two/*many students are a good team.
b. *Every/*no/*more then one/*many a student is a good team.

Winter's system builds on the distinction between the semantic number of a predicate (the atom/set distinction) and the morphological number of the predicate (the sg./pl. distinction), see (53) and (54). In (55) are some lexical entries for illustration. The first two principles are analogical to Landman's pluralization star operator plus the basic categorization of individual atom and group atom denoting classification. Winter's innovations are of two kinds: first Winter doesn't assume that there is a totally productive mapping between sums and groups – see the lexical entry for *committee*; second he allows also sums into the extension of predicates like *meet*. This comes from his test for atomic/set type of predicate mentioned above. I think this is right move, as quantifiers are really sensitive to the semi-collective/genuine collective distinction as we saw in (45-a).

(53) **Principle 1** *When uninflected for number, atom predicates denote sets of atomic entities. Uninflected set predicates denote sets of sets of atomic entities.*

(54) **Principle 2** *Number features change the semantic number of predicates so that all singular predicates denote sets of atoms whereas all plural predicates denote sets of sets.*

(55) a. **student**'={**j**',**m**',**p**'}

b. **students** = {{**j**'},{**m**'},{**p**'},{**j**',**m**'}...,{**j**',**m**',**p**'}}
c. **committee**'={**c**'$_A$,**c**'$_B$}
d. **is_a_good_team**={**c**'$_A$,**c**'$_B$}
e. **meet**'={{**j**',**m**'},{**c**'$_B$}}

If we accept classical Montague's treatment of quantifiers then there's a type problem because there is no semantic difference between the singular and plural determiner quantifiers (*all, every, no$_{sg}$, no$_{pl}$, ...*). All of them are of the type $\langle\langle d,t\rangle,\langle\langle d,t\rangle,t\rangle\rangle$ but in Winter's system (following Bennett) singular predicates are of the $\langle d,t\rangle$ type although plural predicates are of the $\langle\langle d,t\rangle,t\rangle$ type. Given these assumptions, plural marked arguments of a quantificational determiner yield a type mismatch and should yield prima facie uninterpretability.

The situation is rescued via a special interpretation rule called „determiner-fitting" triggered by the presence of morphological plurality. The working of 'dfit' is a bit complicated but let's say that it can explain the distinction between (57-a) and (57-b).

An important prediction of the system is that quantifiers are incompatible with genuine collective predicates like *be a good team* (even if the quantifiers are in plural). They are compatible with set predicates like *meet* via the dfit strategy but this strategy is unavailable to rescue grammatically for collective atom predicates.

(56) **Determiner fitting**
$dfit = \lambda D_{(et)(ett)}.\lambda\mathcal{A}_{ett}.\lambda\mathcal{B}_{ett}.D(\cup\mathcal{A})(\cup(\mathcal{A}\cap\mathcal{B}))$

(57) a. All students met in the hallway.
b. *All students are a good team.

Nevertheless some at first sight quantifiers can be subjects of these atom collective predicates like *be a good team*, see (58), they are quantifiers of the flexible type (their syntactic projection is only D′, not a full DP), so they can be type shifted into a set type and then turned into groups. As groups they are eligible arguments for genuine collective predicates like *be a good team*. The sample derivation of denotation of NP like *the students* is shown below. In (59-a) the bare plural *students* denotes set of atoms and sums, in (59-b) application of the maximalization σ-operator (the meaning of the definite article) turns the denotation into the supremum – the maximal entity in the denotation of plural NP *students*, in (59-c) we type-shift the supremum into a group using Landman's $\uparrow$-operator, and in (59-d) we apply the genuine collective predicate to the group. Winter (2001) generalizes that for rigid nominals the mapping to group-atoms is not available but for flexible ones it is, this is the reason of ungrammaticality of (57-b) and grammaticality of (58-a-c).

(58) a. The students are a good team.
b. Some students I know are a good team.
c. Five students I know are a good team.

(59) a. *students*={a,b,c,a⊔b,a⊔c,b⊔c,a⊔b⊔c}
b. *the students*={a⊔b⊔c}

c. *the students* (as a group)={↑(a⊔b⊔c)}
d. BE_GOOD_TEAM(↑(a⊔b⊔c)) (=meaning of (58-a))

If we return to the example (43), repeated below as (60), we can say that the system predicts that it can be grammatical only if the n-word isn't a generalized quantifier and rigid nominal. So this is another piece of puzzle which points at the predicate nature of n-words.

(60) can be formalized as (61), which in LoP says, that there is no plurality in the denotation of plural nominal *students*, which could be true group-shifted argument of the genuine collective predicate BE_GOOD_TEAM.

(60) *Žádní mí studenti nejsou dobrá parta.*
no my students not-AUX good team
'#No students of mine are good team.'

(61) $\neg\exists x \in {}^{*}STUDENT : BE\_GOOD\_TEAM(\uparrow(x))$

The corresponding English sentence in (62) is ungrammatical. That shows that English n-words are at least syntactically rigid nominals, read DPs, and because of that unlike Czech n-words they cannot be mapped to impure atoms.

(62) No students are a good team.

2.7.2 Coordination of n-words

The next important piece of data is exemplified by sentence (63) which shows that with set predicates n-words can assemble a plural entity with a property assigned to them by the set predicate. This property is then negated because of the propositional negation (signalized by negative concord both on the n-words and on the verb).

The generalized quantifiers approach cannot explain this sentence interpretation because the basic denotation of negative quantifiers in GQ theory is a disjoint operation on sets (*no student of mine* would denote a set of sets disjoint from my students) and the only meaning which GQ theory can assign to (63) would be that some intersection of a set of entities disjoint from my students and teachers met in Prague. That is of course a very implausible reading for (63).

In Partee's type shifting system the truth conditions would be similar to the GQ treatment. (63) would mean that some non-student of mine and some non-teacher of mine met in Prague, again a wrong meaning for the sentence (63). This also supports the syntactic theory of negative concord phenomena, as proposed in Penka (2007a), because the scope of negation is interpreted at the propositional level and the scope of n-words is interpreted under the collective predicate *meet* (first there is summation of the two indefinites which is type shifted into a group – about the group consisting of any atom of student with any atom of teachers, it is said that the group doesn't belong to the denotation of the collective predicate *meet*).

But if we follow the main line of argumentation here and treat n-words as indefinites, the intuitive meaning of (63) is that for any chosen pair consisting of my student and my

teacher, this pair don't have a property MET_IN_PRAGUE which is exactly what (64) formalizes. As the grammatical judgment in English translation shows, this sentence is either ungrammatical in English or it has the peculiar meaning discussed in the preceding paragraph, which probably leads to its unacceptability.

(63) *Žádný můj student a žádný můj učitel se v Praze nesešli..*
no my student and no my teacher REFL in Prague not-met
'#No student of mine and no teacher of mine met in Prague.'

(64) $\neg\exists x \in STUDENT : \exists y \in TEACHER : MEET(\uparrow (x \sqcup y))$

2.7.3 Negatvie NPs in Czech and English and their formalization in LoP

As was demonstrated in the previous sections, 2.7.1 and 2.7.2, Czech and English differ in the way they distribute (English) or don't allow to distribute (Czech) the pluralities denoted by their negative NPs. Czech negative NPs are always interpreted cumulatively (and allow the shift to groups), while English negative NPs are interpreted only distributively. Let's consider English sentence (65) and its Czech translation in (66).

(65) No women gave birth to twins.

(66) *#Žádné ženy neporodily dvojčata.*
no women not-gave_birth twins
'No women gave birth to twins.'

Predicate *give birth to twins* is extremely distributive, its singular and plural denotation would be e.g. sets in (67-a) and (67-b). There is no group element either in the singular or the plural denotation, because even if today the act of childbirth is carried out by many nurses and doctors helping the mother, we still at least linguistically (and quite naturally) credit the main responsibility to the mother only. Let's assume that plural *women* (in both languages has the denotation as in (67)), then the English sentence in (65) is true in such a model (let's assume that individuals *a,b,c* are cows e.g.).

(67) a. *give birth to twins* = {a,b,c}
b. **give birth to twins* = {a,b,c,a⊔b,a⊔c,b⊔c,a⊔b⊔c}

(68) **women* = {d,e,d⊔e}

Czech sentence like (66) should be true in such a scenario but it is ungrammatical. Why? There are two options for its interpretation: cumulative and collective. I will discuss both in details now. The cumulative interpretation is formalized in (69). The trouble with the cumulative interpretation is that it forces us to understand the Czech sentence as we would understand an English sentence like (70) which in the cumulative reading would ascribe one baby from the twins to each mother. (70) is of course totally natural in the distributive reading, but it lacks the cumulative reading for biological reasons.

(69) $\neg\exists ex[^*WOMAN(x) \wedge {}^*GIVE\_BIRTH(e) \wedge {}^*Ag(e) = x \wedge {}^*TWINS(Pat(e))]$

(70) Jane and Mary gave birth to twins.

The second interpretative option for Czech negative NPs would be to shift the plurality into group atom. But again, we cannot interpret such a reading for biological reason. Compare English sentence like (71) which sounds just weird. To sum up: Czech n-words are of the predicative $\langle d,t\rangle$ type and in LoP they scope under the event variable, their reading is hence cumulative or collective but never truly distributive. But what about singular n-words? Czech sentence like (72-a) is perfectly acceptable and has the meaning corresponding to the English plural negative NPs. I assume that this is simply an effect of grammatical number: as in singular the cumulative reading and the distributive reading cannot be distinguished, we have here the illusion of distributivity but in fact, the singular n-word is still under the closure of the event variable, so we don't have the genuine distributivity – see the formalization in (71-b).

(71) Jane and Mary as a group gave birth to twins.

(72) a. *Žádná žena neporodila dvojčata.*
no woman not-gave_birth twins
'No women gave birth to twins.'
b. $\neg\exists ex[WOMAN(x) \wedge GIVE\_BIRTH(e) \wedge Ag(e) = x \wedge TWINS(Pat(e))]$

English negative NPs on the other hand obligatorily scope over the event variable, it carries the logical negation along the way and their interpretation in LoP is (73). I formalize the plural negative NP as $\neg\exists x \in WOMAN$, because it is originally composed from $^*WOMAN$ and Landman's scopal quantifying-in rule which ranges over all atoms in the plurality which can be collapsed into $\neg\exists x \in WOMAN$ – see the next section for the explicit account of the composition.

(73) $\neg\exists x \in WOMAN(x) : \exists e[GIVE\_BIRTH(e) \wedge Ag(e) = x \wedge TWINS(Pat(e))]$

2.7.3.1 English negative NPs in LoP

In this section I will demonstrate how English negative noun phrases compositionally contribute to the meaning of the sentences in which they occur. The formal treatment is done LoP and draws heavily from the chapter 8 of Landman (2004). Landman (2004, p. 176) proposes the following interpretation for nominal negation – see (74). Nominal negation (of the type $\langle\langle\langle d,t\rangle,t\rangle,\langle\langle d,t\rangle,t\rangle\rangle$) is stored and retrieved as soon as the derivation reaches one of the admissible types for negation – in this case the type of generalized quantifiers ($\langle\langle d,t\rangle,t\rangle$). As the consequence of its types, nominal negation is interpreted differently in argument and adjoined/predicative positions and allows the collective interpretation for English NPs in case they occur in the adjoined/predicative positions. But in the argument positions the negation is a noun phrase modifier interpreted as $\lambda T\lambda P.\neg T(P)$ – its logical type is $\langle\langle\langle d,t\rangle,t\rangle,\langle\langle d,t\rangle,t\rangle\rangle$. In adjunct positions the nominal negation is incorporated auxiliary negation which scopes in the moment when the derivation reaches the type $\langle t\rangle$, its starting type is then $\langle t,t\rangle$. In Landman's system there is no no type shifting of negation (compare with Partee (1987) where neg *NP* is

interpreted as ATOM - $[\![NP]\!]$) in a sense that there is a complement interpretation for negative NPs – negation is always interpreted as classical logical negation but its different interpretation is a result of different scopes where it occurs. Sample derivation of English sentence (75) follows next. The negative NP starts its interpretation as a simple plural predicate in LoP and the negative part of its meaning is stored – (75-a), because the type of the NP ($\langle d,t\rangle$) doesn't fit any of the admissible types for nominal negation.

(74) **nominal negation**
$no \rightarrow \neg_n$ where n is $\langle t,t\rangle$ or $\langle\langle\langle d,t\rangle,t\rangle,\langle\langle d,t\rangle,t\rangle\rangle$

(75) No girls slept.
a. *no girls* $\rightarrow {}^*GIRL$, STORE $\neg_n$

Because the negative NP is in argument position, it must undergo argument shift to $\langle\langle d,t\rangle,t\rangle$ type and because $\langle\langle d,t\rangle,t\rangle$ is one of the input types for nominal negation, $\neg_n$ must be retrieved from the store – (76-a). This is the scopal version of negative NP and as such scopes over the predicate – (76-b) – and over the event variable.

(76) a. $\lambda P.\neg\exists x[{}^*GIRL(x) \wedge P(x)] \ldots$ type $\langle\langle d,t\rangle,t\rangle$
b. $\lambda x\lambda e.SLEEP(e) \wedge Ag(e) = x \ldots$ type $\langle d,\langle e,t\rangle\rangle$

The types of the negative NP and the predicate are incompatible in this step of derivation, so we apply maximalization (closure of the event variable) – (77-b) and next we abstract over variable x, turning its type $\langle t\rangle$ into the type $\langle d,t\rangle$ – (77-c).

(77) a. $\lambda P.\neg\exists x[{}^*GIRL(x) \wedge P(x)] \ldots$ type $\langle\langle d,t\rangle,t\rangle$
b. $\exists e[SLEEP(e) \wedge Ag(e) = x] \ldots$ type $\langle t\rangle$
c. $\lambda x.\exists e[SLEEP(e) \wedge Ag(e) = x] \ldots$ type $\langle d,t\rangle$

Then we quantify-in the negative NP and according to Landman (2000, 194) we must use the rule of scopal quantifying-in which ranges over atoms of the quantified plurality (the part $\forall x_n \in ATOM(x)$ in (78)). SQI quantifies α into ϕ – λ-abstraction is part of the SQI in fact, α is the scoped operator. Obligatory distributive interpretation of scoped operators is consequence of this. After application of SQI to (77-a) (α) and (77-b) (ϕ) we obtain (79). For easier reading I will use the formalization in (78-a) which simply substitutes the negation of existential quantifier with universal quantification over the negated formula (this follows from the predicate logic equivalence of $\neg\exists xPx$ and $\forall x\neg Px$).

(78) SQI_n: **scopal quantifying-in**.
SQI_n=APPLY$[\lambda x.\forall x_n \in ATOM(x) : \phi, \alpha\ ]$

(79) $\neg\exists x[{}^*GIRL(x) \wedge \forall x_n \in ATOM(x) : \exists e[SLEEP(e) \wedge Ag(e) = x_n]]$
a. $\forall x[{}^*GIRL(x) \wedge \forall x_n \in ATOM(x) : \neg\exists e[SLEEP(e) \wedge Ag(e) = x_n]]$

The obligatory distributive interpretation of quantified NPs (and English negative NPs seem to behave in all respects like ordinary quantifiers like *every NP*) is the theoret-

ical explanation of ungrammaticality of such operators as arguments of cumulative or collective predicates. So English negative NPs are treated like obligatorily quantified-in indefinites with stored negation. Their behaviour follows from that and it explains the ungrammaticality of the following examples – (80-a) and (80-b) are ungrammatical, because both NPs must scope over the event variable in LoP and as such must be interpreted distributively but this of course clashes with the collective interpretation of the predicate *gather*.

(80) a. #Every student gathered in the hall.
b. #No students gathered in the hall.

As for the **negative NPs in predicative or adjoined positions** – the derivation doesn't go through the $\langle\langle d,t\rangle,t\rangle$ type of NP, so negation is retrieved later, after the existential closure of event variable. An immediate prediction of this assumption is that cumulative and collective reading of Germanic negative NPs is possible in non-argumental positions – see Landman (2004, p.177) – which seems to be the case at least for Dutch. So Dutch allows in its *there is* constructions the negative NPs to have the cumulative and collective reading as demonstrated in (81-a) and (81-b) respectively.

(81) a. Er spelt geen meisje in de tuin.
'There was no girl playing in the garden.'
$\neg\exists e[PLAY(e) \wedge GIRL(Ag(e)) \wedge IN(e) = \sqcup(GARDEN)]$
b. Er kwamen drie jongens en geen meisjes samen.
Three boys and no girls gathered.

What we seem to see is that there is a correlation between the predicative interpretation of NP and its collective/cumulative reading. The tentative hypothesis can have a form of an empirical generalization: distributive interpretation disallows predicative type of NP and conversely cumulative/collective interpretation is the only plural interpretation of the predicative NPs. Whether such hypothesis should have deeper explanation and whether it's empirically correct is something I hope to examine in a future work.

2.7.3.2 Czech negative NPs in LoP

The same semantics as in (74) would give totally incorrect predictions for Czech negative NPs. This is so for two main reasons: (i) negative force – Czech n-words don't carry any real negative semantics (so there is no double negative reading in Czech) and (ii) no distributive interpretation of Czech negative NPs – there is no distributive reading of Czech n-words. Basically then we can assume that Czech n-words don't have the $\langle\langle\langle d,t\rangle,t\rangle,\langle\langle d,t\rangle,t\rangle\rangle$ type and their type is $\langle d,t\rangle$. Moreover they don't store the negation. Negative force comes from the verbal negation. To formalize this we can use Landman's auxiliary negation rule as repeated here in (82) (after Landman (2004, p.174))

(82) **Auxiliary negation**
niet(not) $\rightarrow \neg$ of type $\langle t,t\rangle$

The obligatory presence of verbal negation can be formalized as in (83). So let's assume that negation on Czech n-words is simply signal that the argument shift for Czech negative NPs in argument positions must be done no later then at the point of negating the existential closure of the event variable.

(83) Czech n-words: argumental shift of Czech n-words is possible only under negated event variable.

This is a sort of predicative analysis of negative NPs, close to syntactic proposals like Zeijlstra (2004) but I think this simple rule explains the behaviour of Czech negative NPs quite well. It explains that lack of negative verb with n-words leads to ungrammaticality: (84) is ungrammatical because $\langle d,t\rangle$ type cannot occur in argument position and because the predicative NP isn't existentially closed, the verb and the argument cannot be combined because of type mismatch: verb is of the type $\langle d,\langle e,t\rangle\rangle$, NP of type $\langle d,t\rangle$ and there is no type shifting rule which can repair this. Let's look now at the derivation of (85) and the ingredients in (85-a) – negative NP, (85-b) – the predicate and (85-c) – the verbal negation.

(84) **Žádný chlapec přišel.*
no boy came
'No boy came'

(85) *Žádní chlapci nepřišli.*
no boys not-came
'No boys came.'

a. žádní chlapci $\ldots \lambda x.{}^{*}BOY(x)\ldots\langle d,t\rangle$
b. přišli $\ldots \lambda x.\lambda e.COME(e)\wedge Ag(e)=x\ldots\langle d,\langle e,t\rangle\rangle$
c. ne-$\ldots\neg\ldots\langle t,t\rangle$

The derivation continues as: the interpretation of negated verb is predicative with the event argument (the negation cannot apply and is stored in this moment because of the type incompatibility) – (86). We apply the argument shift (check whether negation is in the store) to the argumental negative NP – (86-a). And we lift the predicate, so it can apply in situ to NP – (87-b).

(86) a. ne-přišli $\ldots\lambda x.\lambda e.COME(e)\wedge Ag(e)=x\ldots$ STORE $\neg$

(87) a. $\lambda P.\exists x[{}^{*}BOY(x)\wedge P(x)]\ldots\langle\langle d,t\rangle,t\rangle$
b. $\lambda T.\{e\in COME : T(\lambda x.e\in COME(e)\wedge Ag(e)=x)\}\ \ldots\langle\langle d,t\rangle,t\rangle,\langle e,t\rangle\rangle$

Next, we apply the predicate to argument (88-a), then do the maximalization (existential closure of the event variable – (88-b)) and then retrieve the negation because we reach the $\langle t\rangle$ type –(88-c).

(88) a. $\{e\in COME : \exists x[{}^{*}BOY(x)\wedge Ag(e)=x]\}$
b. $\exists e[COME(e)\wedge\exists x[{}^{*}BOY(x)\wedge Ag(e)=x]]$
c. $\neg\exists e[COME(e)\wedge\exists x[{}^{*}BOY(x)\wedge Ag(e)=x]]$

The obligatory cumulative interpretation explains why Czech n-words occur as arguments of cumulative and collective predicates. As arguments of collective predicates, they undergo the group-shift but they remain in the scope of the existential closure of the event variable. On the other hand, they resist to be arguments of distributive predicates as the following examples show: (89-a) is ok under the cumulative interpretation. (89-b) is the pure collective interpretation. And (89-c) again demonstrates that Czech negative NPs resist to be arguments of strictly distributive predicates.

(89) a. *Žádní pohřebáci nepohřbili víc jak 15 lidí za den.*
no undertakers not-buried more than 15 people in day
'??No undertakers buried more than 15 people per day.'
b. *Žádní chlapci neutvořili pyramidu.*
no boys not-formed pyramid
'??No boys formed a pyramid.'
c. #*Žádní chlapci neměli modré oči.*
no boys not-have blue eyes
'No boys had blue eyes.'

2.8 Prediction III: intensional predicates

Let's repeat: n-words are indefinites and without additional structure they denote sets. From it follows that they should be grammatical in environments selecting for sets or properties. Intensional predicates were argued to be property selecting and we will see that this works well with the indefinite status of Czech n-words.

Indefinites in the scope of intensional verbs are generally able to have two readings, the de dicto and the de re, as (90) illustrates, which can mean either that there are two criminals such that the inspector must arrest them or that there is a norm for the inspector to arrest two criminals per week, irrespective of their identity.[2]

(90) The inspector must arrest two criminals this week.
a. de dicto: norm for the inspector per week is two criminals
b. de re: there are two criminals such that the inspector must arrest them

N-words in negative concord languages like Czech can be interpreted only de dicto in these constructions as I want to show in this section. Let's look at (91) and first it's the de dicto reading.

(91) *Petr nehledá žádného jednorožce.*
Petr not-searches no unicorn
'Petr doesn't seek any unicorn.'

In Montague's classical analysis, the de dicto reading would be analyzed as a relation

[2]The problem of the de dicto/de re interpretation in the scope of modal verbs is one of the big topics of formal semantics going back at least to Montague (1973). For the discussion of Germanic n-words and their semantics in the scope of intensional verbs see Penka (2007a, chap. 3).

SEEK between Petr and the intension of a generalized quantifier as in (92-a), in other words, intensional verbs denote relations between individuals and quantifier intension, i.e. they are of type $\langle s, \langle\langle d,t\rangle, t\rangle\rangle, \langle d,t\rangle\rangle$. This reading is very weak. It expresses that Petr stands in the SEEK relation to the function which assigns to every possible world the set of properties that no unicorn has.

It's because on Montague's analysis of the de dicto reading, the negation is sitting in the wrong place. For Montague, the only alternative is to scope it out. But that gives the de re reading, which is also wrong.

Zimmermann (1993) argues against Montague's analysis of quantifiers in the scope of intensional verbs, in favor of an analysis where the complement of SEEK is an intensional property, rather than the intension of a generalized quantifier.

This is exactly in accordance with the analysis which postulates an indefinite analysis for n-words and is also one of the main arguments for separating negative and indefinite part of n-words (irrespective of the negative concord status of the examined language), as Landman (2004) and Penka (2007a) show, because otherwise we would end up with the same problems as in (92-a) because at the level of properties, the only plausible analysis of negation is as complementation as in (92-b).That would mean that Petr is seeking non-unicorns and not that Peter is not searching for unicorns. The most plausible meaning of (92) is (92-c) where negation takes scope over whole formula

(92) Petr nehledá žádného jednorožce.

a. $SEEK(\hat{}\lambda P.\neg\exists x[UNICORN(x) \wedge P(x)])(p)$
b. $SEEK(\hat{}(ATOM - UNICORN)(p))$
c. $\neg SEEK(\hat{}UNICORN)(p))$

Let's return to the de re reading of Czech sentences with n-words. It's easier to test them when embedding the n-word under modal verbs than under an intensional verb like *seek*. Sentence (93) under the de dicto reading means that there's no obligation for the inspector to arrest two criminals this week.

But what would be the de re reading? The de re reading would be true in situations in which the de dicto reading is false. If the norm of work for inspectors says that there are no criminals, say a murderer and a burglar, which have to be arrested this week, but only that two criminals must be arrested per week, then (93) under the de dicto reading is false but under the de re reading is true.

This is so because in the de re reading an indefinite would scope over modal verb but under negation. This reading is unavailable for the sentence (93), so I conclude that n-words in Czech don't have the de re readings. This follows from the predicate semantic type of Czech n-words. On the other hand in Germanic languages, negative noun phrases as quantifiers can quantifier raise over the modal verb, which is the reason for their ability to have the de re reading as well.

(93) *Inspektor nemusí tento týden zavřít žádné dva zločince.*
inspector not-must this week arrest no two criminals
'The inspector need not arrest two criminals this week.'

a. $\neg$ must $>\exists$
b. *$\neg > \exists >$ must

2.9 Open questions

I have analysed Czech negative noun phrases as indefinites with the need to be licensed by negation. Indefinites are generally peculiar in their wide scope behaviour (see e.g. Fodor and Sag (1982),Kratzer (1998), ...). Let's remind ourselves of the contrast between universal quantifier in (94) and an indefinite in (95)

(94) *Jestliže Petr koupí každou knihu v tomhle knihkupectví, tak přijde na buben.*
If Petr buys every book in this bookshop then will-be-he on drum
'If Petr buys every book in this book shop, then he will be broke.'
a. $[\forall x[BOOK(x) \rightarrow BUY(p,x)]] \rightarrow BROKE(p)$
b. *$\forall x[[BOOK(x) \rightarrow BUY(p,x)] \rightarrow BROKE(p)]$

(95) *Jestliže Petr koupí jednu knihu v tomhle knihkupectví, tak přijde na buben.*
If Petr buys one book in this bookshop then will-be-he on drum
'If Petr buys one book in this book shop, then he will be broke.'
a. $[\exists x[BOOK(x) \wedge BUY(p,x)]] \rightarrow BROKE(p)$
b. $\exists x[BOOK(x) \wedge [BUY(p,x) \rightarrow BROKE(p)]]$

It would be appropriate to check the behavior of Czech n-words whether it shows something similar in this respect. That means, if the n-words demonstrate any wide scope phenomena similar to the regular indefinites. At first sight this is not true as we see from (96) with the only grammatical reading in (96-a) and with the logically possible, very weak, but in the natural language totally ungrammatical reading in (96-b).

(96-b) can be paraphrased as: there is such an x (book) which if Peter doesn't buy the x, then he will remain rich. This would be true in a situation where one very expensive book in the bookshop would make Peter poor, although buying other books would be harmless for his wallet, but the sentence (96) is much more strong – it says that any book in this bookshop would ruin Petr.

(96) *Jestli si Petr nekoupí žádnou knížku v tomhle knihkupectví, tak zůstane bohatý.*
If REFL Petr not-buy no book in this bookshop then remain-will-he rich
'If Petr buys no book in this book shop, then he will remain rich.'
a. (i) $\neg[\exists x[BOOK(x) \wedge BUY(p,x)]] \rightarrow REMAIN\_RICH(p)$
(ii) $\exists x[BOOK(x) \wedge \neg[BUY(p,x) \rightarrow REMAIN\_RICH(p)]]$

Let's follow an old practice and describe the fact by a stipulatively named rule and because it's just the opposite of the specificity marking of *certain*, let's call it unspecificity marking rule.

(97) **Unspecificity marking rule**
The n-words in Czech denote a predicate that must be existentially closed under the scope of verbal negation and also under the scope of any other logical operator.

The scope possibilities of Czech n-words are very restricted: they must be interpreted in the scope of negation and moreover in the scope of any other logical expression in their sentence. This again formally follows from the status of negation in Landman's framework. Negation scopes over the event variable, if some expression (noun phrase, adverbial, ...) wants to be scopally interpreted it must undergo quantifying-in which raises it over the negation. If Czech n-words are interpreted necessarily under the scope of negation, then by transitivity, they must be interpreted under all scope taking expressions in their sentence. The following examples demonstrate this claim.

(98) *Petr si nechtěl vzít žádnou řeznici.*
Petr REFL not-wanted marry no she-butcher
'Petr wanted to marry no woman butcher.'
a. $\neg >$ want $> \exists$ woman butcher
b. $*\exists$ woman butcher $> \neg >$ want
c. $* \neg > \exists >$ want

(99) *Dva řezníci nezabili žádného vola.*
Two butchers not-killed no ox
'Two butchers killed no ox.'
a. 2 butchers $> \neg > \exists$ ox
b. $*\exists$ ox $>$ 2 butchers $> \neg$

(100) *Petr často nejedl žádný řízek.*
Petr frequently not-ate no schnitzel
'Petr frequently ate no schnitzel.'
a. frequently $> \neg > \exists$ schnitzel
b. $*\exists$ schnitzel $>$ frequently $> \neg$

Last remark: the reason why n-words are incompatible with modifiers of the *certain* type is maybe semantic: *certain* wants to have widest scope but *no* goes in the opposite direction. From this it follows that no closure is available and ungrammatically arises.

(101) **Petr si nechce vzít žádnou jistou studentku.*
Petr REFL not-wants marry no certain student
'Petr wants to marry no certain student.'

2.10 Summary

The present analysis of n-words has shown that Czech n-words are of the set type ($\langle d, t\rangle$) and their type does not change in predicate position. N-words in argument position are interpreted as other indefinites through existential closure. The negative morphology of n-words is only an agreement feature which signals propositional negation (negative n-words in Slavic languages must be accompanied by a negated verb, where negation is high enough to have scope over the event variable). So n-words are indefinites of a special sort.

As predicates of the set type, n-words can be interpreted in opaque contexts selecting for properties; they can appear in the predicative nominal constructions (they are not quantifiers there); they can be mapped to the atom element representing the relevant group of objects and as such they can be arguments of collective predicates; and they can form summation of their arguments in coordination which is then interpreted as a generalized quantifier ranging over collective predicates.

3 Negation and aspect

3.1 Introduction

This chapter examines how negation interacts with aspect. Before I introduce basic data illustrating the interaction, let me sketch some terminology needed for the description of the data.

Different time intervals can be modified by time adverbials. Some of them impose semantic restrictions on the predicates they modify. One of those cases are the *in an hour/for an hour* type adverbials. *In an hour* is a time adverbial which can modify only telic predicates (in case it modifies the event time) and *for an hour* can modify only atelic predicates. Telic VP [*ate the sandwich*] in (1-a) is compatible only with the emphin an hour modifier and atelic VP [*ate sandwiches*] in (1-b) is grammatical only with the *for an hour* adverbial. Formal definition of the subinterval property, which is theoretical reflection of *for*-adverbial sensitivity is in (2).

(1) a. John ate the sandwich in an hour/#for an hour.
b. John ate sandwiches *in an hour/for an hour.

(2) A predicate of times P has the subinterval property iff whenever P(i) for an interval i, then for all $i' \subseteq i$, P(i').

The same situation is reproducable in Czech: the atelic predicates are compatible with the bare NP *hodinu* (in a sense that there isn't any preposition assigning case to the NP, which will be important later) and telic predicates are grammatical with the PP *za hodinu*:

(3) a. *Petr četl tu knížku hodinu/#za hodinu.*
Petr read-imperf the book hour/in hour
'Petr was reading the book for an hour.'
b. *Petr přečetl tu knížku *hodinu/za hodinu.*
Petr read-perf the book hour/in hour
'Petr read the book in an hour.'

In the previous examples we saw that durative sentences (sentences with atelic VP) combine with *for*-adverbials, whereas non-durative sentences combine with *in*-adverbials. If we limit ourselves to these combinatorial tests, we seem to be forced to the conclusion that negative sentences are both durative and non-durative, because they are grammatical with *for*-adverbials and *in*-adverbials alike, as observed by Krifka (1989b) and de Swart (1996).

(4) a. Jane did not drink (a glass) of wine for two days.
b. Jane did not drink (a glass) of wine in two days.

Czech examples show the similar pattern. And the fact that negated telic sentences combine with *for*-adverbials while the same sentences without negation are ungrammatical with *for*-adverbials, led Dowty (1979), Verkuyl (1993) among others to a conclusion that negation can change telic predicates into atelic. They argue that negation affects the situation (grammatical) aspect properties of event descriptions and converts all event descriptions to states, allowing the temporal adverbs to modify the event time of the predicate.

(5) a. *Petr nevypil sklenici vína dva dny.*
Petr neg-drink-perf glass wine two days
'Peter didn't drink a glass of wine for two days.'
b. *Petr nevypil sklenici vína za dva dny.*
Petr neg-drink-perf glass wine in two days
'Peter didn't drink a glass of wine in two days.'
c. **Petr vypil sklenici vína dva dny.*
Petr drink-perf glass wine two days
'Peter didn't drink a glass of wine for two days.'

There is a different way in which one can try to solve the puzzle. The second approach (advocated in Kamp and Reyle (1993), Csirmaz (2006) among others) doesn't introduce any aspect shifting properties of negation, instead it derives the aspect related effects of negation from its truth-reversing and entailment changing nature. I will show that as far as Czech data indicate, the second position is preferable, because it represent the zero option (no special machinery is introduced).

In the next section I will present basic theoretical assumptions which I will use further to support the second approach, applied to Czech data.

3.2 Time and aspect

I follow the insight of Reichenbach (1947) and Klein (1994) in adopting a system of three time intervals, which can be characterized as follows. The time intervals are the event time, the reference time and the utterance time. The event time is the runtime of the event. The reference time is a time interval standing in (basically) two relations to the event time: the reference time includes the event time (perfective grammatical aspect) and the event time includes the reference time (imperfective grammatical aspect). In both cases, the event time is existentially quantified, as shown below.

(6) a. $[\![\text{perfective}]\!]=\lambda P_{\langle s,t\rangle}.\lambda t.\exists t'.[t' \subset t \wedge P(t')]$
b. $[\![\text{imperfective}]\!]=\lambda P_{\langle s,t\rangle}.\lambda t.\exists t'.[t \subset t' \wedge P(t')]$ Iatridou et al. (2001)

Finally, the reference time is ordered with respect to the utterance time, this ordering is provided by tense. With past tense, the reference time precedes the utterance time;

with present tense, the reference time includes the utterance time.

As an example, look at the following two sentences. (7-a) shows these relations between the time intervals: the reference time (yesterday) includes the event time (runing time of Peter's writing the letter) and the reference time precedes the utterance time. The first ordering is coded by the perfective aspect, the second ordering is expressed by the past tense. (7-b) shows the inverse relation between the reference time and the event time: imperfective aspect signals that the reference time (today) is included in the event time (Peter's writing the letter). Present tense signals moreover that the reference time includes the utterance time which is then by transitivity also included in the event time.

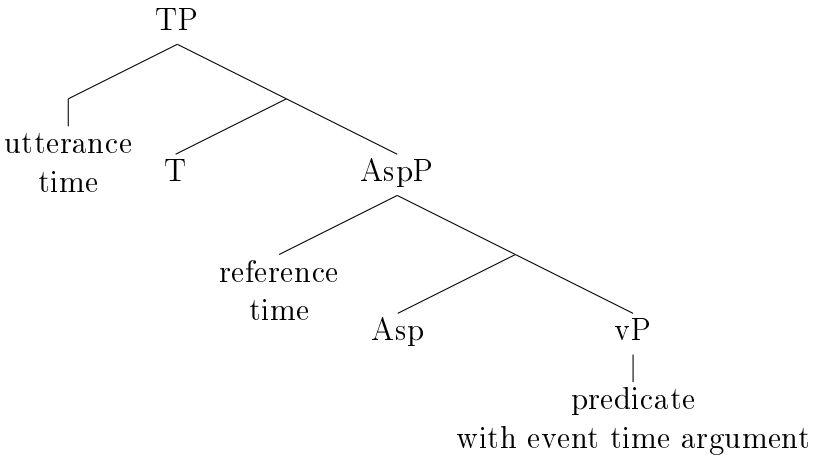
(7) a. *Petr napsal včera dopis.*
Petr wrote-perf yesterday letter
'Peter wrote a letter yesterday.'
b. *Petr dnes píše dopis.*
Petr today writes-imperf letter
'Peter writes a letter today.'

Let's follow Kamp and Reyle (1993) in their theory of tense and aspect which assumes the general grammatical structure of tensed clauses in (8). The predicate-argument structure of the sentence provides the description of some eventuality. Aspectual operators in some languages are optional and in some they allow recursion, which is why the Kleene star is used in (8) to indicate zero, one, or more operations.

(8) [Tense [Aspect* [eventuality description]]]

I will adopt this general standpoint and follow the idea spelt in the generative grammar framework. With Csirmaz (2005) I assume that tense is encoded in T head and perfective or imperfective aspect in Asp functional head. Following Iatridou et al. (2001), I assume that the event time is asociated with vP, the reference time with AspP and the utterance time with TP. The functional sequence which represents the same structural relations as (8) can be represented as a tree in (9), addopted from Csirmaz (2005, ex. 13)

(9)



3.2.1 Modification of time intervals

3.2.1.1 Event time modification

Event time modification is done by semantically compatible adverbials. Telic events are modified by *in*-adverbs, atelic events are modified by *for*-adverbs. Illustrating the event time modification is straightforward, the adverbs measure the length of the events.

(10) a. Peter was happy for ten minutes.
b. Peter slept for two hours.
c. Peter run to the store in ten minutes.
d. Peter read the book in two hours.

3.2.1.2 Utterance time modification

The modification of the time of the utterance is excluded in general. Hornstein (1990) argues that the time of the utterance resists modification because of its deictic nature. That means that (11) can be understood only as event time modification – the event of Peter's arrival was at 14:00 in the past. The utterance time modification would have a meaning such that the sentence was uttered at 14:00 and in some previous time (by 14:00) Peter had arrived. (11) doesn't seem to have such reading.

(11) At 14:00, Peter arrived.

3.2.1.3 Reference time modification

Modification of the reference time: the time interval of the adverb is interpreted as the topic time. In case of perfective aspect, the topic time includes the event time. Consider the sentences like (12-a) and (12-b) where the event time is modified by Czech *in*-adverb, but the reference time is modified by the time adverbs *během minulých pěti let* 'in the last five years' and Czech *for*-adverb *poslední čtyři roky* 'for last four years' respectively.

(12) a. *Během minulých pěti let vyjel Karel ten kopec za půl*
during last five years drive_up-perf Karel the mountain in half
hodiny.
hour
'In the last five years Karel drove up the mountain in half an hour.'
b. *Poslední čtyři roky tady Petr našel jen jednu houbu.*
last four years here Petr found only one mushroom
'In the last four years Petr found only one mushroom here.'

3.2.2 Negation and time modification

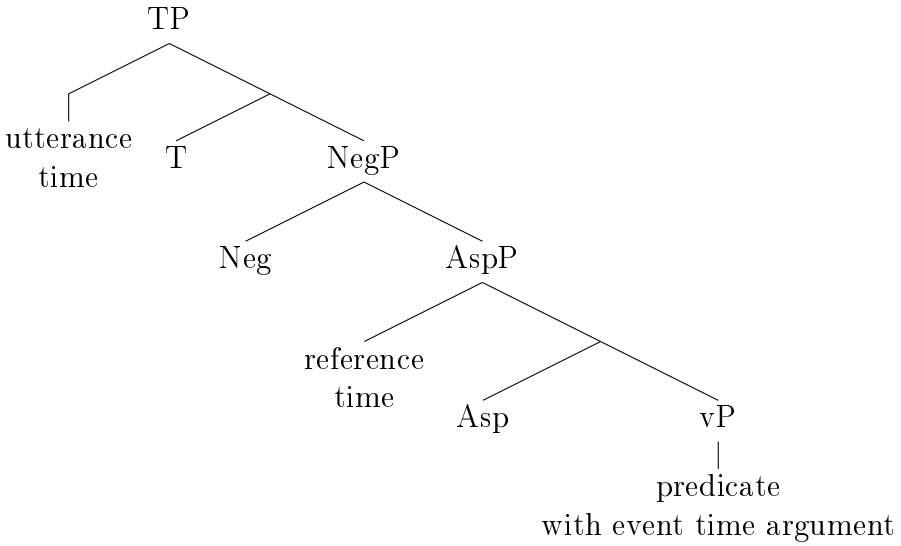
Let's repeat the examples (5) as (13). What they seem to show is that a durative adverbial with negated event predicates modifies the reference time, while *in*-adverbial modifies the event time. (13-a) can be paraphrased as: during two days there wasn't

any event of Peter's drinking wine (no matter how long that event would last). (13-b) is understood as: the event of Peter's not-drinking the glass of wine was longer than two days. In the first case the *for*-adverbial modifies the reference time, because the reference time is divisible, while in the second case the *in*-adverbial modifies the telic event.

(13) a. *Petr nevypil sklenici vína dva dny.*
Petr not-drink-perf glass wine two days
'Petr didn't drink a glass of wine for two days.'
b. *Petr nevypil sklenici vína za dva dny.*
Petr not-drink-perf glass wine in two days
'Petr didn't drink a glass of wine in two days.'

Let us consider how the time modification of negated event predicates is derived. I assume following Pollock (1989) among others, that negation is the head of its own projection. I also assume that NegP appears between TP and AspP. With these assumptions, illustrated in the tree (14) below, the description of the observed data is straightforward.

(14)



Durative adverbials cannot be merged sooner than the event predicate is changed into a divisible one. This is done by negation. Consider a sentence like (15). The *for*-adverbial modification is possible because the negated event is divisible (during one hour there was not a single occurrence of event of John's finding a mushroom in 10 minutes). The properties of the event time are still telic, since the event time can be modified by an *in*-adverbial.

(15) For an hour, John didn't find any mushroom in ten minutes.

There is a nice prediction of the presented formalism: with atelic predicates durative adverbials can modify both reference time and event time, with telic predicates they can modify only reference time because the event time is not divisible and for this

reason incompatible with the semantics of the adverb. The prediction seems to born out, as (16-a) with atelic verb is ambiguous as reflected in the logical form in (16-a') and (16-a"). Telic predicate *zapršet* 'start to rain' on the other hand allows only the topic time modification by durative adverbial, so the only logical form avaliable for (16-b) is (16-b').

(16) a. *Nepršelo tu dva měsíce.*
not-rained-imperf here two months
'It hasn't rained here for two months.'
a' $\exists$t[two_months(t) $\wedge\forall$ t'(t' $\subseteq$ t) $\rightarrow \neg\exists$ e[RAIN(e)$\wedge$ AT(e,t')]]
a" $\neg\exists$ e$\exists$t[two_months(t) $\wedge\forall$ t'(t' $\subseteq$ t) $\rightarrow$ [RAIN(e) $\wedge$ AT(e,t')]]

b. *Nezapršelo tu dva měsíce.*
not-rained-perf here two months
'It hasn't rained here for two months.
b' $\exists$t[two_months(t) $\wedge\forall$ t'(t' $\subseteq$ t) $\rightarrow \neg\exists$ e[RAIN(e)$\wedge$ AT(e,t')]]

3.2.3 Downward entailing predicates

Negation is maybe the most prominent exponent of the entailment reversing operators in natural language but there are many others which seem to license the same type of expressions, known as negative polarity items. In this section let's look at some of them.

Csirmaz (2005) discuses necesary conditions for modification by *-ig* and *át* adverbs in Hungarian. *-ig* and *át* adverbs only modify durative intervals, as the following example (example from Csirmaz (2005, ex. 1)) shows.

(17) a. *János két és fél óráig futott*
J-NOM two and half hour-until ran
'János ran for two hours and a half '

b. *János két és fél órán át futott*
J-NOM two and half hour-on across ran
'János ran for two hours and a half'

And the necessary condition for modification by these adverbs is the subinterval property, defined in (2), repeated here as (18). The subinterval property for predicates reminds us of the licensing condition for negative polarity items (NPIs), stated in (19) and (20-a) – (20-b) (definitions of the distribution of NPIs are stated in the Fauconnier/Ladusaw tradition and are take from Gajewski (2010)).

(18) A predicate of times P has the subinterval property iff whenever P(i) for an interval i, then for all $i' \subseteq i$, P(i').

(19) F is Downward Entailing (DE) iff for every A, B such that B$\subseteq$A, F(A) $\Rightarrow$ F(B)
['$\Rightarrow$' stands for cross-categorial entailment]

(20) a. A (weak) NPI α is licensed only if α occurs in the scope of a downward entailing operator.
b. Weak NPIs: *any, ever, at all ...*

Let's have a short look at the distribution of weak NPIs and the definitions which explain this distribution. Beatifull paradigm of examples offers Gajewski (2010, ex. 1):

(21) a. Bill didn't ever say anything.
b. No student ever said anything.
c. Few students ever said anything.
d. At most 5 students ever said anything.
e. *Between 5 and 10 students ever said anything.
f. *Some students ever said anything.

The explanation of grammaticality of the weak NPIs *ever* and *anything* in the scope of *no* is the following: because (22) is a valid entailment. For the quantifier *some* on the other hand, we see that (23) is an invalid entailment and because of that, the existential quantifier *some* is unable to license the NPIs.

(22) No student moves.
{x: x runs} $\subseteq$ {y: y moves}
$\therefore$ No student runs.

(23) Some students moves.
{x: x runs} $\subseteq$ {y: y moves}
$\therefore$ Some students run.

The downward entailing property of operators and the subinterval property of predicates are two sides of the same coin: both are based on the entailment from set to subsets, be it general cross-categorial entailment for downward entailing or predicate entailing from intervals to subintervals. I will call the predicates which license the durative adverbials like *-ig* and *át* in Hungarian and their counterparts in other languages, downward entailing predicates therefore.

Besides durative predicates and negation applied to any of Vendler's aspect classes, there are other environments with the subinterval property (or downward entailing property). That is well known fact in the studies dedicated to the negative polarity items phenomena. The other environments studied e.g. by von Fintel (1999) besides the negation, monotone decreasing quantifiers are negative polarity licensing by *only*, adversatives, superlatives, and conditionals. Csirmaz (2005) explores two of them: downward entailing quantifiers and arguments modified by Hungarian *only* (*csak*). Monotone decreasing quantifiers like *few people* yield the subinterval property for the predicate applying to the reference time. For Hungarian, I will repeat the examples from Csirmaz (2005, ex. 33) – see (24-a) – (24-c). Monotone decreasing quantifier *kevesebb mint tíz ember* ('fewer then ten people') yields subinterval property for the predicate and the durative adverbials *két évig / két éven* ('for two years') can modify the reference time. The modification of the reference time is made visible by the linear position of

the durative adverbials. Nonmonotonic or monotone increasing quantifiers like *exactly ten people* and *more than ten people* respectivelly (and their Hungarian pandans) don't turn the predicate into one with the subinterval property, so the durative adverbials are ungrammatical.

(24) a. *két évig / két éven át kevesebb mint tíz*
two year-until / two year-on until fewer than ten people-NOM
ember végzett gyógytornász szakon
finished physiotherapy major-on
'For two years, fewer than ten people majored in physiotherapy'

b. **két évig / két éven át (pontosan) tíz ember végzett*
two year-until / two year-on until exactly ten people-NOM finished
gyógytornász szakon
physiotherapy major-on
'For two years, (exactly) ten people majored in physiotherapy'

c. **két évig / két éven át több mint tíz*
two year-until / two year-on until more than ten people-NOM
ember végzett gyógytornász szakon
finished physiotherapy major-on
'For two years, more than ten people majored in physiotherapy'

Other arguments, including objects and goals also license the subinterval property of the predicate. Another set of Hungarian data from Csirmaz (2005, ex. 35) follows. This set of data shows that monotone decreasing quantifier *kevesebb mint* NP makes the predicate tainted with the subinterval property again which makes them available for the durative adverbial modification.

(25) a. *János két és fél óráig / két és fél órán át kevesebb,*
J-NOM two and half hour-until / two and half hour-on across fewer
mint tíz kagylót talált
than ten shell-ACC found
'For two hours and a half, János found fewer than ten shells' (although he hoped to find more)

b. *János két hétig kevesebb, mint öt embernek mondta el a*
J-NOM two week-until fewer than five people-DAT told away the
hírt
news-ACC
'For two weeks, János told the news to fewer than five people' (but afterwards he told it to everyone he met'

c. *János pár percig kevesebb, mint három embert ismert fel*
J-NOM few minute-until fewer than three people-ACC recognized up
'For a few minutes, János recognized fewer than three people'

That also shows that this type of durative adverbial licensing isn't derivable from the usual negative polarity items licensing. Even though it would be attractive to pursue reductionist theory which would claim that durative adverbials can be licensed by downward entailing operators, this sort of hypothesis isn't viable. Because negative polarity items must be in the scope of their licensors, which clearly isn't the case for the durative adverbials. The distinction is ilustrated by the following data: the negative polarity item *vůbec* ('at all') must be in the scope of its licensor (*málo profesorů* – 'few profesors'), see the contrast between (26-a) and (26-b). The durative adverbials (as I will show bellow, the durative adverbial of the *for an hour* type cannot be used in Czech in this type of constructions, so I use the durative variant of the *until* lexical item in Czech) needs only predicate which has the subinterval property and doesn't need to be in the scope of the operator which turns the predicate into the downward entailing predicate, see contrast between (26-c) and (26-d), where monotone decreasing quantifier (*málo knihkupců* – 'few booksellers') in the object position makes the predicate downward entailing predicate but monotone increasing quantifier (*některé knihkupce* – 'some booksellers') doesn't.

(26) a. *Málo profesorů vyhodilo vůbec nějaké studenty.*
few professors rejected ever some students
'Few professors ever reject some students.'
b. *#Vůbec nějací studenti navštívili málo profesorů.*
ever some students visited few professors
'Ever some students visited few professors.'
c. *Až do svého 30. roku Petr poznal málo knihkupců.*
until up his 30 year Petr met few booksellers
'Petr had met few booksellers until he turned 30.'
d. *#Až do svého 30. roku Petr poznal některé knihkupce.*
until up his 30 year Petr met some booksellers
'Petr had met some booksellers until he turned 30.'

In all the examples where monotone decreasing quantifier changes the predicate into the predicate with the subinterval property, this subinterval property holds for the predicate which applies to the reference time. The adverbs must be merged as reference time modifiers for their subinterval licensing condition to obtain. In Hungarian the linear order of the quantifier and the adverb corresponds to their relative scope and because of this correspondence, the following example is ungrammatical since the *-ig* adverb is interpreted as the event time modifier. So the following example taken from Csirmaz (2005, ex. 37) is hardly acceptabel (according to Csirmaz) because the *-ig* adverb being positioned on the right edge of VP suggest that the modification concerns the event time

and not the reference time. And as the verb *érkezett* ('arrive') is an achievment, the durative adverbial cannot modify its event time.

(27) ??*kevesebb, mint öt vendég érkezett meg két és fél óráig*
fewer than five guest-NOM arrived perf two and half hour-until
'For two hours and a half, fewer than five guests arrived'

Constituents modified by *csak*, the Hungarian equivalent of *only*, also license *-ig* and *át* modification. Csirmaz (2005) uses a solution offered by von Fintel (1999) to a problem of *only* and downward entailing. The problem of *only* and downward entailing is that even if *only* licenses negative polarity items (see (28)) , it isn't downward entailing in the usual sense of entailment, as shows (29-a) and (29-b).

(28) *Pouze Petr vůbec něco snědl.*
only Petr ever something ate
'Only Peter ever ate something.'

(29) a. *Petr snědl pouze houby.*
Petr ate only mushrooms
'Petr ate only mushrooms.'
b. $\nrightarrow$ *Petr snědl pouze hřiby.*
Petr ate only boletus
'Petr ate only boletus.'

Even if (29-a) is true, it isn't necessarily true that (29-b) is true as well (Petr can ate only champignons e.g., then (29-a) is true and (29-b) is false). If we assume (quite uncontroversially) that boletus is subspecies of mushrooms, then in downward entailing environment the reasoning form (29-a) to (29-b) should follow smoothly as the following example shows.

(30) a. *Petr nenašel houby.*
Petr not-found mushrooms
'Petr didn't find any mushrooms.'
b. $\rightarrow$ *Petr nenašel hřiby.*
Petr not-found boletus
'Petr didn't find any boletus.'

von Fintel (1999) nevertheless quite convincingly shows that despite appearance, *only* is downward entailing if we disregard its intervening presuppositions. I take it for granted that this hypothesis is correct and with Csirmaz (2005) and von Fintel (1999) I consider *only* negative polarity items licensor because it is downward entailing in the Strawsonian sense of entailment (see von Fintel (1999) for details).

Let's illustrate von Fintel's argumentation on an example: von Fintel claims that for checking of downward entailment, natural language speakers verify only such hypothetical arguments, for which conclusions have defined semantic values. While (31) isn't a valid logical argument, von Fintel claims that speakers of natural language in fact enrich

the argument with a premise granting the truth of the conclusion. Such argument looks like (32).

(31) a. car $\subset$ vehicle (lexical knowledge)
b. Only Peter bought a vehicle. (asserted premise)
c. $\therefore$ Peter bought a car. (conclusion)

(32) a. car $\subset$ vehicle (lexical knowledge)
b. Only Peter bought a vehicle. (asserted premise)
c. Peter bought a car. (added premise)
d. $\therefore$ Peter bought a car. (conclusion)

By the notion of Strawson entailment *only* is Strawson downward entailing and can license negative polarity items (as is reflected in all natural languages).

(Csirmaz, 2005, p.150) argues for extension of Strawson entailment also to the divisibility property of predicates. By the similar logic as argued by von Fintel, durative adverbials should be licensed also by such operators which can be classified as Strawson downward entailing. Csirmaz's definition of Strawson divisibility is in (33).

(33) Strawson divisibility
A predicate P of times is Strawson divisible iff whenever P(t) for an interval t, then for all t' $\subseteq$ t, such that the predicate is defined at t', $\exists$t" [t' $\subseteq$ t" $\subset$ t $\wedge$ P(t")]

So under Fintel's/Csirmaz's hypothesis, decreasing quantifiers as well as *only* are downward and license modification of the reference time by *-ig* and *át* adverbs in Hungarian. Without *csak* this modification is ungrammatical as the followign example shows.

(34) a. *Két évig / két éven át csak János végzett gyógytornász szakon*
two year-until / two year-on across only J-NOM finished physiotherapy major-on
'For two years, only Janos graduated in physiotherapy'

b. *Két évig / két éven át csak öt ember végzett gyógytornász szakon*
two year-until / two year-on across only five people-NOM finished physiotherapy major-on
'For two years, only five people graduated in physiotherapy'

c. **Két évig / két éven át (pontosan) öt ember végzett gyógytornász szakon*
two year-until / two year-on across exactly five people-NOM finished physiotheraphy major-on
'*For two years, (exactly) five people graduated in physiotherapy'

If we check these data patterns in Czech, we a bit surprisingly discover that the durative *hodinu* phrase isn't admissible as a modifier with the downward entailing operators like monotone decreasing quantifiers like *few people* neither with the arguments modified by the Czech equivalent of *only*.

(35) a. #*Dva roky málo lidí vylezlo na Mt. Everest.*
two years few people climbed to Mt. Everest
'Few people climbed Mt. Everest for two years.'
b. #*Dva roky málo studentů napsalo svou diplomovou práci.*
two years few students wrote their diploma thesis
'Few students wrote diploma thesis for two years.'
c. #*Dvě hodiny Petr našel málo hub.*
two hours Petr found few mushrooms
'Petr found few mushrooms for two hours.'
d. #*Dva roky pouze Petr vylezl na Mt. Everest.*
two years only Petr climbed to Mt. Everest
'Only Petr climbed Mt. Everest for two years.'
e. #*Deset minut Petr poznal pouze prezidenta.*
ten minutes Petr recognized only president
'Only Petr recognized the president for ten minutes.'

But all the examples turn to be grammatical once we substitute the *for*-adverbial for time delimiting adverb *až do* ... 'until ...'.

(36) a. *Až do roku 1953 málo lidí vylezlo na Mt. Everest.*
until up year 1953 few people climbed to Mt. Everest
'Few people climbed Mt. Everest until 1953.'
b. *Až do minulého roku málo studentů napsalo svou diplomovou práci.*
until up last year few students wrote their diploma thesis
'Few students wrote diploma thesis until last year.'
c. *Až do včerejška Petr našel málo hub.*
until up yesterday Petr found few mushrooms
'Petr found few mushrooms until yesterday.'
d. *Až do roku 1953 pouze Petr vylezl na Mt. Everest.*
until up year 1953 only Petr climbed to Mt. Everest
'Only Petr climbed Mt. Everest until 1953.'
e. *Až do chvíle, kdy začal mluvit, pouze Petr poznal prezidenta.*
until up moment when started speak only Petr recognized president
'Until the president started speaking only Peter had recognized him. '

Csirmaz (2005) observes the same phenomena for different languages which allow its durative adverbs to be structurally case-marked. She claims that at least Hungarian, Korean and Finnish exhibit the pattern. Descriptively the restriction can be stated as: the durative adverb with accusative case marking cannot modify the topic time of the Strawson divisible event predicate. I repeat her Korean and Finnish examples (89) and

(90) from page 178 below as (37) and (38).

(37) a. *Sip-pwun tongan, ku-nun taythonglyeng-ul alapo-ci-mos-hay-ss-ta*
ten-minute for he-top president-acc recognize-cl-not-do-past-dec
'For ten minutes, he didn't recognize the president'
b. #*Sip-pwun-ul, ku-nun taythonglyeng-ul alapo-ci-mos-hay-ss-ta*
ten-minute-acc he-top president-acc recognize-cl-not-do-past-dec
'For ten minutes, he didn't recognize the president'

(38) a. *[Kymmeneen minuuttiin]$_{ILL}$ hän ei tunnistanut presidenttiä*
ten-ill minute-ill he-nom not recognized president-part
'For ten minutes, he didn't recognize the president'
b. *[Kymmenen minuttia]$_{PART}$ hän ei tunnistanut presidenttiä*
ten-part minute-part he-nom not recognized president-part
'For ten minutes, he didn't recognize the president'

Her explanation is essentially syntactic – because the accusative marked adverbs need to be case licensed, they have to be merged in the domain of an accusative case assigner, vP in this case. And because vP is associated with the event time, the accusative-marked adverbials cannot modify the reference time. Formal implementation of the idea is in (39) (Csirmaz's example (94) on page 181). Czech seems to fit into the picture nicely – bare accusative marked *for*-adverbs like *dva roky* 'two years' cannot modify Strawson divisible predicates, while prepositional phrases like *až do včerejška* 'until yesterday' are grammatical with negated event predicates as well as with Strawson divisible predicates.

(39) A *for*-adverb can modify a time interval t only if the minimal maximal domain containing the external merge position of the adverb also contains the time interval.

In the previous sections I have examined some of the types of sentences exhibiting interactions of negation with aspect. So far we didn't find any environment which would force us to assign some stronger semantics to negation than its usual truth-value reversing meaning familiar from classical logic. In the next section I will focus on another phenomena where negation and aspect interact. I will compare two conjunctions – Czech *dokud* and English *until*, because they both demonstrate aspectual sensitivity and also interact with negation in an interesting manner.

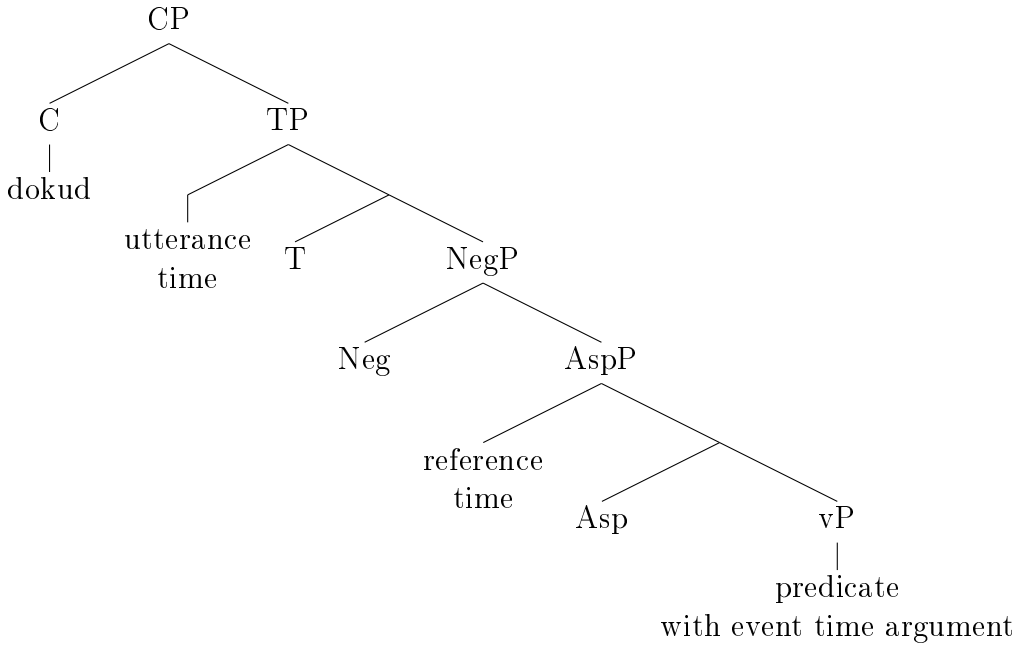
3.3 *Dokud* and *until*

There is an ongoing research concerning the English *until* and its proper treatment. Karttunen (1974) argues that *until* is ambiguous and that we can explain its behavior if we postulate two separate *until*: one durative and another one punctual negative polarity item. de Swart (1996) claims that there is no ambiguity and that we can predict all the relevant data via different scoping of negation and one lexical entry for until (for a careful recapitulation of the debate and additional references see Giannakidou (2002)).

The rest of the current chapter provides a new empirical support for analyzing *until* as one. The new data come from the Czech conjunction *dokud* which is a counterpart of English *until*. Czech is a helpful data source for *until* debate because it is a language with overt aspectual morphology. And one of the crucial arguments for or against the ambiguity of *until* concerns the interplay of aspectual system and negation. I argue that the non-ambiguity treatment of *dokud* and *until* can be pursued even if we don't accept the stativizing effect of negation. Concretely, I will argue that *dokud* can and should be analyzed as a reversed implication with basically durative meaning, thus supporting the view of until as a non-ambiguous expression, but I will do so (instead of proposals like de Swart (1996) and Krifka (1989b) where negation is treated as stativizer) sticking to the zero hypothesis, namely that negation doesn't have any aspect shifting properties.

I interpret *dokud* as a reference time modifier, which follows naturally from its syntactic status. *Dokud* as a complementizer is located in CP projection and immediately dominates TP where the utterance time is interpreted and all projections below – see (40). From this it follows that *dokud* cannot directly work with the event time and that it can only modify the reference time in AspP (the modification of the utterance time is impossible – as I discussed in the section 3.2.1.2). This is illustrated in (41): the event time of Peter's running the race is modified by the adverbial *za deset minut* 'in ten minutes' but the reference time of (multitude of) the runnings is framed by the adverbial *během minulých pěti let* 'during last five years' – *dokud* operates on the reference time and limits the time of Peter's admiration (the main clause) to this five years (the reference time). So furthermore I will assume that *dokud* (and *until* in English, if it occurs as a complementizer) is a reference time modifier even though I will not mention this explicitly.

(40)



(41) Dokud během minulých pěti let běhal Karel závod za 10 minut, tak se mu všichni obdivovali.

'Till Peter, in last 5 years, was able to run the race in 10 minutes, all the people admired him.'

In English, the preposition *until* is grammatical only in atelic sentences (42-a). Using *until* in telic sentences yields ungrammaticality (42-b), unless the telic sentence is negated (42-c). As said above, there is an ongoing disagreement about the proper treatment of the facts. The two existing approaches argue either that the contrast follows from the fact that negation has a stativizing effect (Krifka (1989b), de Swart (1996)) and therefore there is only one durative *until*; or that there is no principle explanation and *until* must be treated as semantically ambiguous, namely, the meaning of *until* is either durative, or punctual (Karttunen (1974), Giannakidou (2002)). The punctual *until* is claimed to be a negative polarity version of the durative *until*, and as such can be found only in negated sentences. The next section looks at the debate in more detail.

(42) a. The princess slept until midnight.
b. *The princess arrived until midnight.
c. The princess didn't arrive until midnight.

3.4 The one *until* vs. two *until* approaches

Besides the aspectual sensitivity of *until* illustrated in (42), both approaches try to capture the following basic set of facts. While atelic sentences containing negation and *until* are ambiguous, telic sentences with both expression have just one meaning. Consider the atelic option first, as illustrated in (43). Atelic sentences like (43) have two independent meanings. First meaning can be paraphrased as: John was awake at least until midnight – until scopes above negation – schematically as in (43-a). This reading would be falsified by any interval of time before midnight, in which John would have slept. The second meaning where negation has wide scope with respect to *until* – schematically as in (43-b) – is true in a situation where John sleeps before midnight, but not all the way till midnight (e.g. he wakes up at 11:30). Both readings are logically independent as one is true in situations which make the second reading false and vice versa.

(43) John didn't sleep until midnight.
a. until midnight $>$ ¬sleep(John)
b. ¬ $>$ until midnight $>$ sleep (John)

As discussed in the previous paragraph, atelic sentences containing negation and *until* are ambiguous and it is natural to capture the ambiguity via different scopes of *until* and negation. Telic sentences like (44) on the other hand aren't ambiguous in the same way. (44) can be interpreted only as reporting that John arrived after midnight but definitely not before. (44) cannot mean that John arrived sooner than at midnight (e.g. at 10:00). So in telic sentences it is impossible for negation to have a wide scope with respect to *until*, schematically as in grammatical (44-a) and ungrammatical (44-b). This

is the same pattern we observed in section 3.2.2, because *until* seem to be durative modifier and as such it must scope over negation, because the main predicate is telic (achievement) and only after the negation has been applied to it, durative modification can take place.

(44) John didn't arrive until midnight.
a. until midnight $>$ $\neg$arrive(John)
b. *$\neg$ $>$ until midnight $>$ arrive(John)

The theoretical solution of this intricate set of data proceeds in two possible approaches as sketched in the previous section. I will discuss both shortly. The proper evaluation of the debate out-scopes the goals of my book, so I will concentrate only on the main ingredients of both approaches.

One *until* approach accounts for the data in the following way. *Until* and negation interact scopally, therefore all the meaning differences in atelic sentences as well as the non-ambiguity of telic sentences can be derived from their different scope possibilities. *Until* is basically durative and can combine only with atelic predicates, so in case of telic predicates' negation it acts as an aspect shifting operator changing accomplishments and achievements into states. If there is not such a shifter, the ungrammaticality obtains, see (42-b). I will comment on the aspect shifting nature of negation in the next paragraph. Let's note that the one *until* approach correctly prohibits the wide scope reading of negation in telic sentences like (44), because *until* would combine here with telic predicates, which is independently known to lead to ungrammaticality.

The key ingredient of one *until* approach is the aspectual shifting nature of negation. A recent defender of this approach, de Swart (1996), postulates the following semantics for aspectual shifting negation – see (45), her examples (31) and (32) on page 235. Negation of telic predicates in her framework describes a state which corresponds to a negative state of affairs. de Swart (1996) follows Krifka's (1989b) proposal to interpret negative eventualities as a 'fusion' of all eventualities at a given time t which are not of the type denoted by the predicate P. For (44) it would mean that the sentence denotes such state s where the sum of all events of John not arriving appeared. The aspectual shifting negation is defined in (45-b) – it is a function from predicates P into state s, such that it denotes only the state where not a single event of type P occurred. The crucial MAX operator from (45-a) which is responsible for the supremum ('fusion') of all events of type P is defined in (45-b).

(45) a. $\lambda P \lambda s[MAX(s) \wedge \neg \exists e[P(e) \wedge e \subseteq s]]$
b. $\forall e[MAX(e) \leftrightarrow \exists t[e = sup_e(\lambda e' \exists t'(AT(e't') \wedge t' \subseteq t))]]$

The two *until* approaches stem from Karttunen, a recent representative is Giannakidou (2002). According to Karttunen (1974) *until* in negated sentences is different from the durative *until* appearing in non-negated atelic sentences. The first *until* is a negative polarity item and as such it must be interpreted in the scope of negation. Karttunen argues that NPI until is punctual and its semantics is equivalent to *before* under negation. The ambiguity of atelic sentences like (43) is explained in this framework differently

than in the scope treatment – schematically as in (46-a) corresponding to (43-a) vs. (46-b) corresponding to (43-b). The interpretation of (46-a) is the same as in the one *until* approach. But according to Karttunen and Giannakidou (46-b) has an inchoative meaning. The inchoative meaning illustrated for example (43) can be paraphrased as: John fell asleep after midnight but not before. In two until approach the NPI until guarantees entailment of the positive state of affairs after the time expressed by until NP. This actualization is argued to be the main reason for populating lexicon with two homophonous *until*.

(46) a. durative until midnight $>$ ¬sleep(John)
b. ¬ $>$ NPI until midnight $>$ sleep(John)

The reason for non-ambiguity of telic sentences like (44) in the two *until* approach is the following: the punctual *until* is NPI, the sentence like (44) can have two readings schematized as (47-a) and (47-b). The punctual *until* is not aspectually sensitive, it can occur both with telic as well as with atelic predicates, but it must be in the scope of negation. The first reading is probably filtered out in this approach because negation isn't aspectual shifter for Karttunen and Giannakidou, so there is a prima facie incompatibility between the durative *until* and the telic predicate in (47-a). The remaining reading (47-b) entails actualization of John's arrival after midnight. And this prediction is considered to be the cornerstone of the argumentation for two *until* by Karttunen and Giannakidou.

(47) a. durative until midnight $>$ ¬arrive(John)
b. ¬ $>$ NPI until midnight $>$ arrive(John)

3.5 *Dokud*

In the previous section I discussed the *until* debate. Now I will focus on *dokud*, its relation to *until* and how can the proper treatment of *dokud* help us understand the one vs. two until frameworks.

As it has been shown already in the previous sections, *until* requires a particular aspect. The Czech conjunction *dokud* is similar in this respect. The basic empirical observation concerning *dokud* is, that it occurs embedded in sentences containing atelic aspect (48-a), but it becomes ungrammatical when its sentence is telic (48-b). But negation seems to reverse the pattern again, as we see in (49). Sentences (48-b) and (49) form a minimal pair distinguished only by negation. What we see is the common property of *until* and *dokud*: both expressions are sensitive to the telicity of their sentences, they appear in atelic sentences only, but telic negated sentences are grammatical for both – see example (42) repeated here as (50). Czech and English differ in the way the telicity is coded – in Czech perfective aspect on verb like *probudit* ('wake up') enforces the telicity of the sentence, in English the lexical semantics of achievements like *arrive* causes the whole sentence to be telic but if we put aside this difference, *dokud* and *until* exhibit the same distribution.

(48) a. *Petr četl knížku, dokud Marie spala.*
Petr read.Imperf book DOKUD Marie sleep.Imperf
'Petr was reading a book while Mary was sleeping' ✓ *dokud*+atelic

b. **Petr četl knížku, dokud se Marie probudila.*
Petr read.Imperf book DOKUD SE Marie sleep.Perf
'Petr was reading a book while Mary woke up' **dokud*+telic

(49) *Petr četl knížku, dokud se Marie neprobudila.*
Petr read.Imperf book DOKUD SE Marie woke_up.Perf.Neg
'Petr was reading a book while Mary didn't wake up' ✓dokud+NEG+telic

(50) a. The princess slept until midnight. (=(42))
b. *The princess arrived until midnight.
c. The princess didn't arrive until midnight.

Even if *until* and *dokud* act similarly with respect to their aspectual sensitivity, they are at least on surface semantically very different. The first difference, let's name it **property 1**, is a basic semantic difference: extituntil (without negation) denotes succession of two events (see 10-a) but dokud (without negation) denotes subinterval relation of two events (see (51-b)). For a bit more insightful understanding of the differences, I formalize this distinction by the temporal trace function τ (following Krifka (1989a)). This function maps an event to its temporal trace, or 'run time'. For English *until* in (51-a) it means that the event of stirring with a metal spoon precedes the event of dissolving the sugar. Formally the function τ mapping the event of the main clause denotes some interval preceding the time interval of the result state following the moment when the sugar has dissolved. But for Czech *dokud*¸ the intuitive meaning of (51-b) is that the event denoted by the main clause is contained in the bigger event denoted by the embedded clause. Let's model this intuition with the subset relation and say that the run time of the embedded event is a superinterval of the run time of the main event – see (51-b). But surprisingly with negated telic verbs in both sentences, as in (52-a), Czech dokud intuitively denotes the succession as well. (52-a) means that the event of Petr's finishing reading the book follows the event of Mary's return. A similar English sentence with both telic sentences and only the main negated verb is in (52-b), where also the intuitive meaning is: the event of the embedded clause must precede the event of the main clause. Let's hypothesize that the inclusion relation is basic meaning of *dokud* and that the consecution is the basic meaning for *until*. The consecutive interpretation of *until* is particularly well visible in sentences like (42) where until acts as a preposition (see Giannakidou (2002, ex.6) for the formal treatment of this durative *until*). My basic assumption concerning the meaning relation between *until* and *dokud* follows the data in (51) and (52). *Dokud* denotes inclusion (51-b), but in negated sentences it denotes consecution (52-a). Thus *until* is a mirror image of *dokud* – its basic meaning is the consecution (51-a). The distinction simply follows from the negation incorporated into *until* which can be emulated with sentential negation for *dokud* (52-a). Otherwise both

conjunctions are alike but reversed by negation.

(51) a. Stir with a metal spoon until the sugar has dissolved.
tau(STIR) $<$ τ(DISSOLVE)
b. Petr četl knížku, dokud Marie plavala.
'Petr was reading a book, while Marie was swimming.'
τ(READ) $\subset$ τ(SWIM)

(52) a. Petr nepřečetl tu knížku, dokud se Marie nevrátila.
'Petr hadn't finished reading the book until Mary returned'
τ(RETURN) $<$ τ(READ)
b. The EC will not lift its sanctions until that country makes political changes.

Let's look at another property which is especially important with respect to *dokud*. I will call it **property 2**. Slavic languages belong to strict negative concord languages (for a recent linguistic treatment of this phenomena see e.g. Zeijlstra (2004)), so any negative indefinite requires its main verb to be negated, otherwise the ungrammaticality obtains. Czech is a fine example of this Slavic pattern, as you can see in (53): (53-a) containing three negative indefinites is grammatical because its main verb is negated. Nevertheless (53-b) with non-negated main verb is ungrammatical. Surprisingly, negative concord is disrupted in sentences with *dokud* and telic embedded verb, as witnessed in (54-c). (54-a) and (54-b) show that the decisive factor for ungrammaticality of (54-c) is really negative concord – (54-a) with the proper name *Karel* and (54-b) with the indefinite *někdo* are grammatical. (54-c) is ungrammatical, even though the whole embedded sentence *Nikdo neumřel* would be perfectly acceptable if it stood alone. But the pattern is even more interesting because the ungrammaticality of negative concord with *dokud* obtains only if the embedded sentence is telic, as in (54-c), whereas an atelic sentence as in (55) leads to full acceptability of *dokud* + negative concord. A tentative empirical hypothesis concerning negative concord and *dokud* is in (56).

(53) a. *Nikdo nikoho nikde neviděl.*
Nobody nobody.Acc nowhere saw.Neg
'Nobody saw anybody anywhere.'

b. **Nikdo nikoho nikde viděl.*
Nobody nobody.Acc nowhere saw
'Nobody saw anybody anywhere.'

(54) a. *Petr čekal, dokud Karel neumřel.*
Petr waited DOKUD Karel not-died-perf
'Petr waited until Karel died'
b. *Petr čekal, dokud někdo neumřel.*
Petr waited DOKUD somebody not-died-perf
'Petr waited until somebody died'

c. **Petr čekal, dokud nikdo neumřel.*
Petr waited DOKUD nobody not-died-perf
'Petr waited until nobody died' *NC+*dokud*+telic

(55) Petr kouřil dýmku, dokud v hospodě nikdo nebyl.
'Petr was smoking a pipe while there was nobody in the pub'
✓NC+*dokud*+atelic

(56) If *dokud* appears in a in telic sentence, it may combine only with expletive negation. However, if *dokud* appears in an atelic sentence, negative concord may take place.

To summarize the current section, let's recall the empirical generalizations we need to account for. First property 0 which connects *until* and *dokud* – both conjunctions are aspectual sensitive and there's some interplay with negation concerning that. Second, even if both expressions are acting similarly w.r.t. aspect and negation, their semantics seems to be very different, property 1 but this difference is most probably just reflex of negation incorporated into until but missing in the meaning of *dokud*. And finally if we look at negative concord and *dokud*, it seems that negation and aspect interacts again in an interesting way.

1. Property 0: both *dokud* and *until* basically atelic conjunctions sensitive to negation
2. Property 1: a meaning difference between *dokud* and *until*: subinterval vs. succession
3. Property 2: a syntactic observation: *dokud* allows negative concord only in atelic sentences

The next section shows how the behavior of *dokud* can be explained in the non-ambiguity framework. My plan is to show how the peculiar behavior of *dokud* can shed light on the *until* debate, particularly I will argue for a variant of scope treatment of *dokud*.

3.6 Proposal

As was claimed in the previous section, there are two apparent semantics of *dokud*: subinterval and succession, illustrated in (57-a) and (57-b) respectively. The subinterval semantics occurs basically in atelic environments, the succession in the telic environments with negated verbs of both conjoined sentences. The section 3.6.1 begins with the subinterval *dokud* and section 3.6.2 shows how the apparent succession variant of *dokud* can be derived from its basic meaning.

(57) a. Petr zpíval, dokud Marie hrála.
'Petr was singing while Mary was playing'
τ(SING) $\subset$ τ(PLAY)

b. Petr nedopsal tu knihu, dokud Marie neodjela do Londýna.
'Petr hadn't written the book until Mary left for London'
τ(LEAVE) < τ(WRITE)

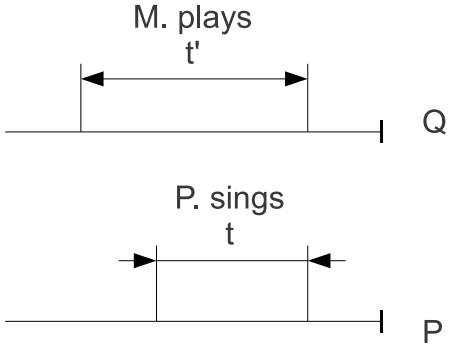
3.6.1 *Dokud* in embedded atelic sentences

My main claim concerning Czech *dokud* is that there is only one *dokud*, its basic semantics is formalized in (58). The formalization based on von Stechow (2002) and his discussion of various types of German *seit*. In core the lexical entry for *dokud* conjoins two predicates (P and Q), P and Q have their respective running times t and t'. The running time of Q (the embedded clause) is a subset of the running time of P (the main clause) and both events' end at some dummy variable (time t"), this time t" is the right boundary (RB in (58)) of both events. The illustration of the meaning for (59) is the figure (60), the lexical entry for *dokud* basically aligns two events such that one is the subset of the other and both are ending in the same time. Both P and Q are reference times of the main clause and the embedded clause respectively.

(58) $[\![\text{dokud}]\!] = \lambda Q \lambda P \exists t \exists t' \exists t''[P(t) \wedge Q(t') \wedge \tau(P) \subseteq \tau(Q) \wedge RB(t,t'') \wedge RB(t',t'')]$, Q is homogeneous

(59) Petr zpíval, dokud Marie hrála.
'Petr was singing while Mary was playing'

(60)



Petr zpíval, dokud Marie hrála.
'Petr was singing, while Mary was playing.'

If we look at *dokud* in terms of propositional logic, then the conjunction denotes a reversed implication (the main clause implicates the embedded clause), normal implication goes in the oposite direction: the embedded clause implicates the main clause. This observation isn't very surprising, as implication is the propositional logic counterpart of the subset relation which is the core of the semantics of *dokud*. Nevertheless I think it is very helpful to think about *dokud* as about reversed implication as we will see shortly. So the sentence like (61-a) – normal implication – claims that there are three scenarios where the whole sentence is right: Peter is singing and Mary is playing, Peter isn't singing and Mary is playing, and finally: Peter isn't singing and Mary isn't playing. (61-b) – reversed implication – on the other hand claims that there are three possible

scenarios for the whole sentence to be true: Peter is singing and Mary is playing, Peter is singing and Mary isn't playing and finally: Peter isn't singing and Mary isn't playing. The truth conditions for dokud are summarized in the table (62).

(61) a. If Peter was singing, then Mary was playing. $p \supset q$
b. Dokud Petr zpíval, Marie hrála. $q \supset p$

(62)

p	q	*dokud*	*if*
1	1	1	1
1	0	1	0
0	1	0	1
0	0	1	1

The main conclusion of this section is demonstrated on the example (63-a): its propositional meaning is simply the implication going from the main clause to the embedded clause – (63-c). The more detailed meaning following from the lexical entry for *dokud* is in (63-b). (63-b) can be read as: there is an event of Petr's sleeping and an event of Mary's singing, both happening at times t and t' respectively, t is a subinterval of t' and both events end at the point t", the right boundary of both events. This gets the truth conditions of (63-a) illustrated in the figure (60) right and the whole process is totally compositional. The core meaning of *dokud* is quite simple but the complications with its distribution arise because it is aspect sensitive and moreover the negation can reverse the intervals, so we come to apparently different meanings. More about this in the next section.

(63) a. Petr spal, dokud Marie zpívala.
'Petr was sleeping while Mary was singing'

b. $\exists t \exists t' \exists t''[\text{SLEEP}(\text{Petr},t) \wedge \text{SING}(\text{Marie},t') \wedge \tau(\text{SLEEP}) \subseteq \tau(\text{SING}) \wedge \text{RB}(t,t') \wedge \text{RB}(t',t'')]$, SING is homogeneous
c. SLEEP $\supset$ SING

As for the aspectual sensitivity, the lexical entry for *dokud* constraints the predicate of the embedded clause to homogeneous predicates. This is the way how I code the atelicity constraint, observed with *dokud*. I assume, following at least Dowty (1979), that homogeneity is the way how to formalize the atelicity of verbal predicates. Recall that a predicate P is homogeneous if it has the subinterval property: P(t): $\forall t\ [t' \subset t \rightarrow P\ (t')]$), so e.g. the predicate *zpívat* from (64-a) is atelic because it is homogeneous – if it is true that Petr was singing from 14:00 to 15:00, then it is true that he was singing in every subinterval of the given time. The verb *dohrát* ('finish playing') from (64-b) is telic on the other hand because it is not true that any subinterval of time where the predicate holds has the subinterval property, the only interval where the predicate holds is the maximal interval – from the beginning of the event till its end. *Dokud* is sensitive only w.r.t. to the telicity of the embedded clause, as witnessed by (64-b) where the telicity of the main clause doesn't cause any ungrammaticality.

(64) a. *Petr zpíval, dokud Marie dohrála.
'Petr was singing while Mary finished playing'
b. Petr napsal tu knihu, dokud byl Karel děkanem.
'Peter wrote the book while Karel was a dean'

The atelicity constraint for *dokud* predicts that it also can be a head of sentences with telic predicates containing downward entailing arguments of such predicates, because at the level of reference time the composition of those two ingredientes assembles downard entailing predicates in the sense discussed in the section 3.2.3. This prediction is borne out as the following two sentences demonstrate – (65) with downward entailing subject *jen málo lidí* 'only few people' is way more acceptable than the same sentence with upward entailing subject *jen někteří lidé* 'only some people'.

(65) ?Petr zpíval, dokud do hospody přišlo jen málo lidí.
'Peter was singing until only few people came into the pub.'

(66) *Petr zpíval, dokud do hospody přišli jen někteří lidé.
'Peter was singing until only some people came into the pub.'

3.6.2 *Dokud* in embedded telic sentences

The second meaning of *dokud*, the consecutive one, intuitively denotes succession of two events as in (67-b). (67-b) can be paraphrased as: if Honza kills the dragon, then the princess will marry him, but not sooner. For English *until* the same meaning appears when *until* occurs in a sentence without negation in the embedded clause – see (52-b) repeated here as (67-a). The distinction between *until* and *dokud* is that the consecutive meaning is possible for *dokud* only if it occurs with two negated telic predicates, while *until* can have this meaning if it occurs in a non-negated embedded sentence as in (67-a). The distinction is probably a reflex of the different derivational make-up of both items as was suggested above: while *dokud* is composed of directional preposition and wh-element, *until* (at least diachronically) contains negation and conjunction. The straight translation of (67-a) into Czech using *dokud* would be (67-c) where both the main clause and the embedded clause are negated contrary to the English source.

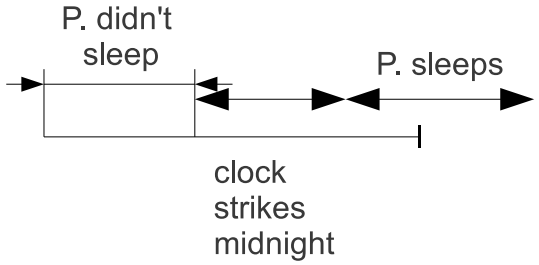
(67) a. The EC will not lift its sanctions until that country makes political changes.
b. Princezna si Honzu nevezme, dokud Honza nezabije draka.
'The princess will not marry Honza until he kills the dragon'
c. Evropská unie ne-zruší své sankce, dokud tato země ne-provede politické změny.

The consecutive meaning for *dokud* can be illustrated on Czech sentences like (68). (68) can be depicted as in figure (69): the event of the embedded clause precedes the event of the main clause – for that we must intuitively de-negate the predicates. Even if the sentence's truth conditions strictly speaking refer to two negative states of affairs, its interpretation is different. It is notoriously difficult to state whether the actualization inference is some sort of presupposition or real entailment. Nevertheless I will try to

describe the actualization in the semantics instead of pragmatics. More about this in the next paragraph.

(68) Princezna neusnula, dokud neodbila půlnoc.
'The princess hadn't fallen asleep until the clock stroke midnight'

(69)



If we want to stick to the assumption that there is only one *dokud*, then the lexical entry in (58) should deliver the right truth conditions in any context. Let's apply the lexical entry to the example (70-a). We obtain straightforwardly (70-b). Its core meaning says that the negation of the event of the princess' marrying Honza is a subinterval of the negation of the event of Honza's killing the dragon. In other words, when the proposition 'Honza killed the dragon' starts to be true, then it would also be possible for the proposition 'Princess marries Honza' to be true. So my hypothesis is that the lexical entry in (58) delivers the truth conditions right, but it's a bit hard to comprehend them. More on this bellow but let's note for now that the semantics of *dokud* predicts right that the negated telic predicate is grammatical with *dokud*, while the un-negated telic predicate isn't – see (71). This is so because the negation of an accomplishment like *kill* has the subinterval property, although the accomplishment pure doesn't have the subinterval property at all. This is so, because negation reverses the entailments: the trade mark of downward entailing (DE) contexts is the reasoning from sets to subsets. The same holds for time intervals as well: telic predicates in DE contexts are homogeneous and there's no need for stativizing theory of negation. Regardless to the fact that it would be possible to describe the data with the stativizing negation, which we could do that with null hypothesis (negation doesn't have any special aspectual properties), let's do the work without the aspectual shifting theory. The only ingredients needed are the following: *dokud* (as well as until) can combine only with homogeneous predicates, because negation of telic predicates is homogenous, *dokud* can combine with such predicates.[1]

[1] In fact I think that Czech conforms to the hypothesis that negation has stativizing effect. One powerful indicator of that is the following. Even though it is possible to negate imperfective imperatives: *čti*! 'read!' *ne-čti*! 'do not read!', the negation of perfective imperatives is highly constrained if possible at all. E.g. second person imperative ??*ne-pře-čti ten článek*! 'do not read the article!' is either ungrammatical or acceptable only with a deontic modality interpretation. I assume this follows straightforwardly from the independently known fact that imperatives are incompatible with states and if Czech negation stativizes the verb, the prediction that only Czech imperfective verbs (they denote activities) are admissible candidates for imperative mood is borne out. But because proper investigations of the stativizing or non-stativizing nature of Czech negation would lead me beyond the scope of the present book, I stick to the minimal hypothesis: negation is just the truth reversing operation we know from propositional logic and it doesn't have any other special properties.

(70) a. Princezna si Honzu nevzala, dokud nezabil draka.
'The princess hadn't married Honza until he killed the dragon.'
b. $\exists t \exists t' \exists$ t'[$\neg$MARRY(princess,honza,t) $\wedge$ $\neg$KILL(honza,dragon,t') $\wedge$ $\tau(\neg\text{MARRY}) \subseteq \tau(\neg\text{KILL}) \wedge \text{RB}(t,t'') \wedge \text{RB}(t',t'')$], $\neg$KILL is homogeneous

(71) *Princezna si Honzu vzala, dokud zabil draka.

As I implied in the previous paragraph, I consider the lexical entry (58) sufficient to describe truth conditions of *dokud* in any context. But I assume that it is hard for native speakers to process such meanings. As clear from the previous paragraph, implication of two negated sentences is quite hard to comprehend, so I assume that hearers use the inferential rule of transposition of implication as stated in (72-a). They use the rule to process the meaning of negated telic sentences with *dokud* more easily. The transposition of implication belongs to the tautologies of propositional logic and when applied to natural language, it claims the equality of an implication with the reversed negation of its antecedent and consequent. Schematically the sentence like (70-a) is then interpreted as the right part of the equation in (72-b): instead of implication of two negations, the sentence is interpreted as an implication going from the embedded clause to the main clause. In that respect negation reverses the implication of *dokud* (recall that *dokud* in non-negated contexts implies from the main clause to the embedded clause), so it behaves in this respect as ordinary *if*.

(72) a. $(\neg Q \supset \neg P) \leftrightarrow (P \supset Q)$
b. $\neg$MARRY $\supset$ $\neg$KILL $\leftrightarrow$ KILL $\supset$ MARRY

However the reversed implication in (72-b) of itself doesn't explain why we should obtain the consecutive interpretation for the embedded and the main clause. Of course we can rely on some sort of Gricean reasoning which would explain why with usual implications we obtain the time alignment of the embedded clause before the main clause. But I suppose the alignment for *dokud* follows from the interplay of aspect and negation and not from such pragmatic reasoning. What the truth-conditions of (70-b) say is that the main clause cannot be true sooner than the embedded clause turns out to be true as well. And when are accomplishments like *kill dragon* false? Simply at all the time points before the culmination point of the accomplishment, and then they start to be true. If we follow this line of reasoning, then the telos part of accomplishments in the embedded clause sets the earliest time of the validity of the main clause. In the framework of von Stechow (2009) following Beaver and Condoravdi (2003) we can formalize this as in (73). The definition of the operator the earliest time is in (74). (73) can be paraphrased as: there is an event of princess' marrying Honza and an event of Honza's killing the dragon, the first event must not start earlier then the second one turns out to be true. This is exactly the meaning of (70-a) and corresponds quite naturally to the intuitions of native speakers.

(73) $\exists t \exists t' \exists t''$[MARRY(princess,honza, t) $\wedge$ KILL(honza,dragon,t'') $\wedge$ τ(KILL) $<$ the earliest τ(MARRY)] (LF of (70-a))

(74) [[EARLIEST]]= λP_{it}.the earliest time such that P(t) = the t, such that P(t) $\wedge(\forall t')[P(t') \supset t<t']$ von Stechow (2009) and Beaver and Condoravdi (2003)

Interim summary: I presented a way how to derive consecutive meaning of *dokud* from its basic subinterval version. The derivation describes the consecutive meaning as arising as a by-product of the aspectual system combining with sentential negation. There is a similarity between *dokud* and *until* in this respect: both seem to be ambiguous but the ambiguity can be treated scopally or by independently justified systems of natural language.

3.7 *Dokud* and negative concord

In the previous section I have shown how to explain the property 0 and property 1 of *dokud* – its aspectual sensitivity and its basic meaning from which the consecutive meaning can be derived. In the present subsection I will deal with the last property discussed in the section 3: the lack of negative concord in *dokud* headed telic sentences. As we saw, there is a correlation between the scope of negation and telicity of the embedded sentence – in telic sentences the negation cannot license negative concord. I assume that this follows from the syntactic nature of negative concord. The verbal negation which licenses the negative indefinites must be locally enough for the negative agreement to take place. Consequently the negation in telic sentences with disrupted negative concord must be in a position inaccessible to negative concord. In this respect I follow Abels (2005), who claims that when negation (in Russian and also other Slavic languages) rises to CP, it cannot license negative concord anymore. Czech sentence demonstrating this hypothesis is (75)– the semantics of the verb *bát se* ('be afraid') conjoined with the subjunctive forces the negation of the embedded predicate to scope above its usual position. And as the negation ends in the CP periphery, it cannot license negative concord from there.

(75) Petr se bál, aby *nikdo/Karel nepřišel.
'Petr was affraid of somebody/Karel coming.'

Let's assume that the lack of negative concord in the embedded telic sentences with *dokud* is caused by the same process: negation taking scope too high for the negative concord to take place. On the other hand, it's not true that negation has scope over the conjunction itself: propositional logical rendering of such scope: $\neg(p \supset q)$ in sentences like (76) would be true only in a situation where the princess would marry Honza, even though he hasn't killed the dragon. In any other situation it would be false – a fatally incorrect prediction – see (76-a) and (76-b). So the negation in telic sentences is for sure located somewhere under *dokud*, but it is higher than in atelic sentences. This shows also that the ambiguity approach is untenable at least for Czech *dokud* because it scopes above negation all the time. Consequently its behavior cannot be explained via postulating its NPI nature.

(76) Princezna si Honzu nevzala, dokud nezabil draka. (=(70-a))
a. $(\neg p \supset \neg q) \leftrightarrow (q \supset p)$
b. $*\neg(p \supset q)$

If we assume that the scope of negation in embedded telic clauses headed by *dokud* is too high to license negative concord, the natural question to ask is why it should be so. Even if we follow von Stechow (2009) in the assumption that negation usually takes wide scope with respect to the time of the sentence (e.g. *John didn't sleep today* is true when negation outscopes past time, otherwise the truth conditions for this sentence would be too weak), it still doesn't follow why telic and atelic sentences should behave differently with respect to the scope of negation. I think that the most probable explanation follows from the homogeneity restriction of *dokud*. As *dokud* requires the embedded clause to be homogeneous, the negation must scope higher than any other element in the clause (recall that telicity of the sentence is the compositional phenomenon, all arguments of verb and of course the verb itself compose in the computation of telicity – see Krifka (1989b) a.o.), otherwise the sentence would be semantically anomalous.

(77) a. *Karel čekal, dokud nikdo neumřel.
'Karel waited until nobody died' *NC+*dokud*+telic
b. Karel kouřil dýmku, dokud v hospodě nikdo nebyl.
'Karel was smoking a pipe while there was nobody in the pub.'
✓NC+*dokud*+atelic

We can detect the same pattern as with the negative concord with positive polarity items. As we saw in the previous section, negation in telic sentences has higher scope then in atelic sentences. So high that even positive polarity items like *někdo* can have narrow scope w.r.t. negation. Look at (78) with the usual behavior of PPI: sentence (78) can only have the logical form in (78-a), the logical form (78-b) is ungrammatical for the sentence, because the negation would scope over the existential quantifier representing the semantic contribution of the PPI *někdo*. On the other hand, (79) with the same PPI *někdo* allows the scope of negation to be wider than the PPI: the sentence is interpreted as: the event of Peter's smoking the pipe was a subinterval of the time during which nobody entered the pub. The interpretation makes it clear that the PPI is interpreted as a non-specific indefinite in the scope of negation. It doesn't require any specific individual to be the one who stops Peter's smoking the pipe: (79) is true if Petr stops smoking his pipe when anyone enters the pub. I assume again that this follows from the higher scope of negation in telic sentences – dokud requires its embedded sentence to be homogeneous, negation outscopes all the elements in its sentence, so even PPI like *někdo* can be interpreted in its scope.

(78) Někdo nepřišel.
'Somebody didn't come'

a. $\exists x[\text{PERSON}(x) \wedge \neg\text{CAME}(x)]$

b. *¬∃x[PERSON(x) ∧ CAME(x)]

(79) Petr kouřil dýmku, dokud do hospody někdo nevstoupil.
'Petr was smoking a pipe until somebody entered the pub'
nonspecific: Petr was smoking a pipe ¬∃x[PERSON(x) ∧ ENTER(x)]

3.8 Conclusion

I argued for the unified semantics of Czech *dokud*. *Dokud* is a reversed implication: its core meaning is an implication taking as its antecedent the main clause and as its consequent the embedded clause. With respect to the time traces of the events denoted by the main clause and the embedded clause, this translates as the subinterval relation between the running time of the main clause and the running time of the embedded clause. There are two apparent interpretations of *dokud* – 'durative' which occurs in the atelic sentences (the subinterval interpretation) and 'punctual' which occurs in telic sentences (the consecutive interpretation). But the second interpretation is derived from the basic implicational core of *dokud* and the interplay of aspectual and negation system. The conclusion which follows from the *until* debate is the following. To the extent that *dokud* and *until* can be compared (and they behave similarly w.r.t. aspect and negation, moreover they seem to be just mirror images of each other – *until* containing negation which *dokud* lacks), non-ambiguity treatment of *dokud* supports the one *until* theory. And because negation always scopes below *dokud*, the NPI nature of *dokud* is out of the question. This shows that the Karttunen/Giannakidou style of theory is falsified at least in its cross linguistic predictions.

More generally: this chapter examined interaction of negation and aspect. The overall picture which seems to emerge (from the limited set of data I discussed) is that negation doesn't have to be treated as aspectual shifter. Instead, as *dokud* and durative adverbials show, negation is (among other downward entailing operators) simply logical operator which reverses entailments, so durative adverbials and *dokud*, which occur only in homogeneous environments, can appear even in negated telic sentences, because negation marks the whole sentence as downward entailing, as discussed in the section 3.2.3.

4 Negation and the scope of quantifiers

In this chapter I will analyze different scopal readings in sentences like (1) where negation and other logical operators give raise to potential ambiguities. A big part of the chapter is dedicated to linguistic description of negative sentences containing universal quantifier. I focus on such sentences because they – unlike negated sentences with indefinite argument NPs (see (2)) – tend to be interpreted with fixed scope. Consider (2) with indefinite numeral NP *two dogs* – the sentence can be interpreted either with wide scope of the numeral NP over negation resulting in the reading 'there are two dogs such that the two dogs don't bite'. Let's assume that this reading is pragmatically strengthened via Gricean reasoning to something like '...and the rest of the dogs bite'. More about the details of such strengthening in section 4.2. The other scope can be paraphrased as 'It's not the case, that two dogs bite' – for instance it would be true in a world (most certainly not the actual one) where only solitary dogs bite but any plurality of dogs with cardinality two wouldn't bite. Compare this with a sentence (1) where the wide scope of negation over the universal quantifer (I will use the shorthand $\neg > \forall$ for that reading) is at first sight the only available reading. $\neg > \forall$ reading would be true in a lot of situations as far as it's not true that every dog bites, so for instance in a scenario where a half of the dogs bite and the other not, in another scenario where 99 of 100 dogs bite but the one remaining doesn't and etc. So there is a tendency to interpret the universal quantifier contained in negated sentences with narrow scope with respect to negation. This tendency was abundantly described in the previous literature (see Jackendoff (1972), Hajičová (1973)???, Büring (1999) a.o.) and was usually connected to the information structure (more about that later).

(1) All dogs don't bite.

(2) Two dogs don't bite.

The present chapter is empirically based on a research done in Czech national corpus (reported also in Dočekal and Strachoňová (2012)). We parsed about 2000 sentences, disregarding the cases, where the scope preference cannot be decided even from a wider context. In the decidable cases we assigned the relative scope of universal quantifier and negation to them as a way of formalizing their intuitive meaning. The relative scope decisions were based on paraphrases of the sentences where we took into account their wider context and whether the paraphrase fits into the context or not. Look for instance at (3) where the first sentence in isolation can be interpreted either with wide scope of negation over universal quantifier or exactly in the opposite way. But the continuation

makes it clear that only the paraphrase as 'for all men it was true that they didn't agree with Šeng's policy being' is the right one, in other words only the reading $\forall > \neg$ fits into the context. To anticipate a bit, we found out that more than 3/4 of sentences containing negation and universal quantifier in subject position is interpreted only with the scope $\neg > \forall$. That holds irrespective of the linearization between the negated verb and the universal quantifier. A good example of such tendency is sentence (4), where only the scope $\neg > \forall$ is grammatical

(3) *Všichni ti muži nesouhlasili se Šengovou politikou - někteří otevřeně, jiní opatrně.*
all the men not-agreed with Šeng's policy - some openly others cautiously
'All the men didn't agree with Šeng's policy - some of them openly, the others cautiously.'

(4) *Všichni pacienti si ale protilátky nevytvářejí.*
all patients REFL though antidotes not-create
'All patients don't create antidotes though.'

The finding reported in the last paragraph is surprising because Czech is usually considered to wear its logical form on its sleeves, so the linear order of expressions representing logical operators should correspond to the respective scope of the operators. But as I will argue in this chapter, there is one important factor which wins over the information structure tendency. The crucial factor is concurrence in grammar (more about that in section 4.4). The finding has also consequences for other parts of linguistic theory – namely it falsifies the attempts of Hajičová (1973), Jackendoff (1972) and Büring (1999) to link desambiguation of negated sentences with universal quantifiers to information structure, no matter whether the information structure is realized as intonation prominence in English or German or whether it is expressed by changes of linear order like in Czech.

4.1 Data from the corpus

First, I will present data from SYN2010, representative corpus of contemporary Czech. The data are presented int the following manner: first the linearization universal subject NP > negated verb is discussed (section 4.1.1), the both possible scopes, their frequency and apposite examples. Then in the section 4.1.2 the same illustration is shown for the opposite linearization (negated Verb > universal subject NP).

4.1.1 SV linearization

We queried the corpus with the following tags: [lemma="všechen"] [] 0,10 [tag="V....–..-N.–.*"] within <s id=".*"/>

With some surprise we found out that the scope interpretation mirrors the linearization

(nearly) only in the cases when the universal NP is modified by some syntactic means – collective modifiers like *dohromady* 'together as in (5), relative clause like in (6) or demonstrative *to* 'the/that' like in (7).

(5) a. *Mimo to mu zajistili roční plat 62500 dolarů, což všechno*
beside that him provided-they year salary 62500 dollars which all
dohromady nebylo málo.
together not-AUX little
'They provided him with a year's salary 62500 dollars which all together wasn't too little.'

b. *„Třeba jsme to nakonec všichni dohromady neprovedli nejhůř,“*
maybe AUX-we that finally all together made-we worst
utěšoval spíš sebe než chlapce.
comfort-he more himself than boy
"Maybe we made it all together not in the worst manner', he comforted himself more than the boy.'

(6) a. *Všichni, kteří ho spěchali pronásledovat, neopomněli nabídnout*
all which him hurried-they to-pursue not-omited-they offer-to
na usmířenou malé dárky.
for reconciliation small gifts
'All, who hurried to pursue him, didn't omit to offer small gifts as reconciliation.'

b. *„Pokud ovšem všechno, co jste prohlásila, není lež.“ Lisbeth*
if of_course all what AUX-you told isn't lie Lisbeth
zaplály oči.
glared-they eyes
"If all, what you told us, isn't a lie.' Lisbeth's eyes glared.'

(7) a. *Tohle všechno mě nezajímá. Řekni mi, kde ho najdu, víc*
all that me not-interest tell me where him find more
nechci.
not-want-I
'All that doesn't interest me. Tell me, where I can find him, I don't want anything more.'

b. *Měl jsem v Šanghaji svůj vlastní hotel. Ale to všechno dneska nic*
Had AUX in Shanghai my own hotel but that all today nothing
neznamená.
not-means
'I had my own hotel in Shanghai. But all that means nothing today.'

c. *Všichni ti muži nesouhlasili se Šengovou politikou - někteří otevřeně,*
all the men not-agreed with Šeng's policy - some openly
jiní opatrně.
others cautiously
'All the men didn't agree with Šeng's policy - some of them openly, the

others cautiously.'

d. *Všechny ty škody nemohly mít jiný účel než nadělat*
all the damages not-have-they have-to other purpose than make
co nejvíc hluku.
what most noise
'The purpose of all the damages was nothing else than to make as much noise as possible.'

The unmodified universal NPs is in most cases interpreted with the reverse $\neg > \forall$ scope. The rare cases where the semantic scope copies the surface scope are in (8). In percents: 87 % of modified universal NPs are interpreted with the $\forall > \neg$ scope, but only 26 % of bare universal NPs before negative verb are interpreted with the scope of $\forall > \neg$.

(8) a. *Všechny dominantní ženy nesnáší ostatní dominantní ženy.*
all dominant women not-tolerate other dominant women
'All dominant women don't tolerate the other dominant women.'

b. *Určitě chce vzbuzovat dojem, že všechny události s ním*
certainly wants give impression that all events with him
naprosto nesouvisejí.
absolutely not-relate
He certainly wants to give an impression that all events don't relate to him at all.'

c. *„Ale všichni se přece mýlit nemůžeme.“ „Samozřejmě že*
but all REFL surely mislead-to cannot-we of_course that
můžete.“
can-you-pl
"But we all cannot be mislead.' 'Of course you all can."

d. *Všichni ostatní muži, včetně Lucana, se nemohou tomuhle*
all other men including Lucan REFL cannot-they this
neotesanci vyrovnat.
boor compare-they
'All the other men including Lucan are no match for this boor.'

The examples of unmodified NPs where only the scope $\neg > \forall$ is grammatical as their interpretation are in (9). They comprise 74 % of the unmodified SV linearization. Recall that even in case of unmodified universal NPs, there is 26 % of cases like (8) where the interpretation is $\forall > \neg$. More about that later.

(9) a. *Ty peníze byly v hotovosti a bylo jich tolik, že se mu*
the money were in cash and AUX them so_much that REFL him
všechny nevešly do kufříku.
all not-fit into briefcase
'The money was in cash and there was so much of them that they all didn't fit into the briefcase.'

b. *Všichni pacienti si ale protilátky nevytvářejí.*
all patients REFL though antidotes not-create
'All patients don't create antidotes though.'
c. *Myslím, že všechny mrtvoly se ještě neobjevily.*
think-I that all corpses REFL yet not-appeared
'I think that all corpses didn't appear yet.'
d. *„Všechny cesty," namítla suše, „nevedou k sexu."*
all paths objected-she dryly not-lead to sex
"All paths' she objected dryly, 'don't lead to sex."

4.1.2 VS linearization

For this linearization we queried the corpus with the tags: [tag="V....–..-N.–.*"] [] 0,10 [lemma="všechen"] within <s id=".*"/>In this case the results were even stronger: unmodified postverbal universal NPs are interpreted with the scope $\neg > \forall$ in 100 %. The examples are in (10). We didn't find any example of modified universal NP for this scopal reading, which corroborates the tendency of modified universal NPs to be interpreted with wide scope. And I think this also shows some traces of the information structure factors: the VS linearization in prototypical case reflects the logical scope verb > subject, but the modified universal subject NP would contradict such a scope, so there is no evidence of such sentences in the corpus.

(10) a. *Aspoň že ještě není všechno ztraceno.*
at_least that yet not-AUX all lost
'All isn't lost yet at least.'
b. *Zatím tu ještě nejsou všichni, ale zbývající hosti jistě*
so_far here yet not-are all but other guests certainly
dorazí co nevidět.
arrive-they soon
'All are not here yet but the other guests will certainly arrive soon.'
c. *Krom toho přece nemůžeme být všichni tak dokonalí jako George.*
besides that surely not-can be all as perfect as George
'Besides that, we all surely cannot be as perfect as George.'
d. *„Nemůžou být všichni pryč." Ross zavěsil a vytočil číslo znovu.*
cannot-they be all away Ross hung_up and dialed number again
"They cannot be all away' Ross hung up and dialed the number again.'

The interesting case is (11). It shows that a modified universal NP can be interpreted with the wide scope even in VS order. But this probably follows from the intricate interplay of modifiers *ani* 'not a single' and postnominal *dohromady* 'together'. *Ani* 'not' occurs in many Czech NPI idioms like (12) where it obligatory scopes under sentence negation and because the NPI is interpreted existentially, we obtain only the $\neg > \exists$ reading which is equivalent to the $\forall > \neg$ interpretation. *Ani* never occurs in positive contexts and it resists even downward entailing contexts.

(11) *A mě před nimi nedokáží uchránit ani všechny špatné anglické zákony*
And me before them cannot save not all bad English laws
dohromady.
together
'And all the bad English laws together cannot save me from them.'

(12) *Petr tam nepotkal ani nohu.*
Petr there not-met not leg
'Petr didn't meet a living soul there.'

4.2 Events and partitives

Before I proceed to an analysis of the corpus data introduced in sections 4.1.1 and 4.1.2, let me explain, how I think we should formalize intuitions about sentences like (13) (or their translation to any natural language, because I think that the intuitions are language-independent but I will stick to Czech further). Imagine a scenario with 100 deputies, then the sentence can be intuitively true in two situations: (i) when 24 (or less) of the deputies gathered but the rest didn't; (ii) when 75 of the deputies gathered and the rest (25) did not. As it's clear from such intuitions, the sentence (13) is ambiguous in a way that neither of the readings entails the other and vice versa. The theoretical explanation of the ambiguity should explicate both readings and it should take into account the factors which are responsible for it. These are (at least) three following factors:

1. literal meaning of both scopes of numerical noun phrases with respect to negation;
2. pragmatic strengthening of such literal meanings;
3. partitivity of the subject NP.

I will now discuss the LoP treatment of the three factors applied to the sentence (13); my discussion is based on Landman (2000), Landman (2004) and Landman(p.c.:2012). I take the theoretical discussion of possible readings of (13) as a limit case where all complications which can arise with respect to the interpretation of quantified NPs in negated sentences can arise.

(13) *Čtvrtina poslanců se nesešla.*
quarter deputies.GEN REFL not-gathered
'A quarter of the deputies didn't gather.'

Let's now start the compositional building of (13) sentence meaning. First, the meaning of the subject NP *čtvrtina poslanců* 'a quarter of the deputies' is (14)– a set of properties (λP) which a plurality of deputies (*DEP) with cardinality a quarter of all deputies ($|x| = 1/4 \sqcup (DEP)$) has.

(14) $\lambda P.\exists x[^*DEP(x) \wedge |x| = 1/4 \sqcup (DEP) \wedge P(x)]$

The meaning of the predicate *sejít se* 'to gather' is (15)– it is the function from the set of agents ($\lambda a \ldots$ Ag(e)=a) to truth such that for each a there is an event e of gathering ($\lambda e.GATHER(e)$) with a as the agent of the gathering event e. Gathering is a typical case of collective predicates (formalized as Ag(e)=$\uparrow(x)$ in (15)). Let's build the partitivity of the NP but as an operation on the verbal argument, so the partitivity is formalized as (16) (thanks to Fred Landman for hints about this) – partitive Agent also pluralized former group atom ($x \sqsubseteq\downarrow (Ag(e))$. Agent partitivity will combine with a predicate (α) and will output the predicate such that its group agent would include such x which is part of the group agent causing the event e ($x \sqsubseteq\downarrow (Ag(e))$.

(15) $\lambda a \lambda e.GATHER(e) \wedge Ag(e) =\uparrow (a)$

(16) $\text{PART}_{Ag}(\alpha) = \lambda x \lambda e.\exists a[\alpha(e,a) \wedge x \sqsubseteq\downarrow (Ag(e))]$

The partitivity applied to the meaning of the verb *gather* gives the event type in (17)– it's the function from set of individuals (λx) which outputs the event (e) – if there is any – such that x is the part of the group agent (Ag(e)=$\downarrow(\uparrow(x))$) of the event of gathering.

(17) $\lambda x \lambda e.GATHER(e) \wedge x \sqsubseteq\downarrow (\uparrow (Ag(e)))$

Combining this event type (plus the existential closure of the event variable) with the noun phrase and letting the negation scope over the existential closure of the event variable will give the following meaning:

(18) $\exists x[{}^*DEP(x) \wedge |x| = 1/4 \sqcup (DEP) \wedge \neg\exists e[GATHER(e) \wedge x \sqsubseteq\downarrow (\uparrow (Ag(e)))]]$

The truth conditions of (18) are: there is a sum of deputies (${}^*DEP$) with the cardinality 1/4 of all deputies ($|x| = 1/4 \sqcup (DEP)$) and there is no gathering event whose group agent includes that sum. Notice that the truth conditions of (18) are quite weak – (18) would be false only in a situation where 25 of 100 deputies met, in all other imaginable scenarios is (18): in a scenario where 50 out of 100 deputies met (you can find some sum of deputies with the cardinality 1/4 of the deputies which didn't meet) or in a scenario where no deputies gathered (as again you can find some sum of deputies with the right cardinality such that these deputies didn't meet) or even in a scenario where a cat sits on a mat and the rest of the universe is void. But let's assume that (according to the usual Gricean reasoning) hearers strengthen the meaning according to the general implicature in (19) (again thanks to Fred Landman for this suggestion):

(19) **Implicature**: there is a gathering event of deputies and it includes as much deputies as compatible with the sentence uttered.

The effect of such an implicature is that we understand the sentence in the relevant reading as reporting that the remaining 3/4 of the deputies gathered. In LoP the strenghtened meaning is explicated in (20):

(20) $\exists x e[{}^*DEP(x) \wedge |x| = 3/4 \sqcup (DEP) \wedge GATHER(e) \wedge Ag(e) =\uparrow (x)]$

So we see that the interpretation of negated sentences with plurality denoting NPs is a complicated process which we can theoretically reconstruct in two steps:

1. Weak literal event semantics (negated events) which would be compatible with too many situations;

2. Strengthened meaning which follows from a general implicature and attempts to construct an event such that it is compatible with all the information in the literal meaning.

There is another reading of (13) – the one where we scope the negation over the partitive NP. Its truth conditions are in (21)– for the compositional treatment of (21) we have to use the type shifting operation LIFT from LoP which allows in situ application of the predicate to its argument. LIFT changes the type of the intransitive predicate ($\langle d, \langle e, t\rangle\rangle$) to a function from the generalized quantifier denotation to the power-set of events ($\langle\langle\langle d, t\rangle, t\rangle, \langle e, t\rangle\rangle$). For details see Landman (2000, p.48-49).

(21) $\neg\exists e[GATHER(e) \wedge \exists x[^*DEP(x) \wedge |x| = 1/4 \sqcup (DEP) \wedge x \sqsubseteq\downarrow (\uparrow (Ag(e)))]]$

(22) LIFT: $\langle d, \langle e, t\rangle\rangle \rightarrow \langle\langle\langle d, t\rangle, t\rangle, \langle e, t\rangle\rangle$
LIFT[V] $= \lambda T.\{e \in E : T(\lambda x.e \in V(x))\}$
T=$\langle\langle d, t\rangle, t\rangle$, the type of noun phrases

Again the truth-conditions of (21) are weak but surprisingly (at least if we presuppose the existence of deputies, because (21) would be true even in a world void of any deputies), they are stronger than in the case of the wide scope of the partitive NP. (21) would be false if more than 1/4 of the deputies met (30 out of 100, 50 out of 100, ...). But again it would be true in a situation when 24, 23, 21, ...0 deputies met. Again let's assume that hearers strengthen the literal meaning according to an implicature like (23).

(23) **Implicature**: there is a gathering event of deputies and it includes as much deputies as compatible with the sentence uttered.

The strengthened meaning can be formalized as (24)– there is an event of gathering with group agent that consists of less than 1/4 of the deputies.

(24) $\exists xe[^*DEP(x) \wedge |x| \leq 1/4 \sqcup (DEP) \wedge GATHER(e) \wedge Ag(e) =\uparrow (x)]$

The emerging picture which we do get is that negated sentences are always strengthened (according to some implicatures) to the meaning where some event is reported as occurring. The strengthened meaning cannot contradict the literal meaning though but hearers obviously try to avoid understanding of the sentences as tautologies – see Landman (2011) for formal application of this idea and because negated events would be true nearly tautologically, hearers tend to strengthen their literal meaning to obtain the reports of events which happened. In the remainder of this chapter I will return to this idea sometimes even though the main line of my argumentation will focus on another factors which influence the interpretation of negated sentences.

4.3 Proposal

My proposal which explains the data patterns introduced in the preceding sections of this chapter is quite simple. Let's put aside the examples with modified universal NPs for a moment. Unmodified universal NP is interpreted in 74 % cases with the $\neg > \forall$ scope. This shows strong tendency for negation taking wide scope over universal quantifiers. Let's take this empirical finding at face value and make a following generalization (25). The generalization simply states what we saw already, but it doesn't motivate the descriptive pattern. Second, it seems to be empirically incorrect. I will tackle with both problems in the following sections. In 4.4 I will explain why I strongly believe in the truth of (25) and in the section 4.5 I will show how all apparent cases contradicting the generalization (25) can be explained as scope illusions.

(25) Universal quantifier in natural language is always interpreted under the scope of negation ($\neg > \forall$).

4.4 Why $\neg > \forall$?

Why should something like (25) hold in the natural language? Generative grammar and formal semantics offer some ready made answers: *all* can be considered negative polarity item forcing its scope under negation e.g.; or the fixed scope can be result of a functional sequence, where let's say NegP always dominates ∀P; and we would be able to find another options for fixing the scope between the instruments of generative grammar. But I think that both mentioned ways of explanation are at least implausible though. First, NPIs are known to trigger ungrammaticality in the absence of negation or downward entailing operators (e.g. **John saw anyone*, so it's improbable that (Czech) universal quantifier would be NPI as it occurs freely in non-negated sentences. Moreover the universal quantifier seems to interact freely with downward entailing quantifiers. (26) is ambiguous – it can either mean that few people are omniscient with respect to politicians or it can mean that all politicians are known by only few people.

(26) Few people know all politicians.

The second way of explanation (close in spirit to Beghelli and Stowell (1997) which would link wide scope of negation to particular sequence of functional categories in the syntactic tree would be too restrictive. It wouldn't be able to explain the counterexamples mentioned in the data sections.

So my claim is that the fixed scope results from the competence in grammar. Because Czech posses a grammatical means for expressing particular scope of universal quantifier and negation: the scope $\forall > \neg$ is expressed by the negative pronouns *žádný* 'no', *nikdo* 'nobody', the sequence *všechno* ... negated verb is ceteris paribus interpreted only with the opposite scope than *žádný*, namely with the scope $\neg > \forall$. The logic of the argument follows famous Panini's principle well explored in morphology (see Kiparsky (1973) for the introduction of this principle into generative grammar and Neeleman and Szendrői

(2007) for the recent application): if there is an unmarked lexical item and a marked lexical or syntactical expression, where both candidates have the same grammatical or lexical meaning, the grammar chooses always the unmarked candidate. In this particular case consider the sentences (27) and (28). (27) has potentially both readings in (27-a) and (27-b) but because for the logical form (27-a) there is a more economical (unmarked) way to express the meaning, namely (28), hearer interpreting (27) will understand it only as (27-b), probably as a result of some Gricean reasoning.

(27) *Všichni pacienti si ale protilátky nevytvářejí.*
all patients REFL though antidotes not-create
'All patients don't create antidotes though.'
a. $*\forall x[patient(x) \rightarrow \neg create\_antidotes(x)]$
b. $\neg\forall x[patient(x) \rightarrow create\_antidotes(x)]$

(28) *Žádní pacienti si látky nevytvářejí.*
no patients REFL antidotes not-create
'No patients create antidotes.'
a. $\forall x[patient(x) \rightarrow \neg create\_antidotes(x)]$
b. $*\neg\forall x[patient(x) \rightarrow create\_antidotes(x)]$

The concurrence view opens the possibility of other factors which can cancel the equality of candidates. E.g. in a case when negative NP wouldn't be able to express the meaning of the sequence of universal quantifier and negation. I will argue in the following sections that this happens exactly when the universal NP is specific, which as we discussed in the second chapter, isn't a possible meaning of negative NPs in Czech. In the following section I will link my argument to the well known debate about nonexistence of lexicalized universal quantifiers.

Another way how to look at the competition stems from the discussion in the section 4.2 where I stated that even negated events are usually pragmatically strengthened, so the hearer understands the utterances as reports of events compatible with the negated events. Let's formalize (27) in LoP. The ingredients are in (29) and the wide scope of the universal quantifier with respect to negation is in (29-a), the reverse scope is in (29-b). (29-a) means: there is a sum of all patients and for no atom in this plurality there is an event of this atom a making antidotes. Can this literal meaning be strengthened to some report of an existence of the event of constructiong antidote? I doubt so – universal quantifier uses all atoms in the plurality of patients, so there is no strengthening available (contra the case of partitives like *one quarter* discussed in the section 4.2).

(29) *všichni pacienti* 'all patients'
$\rightarrow \lambda P.\exists x[^*PAT(x) \wedge |x| = \sqcup(PAT) \wedge P(x)]$
vytvářet protilátky 'create antidotes'
$\rightarrow \lambda a\lambda e.MAKE\_ANTIDOTES(e) \wedge Ag(e) = a$
a. $\exists x[^*PAT(x) \wedge |x| = \sqcup(PAT) \wedge \forall a \in x \rightarrow \neg\exists e[MAKE\_ANTIDOTES(e) \wedge Ag(e) = a]]$
b. $\neg\exists e[MAKE\_ANTIDOTE(e) \wedge \exists x[^*PAT(x) \wedge |x| = \sqcup(PAT) \wedge Ag(e) = x]]$

Can we strengthen the meaning of (29-b)? In this case yes, the intuitive meaning of this scope reading is: some patients construct antidotes, some do not (unlike the strict meaning of (29-b) which is: there is no event of making antidote with the sum agent being the sum of all patients). The strengthened meaning can be formalized in LoP as in (30).

(30) $\exists xye_1e_2[^*PAT(x) \wedge {}^*PAT(y) \wedge CONSTRUCT\_ANTIDOTE(e_1) \wedge {}^*Ag(e_1) = x \wedge \neg CONSTUCT\_ANTIDOTE(e_2) \wedge {}^*Ag(e_2) = y \wedge x \sqcup y = \sqcup(PAT)]$

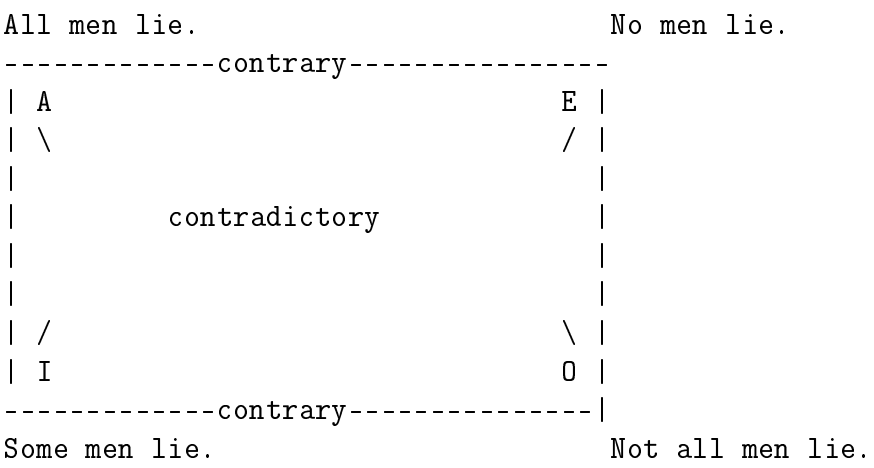
(30) reads as: there are two sums of patients (x and y) which together exhaust all patients ($x \sqcup y = \sqcup(PAT)$). The first sum (x) construct antidotes, the second (y) not. I think this reasoning can explain the absence of the wide scope interpretation of the universal quantifier over negation in sentences like (27) as well as the concurrence view adopted here. The general reasoning is: negated sentences are very weak as to their truth-conditions, so they are strengthened via some pragmatical reasoning, if this reasoning cannot take place, the respective scope reading is shadowed because its truth conditions are hard to anchor to situations/world. Moreover I think that this sort of explanation brings also lover computational cost (there is no competition between different lexical items in the event story) than the competition strategy, so in the long run I would prefer it, but I must leave the proper evaluation of both accounts for future work as it would lead me beyond the scope of the current book.

4.4.1 *O

The logic of the concurrence argument in the previous section follows Horn (1989) and Hoeksema (1998) who explicitly link the preference of negation to scope over universal quantifier to the missing corner in Aristotelian square of oppositions like (31). The square of oppositions is built on two types of negative relations between quantifiers in natural language. The horizontal corners in the square stand to each other in the relation of contrary negation. Both corners cannot be true about the same state of affairs but they can be false – which is highly probable for the exemplar sentence – we live in a world where some men lie and some not, so both *all* and *none* corners are false now. Diagonal corners are in the relation of contradictory negation (the truth of one corner entails falsehood of the other and vice versa). So for instance actual truth of the corner *Some men lie* entails falsity of sentence *No men lie* and if the world would turn to be non-lying paradise, the E corner would be true and the I corner would be false.

The peculiarity of the square lies in the way the four corners are lexicalized. As Horn (1989) points out, only the A, E and I corners are lexicalized by one lexical item in natural languages, but there is no natural language which would lexicalize the O-corner (with one word). The same holds for basic conjunctions: *and*, *neither* and *or* have counterparts in all natural languages but there is no language with basic conjunction which meaning would correspond to the propositional $\neg(p \wedge q)$ meaning. Czech follows this prohibition against lexicalization of the O-corner too, as demonstrated in (32) and (33) for quantifiers and conjunctions respectively. The same absence of the O-corner in

(31)



English is exemplified by the missing lexical items like *no* vs. **nall*, *never* vs. **nalways*, *nor* vs. **nand*, *none* vs. **noth* – Hoeksema (1999).

(32) a. A = Všichni/každý muž(i) lže(ou).
All men lie.
b. E = Žádný muž nelže.
No men lie.
c. I = Někteří muži lžou.
Some men lie.
d. *O = NeVšichni muži lžou.
NotAll man lie.

(33) a. A = Petr a Marie lžou.
Petr and Mary lie.
b. E = (Ani) Petr ani Marie nelžou.
Neither Petr nor Mary lie.
c. I = Petr nebo Marie lže.
Petr or Mary lie.
d. *O = Petr a Marie (oba zároveň) nelžou.
Petr and Mary don't lie (both).

Horn's account of *O constraint builds on Grice's pragmatic calculation of implicatures – assertion of an item on a scale pragmatically implies negation of the stronger scalar alternatives to the item. So for instance the existential quantifier in a positive context lies on the scale like $\langle \exists, \forall \rangle$, the utterance of (34) the asserts (34-a), which is still compatible with the possibility that the sentence is true in a scenario where all men lie. But (34)

pragmatically implies (34-b), negation of the stronger alternative to $\exists$, $\forall$ in this particular case. So (34) is ceteris paribus understood as conjunction of (34-a) – assertion – and (34-b) – implicature, in other words as claiming that some men lie and some don't.

(34) Some men lie.

a. assertion: $\exists x[man(x) \wedge lie(x)]$

b. implicature: $\neg\forall x[man(x) \rightarrow lie(x)]$

The same reasoning applied to the universal quantifier in a downward entailing context ($\forall$ is in the scope of negation) leads to: 1) reversal of the scales ($\langle\exists, \forall\rangle \rightarrow \langle\forall, \exists\rangle$) and 2) again negation of the stronger candidate on the scale ($\exists$) – see Horn (1989) for the details. So (35) asserts (35-a) but implies (35-b). In other words, strengthened meaning of (35) is again conjunction of the assertion and the implicature, namely – not all men lie but some do. Notice now that existential quantifier like in (34) asserts what negation of universal quantifer in (35) implies, and it implies, what negation of universal quantifier asserts. In this sense then it can be said that negation of universal quantifier in natural language is pragmatically equivalent to existential quantifier.

(35) Not all men lie.

a. assertion: $\neg\forall x[man(x) \rightarrow lie(x)]$

b. implicature: $\neg\neg\exists x[man(x) \wedge lie(x)] = \exists x[man(x) \wedge lie(x)]$

And this is exactly Horn's explanation of the missing lexicalization of the O-corner in natural languages. The O-corner is not lexicalized and E-corner is because E is less marked and means (pragmatically) the same as O: recall that negation in all natural languages is more marked than affirmation (in terms of more structure, morphology, ...). And that is also the reason why we don't find any O-corner expressions in other areas of natural language, be it conjunctions, modal verbs or whatever else. I take my explanation of scope preferences between $\neg$ and $\forall$ to be just another instantiation of the missing O-corner explanation.

And moreover I agree with Horn's claim that some instances of non-equality of E and O-corner – consider e.g. partial knowledge as background context for the interpretation of (36)– are not arguments against the concurrence explanation. Consider (36): in the context of speaker's partial knowledge the implicature $\neg\forall$ is suspended, so the E-corner isn't equivalent in this case with the O-corner, because it only asserts but doesn't implicate. But this doesn't destroy the concurrence explanation, on the contrary, the flexibility of the concurrence explanation allows us to explain the cases where the scope of $\neg$ and $\forall$ turns to be $\forall > \neg$ even for unmodified universal quantifiers.

(36) Some students of mine smoke.

4.5 $\forall > \neg$

Let's now turn to cases of modified universal NPs. What is the reason of their $\forall > \neg$ interpretation (recall that modified universal NPs are interpreted with wide scope of the universal NP in 87 %)?

Prototypical example of this type of cases is (37) where *všechno* 'all' is modified by the demonstrative pronoun *to* 'that'. The interpretation of (37) is: for all those things (possessing hotel in Shanghai), they don't matter anymore. Modified universal NPs present direct counterexample to my claim, that negation in natural language always scopes above universal quantifier. My answer to this tension is simple: what we see here is an illusion of the interaction between negation and definiteness.

(37) *Měl jsem v Šanghaji svůj vlastní hotel. Ale to všechno dneska nic*
Had AUX in Shanghai my own hotel but that all today nothing
neznamená.
not-means
'I had my own hotel in Shanghai. But all that means nothing today.'

The phenomena of negation and plurality is rarely discussed in the plurality literature. E.g. Landman (2000) gives the negation fixed scope position – over the event variable – but doesn't explore too much empiry from natural language with respect to the fixed position of negation in his Language of plurality. The wide scope of negation over event variable moreover doesn't mean that other scopal elements in the sentence cannot outscope the negation, because the Language of plurality contains the operation of quantifying-in which can scope any (non-collective) NP over the event variable.

Beck (2001) in her discussion of reciprocal sentences touches the issue of plurality and negation when she analyses sentences like (38) which do have surprisingly only very strong truth conditions. Consider (38-a), imagine a situation with three children, (38-a) seems to be true only if every child is awake, the other possibility, that not every child is asleep is not a viable reading of (38-a). The same strange truth conditions are observed in the case like (38-b) called relational plural. A relational plural is a sentence like (38-b) where two plurality denoting expressions (*the women* and *the men*) are arguments of a verb that denotes a relation (*know* in the example). Again the only interpretation of (38-b) is each-to-each ignorance between the women and the men. In the language of predicate logic, neither (39-a) nor (40-a) are available logical forms for the respective sentences. Although only the strong (39-b) and (40-b) represent the sentence meanings correctly. Generally it seems like universal quantifiers (representing the meaning of the definite NPs) scopes only over negation in these cases.

(38) a. The children are not asleep.
b. The women don't know the men.

(39) a. $*\neg\forall x[x \in CHILD \rightarrow asleep(x)]$
b. $\forall x[x \in CHILD \rightarrow \neg asleep(x)]$

(40) a. $*\neg\forall x[x \in WOMAN \rightarrow \forall y[y \in MAN \rightarrow know(x, y)]]$

b. $\forall x[x \in WOMAN \rightarrow \forall y[y \in MAN \rightarrow \neg know(x, y)]]$

But it doesn't seem possible that the observed 'wide scope of universal quantifier' is a scope phenomenon, because as Beck (2001) convincingly shows, the same $\forall > \neg$ interpretation arises also in the cases where negation is positioned in the clause which dominates the clause with the universal quantifier. But quantifier raising of definite/quantificational NPs never crosses the clause boundary, as (41) exemplifies. (41) doesn't have a reading such as: Peter believes that no children are asleep ($= \forall > \neg = \neg > \exists$).

(41) Peter doesn't believe, that all children are asleep.

Beck's examples illustrating that the illusion of the wide scope reading for the universal quantifier doesn't observe the discussed clause boundary prohibition against quantifier raising are in (42) and (43). Again we do get the $\forall > \neg$ interpretation even if it couldn't arise as the result of quantifier raising of the universal quantifier, because the negation is in the super-ordinate clause.

(42) A: Are the children asleep?
B: No (it is not the case that the children are asleep).

(43) A: Do the women know the men?
B: No (it is not the case that the women know the men).

Beck's way to resolve the tension – we observe the narrow scope of negation although it's impossible for independent reasons to attribute the low scope of negation to quantifier raising of the universal qauntifier – is to distribute the negated property/relation to all the atoms which constitute the plurality(ies) in question. Formalization in (44) says that (the part a) some property P is true about a plurality A, iff every atom a of the plurality A has the property P. And as for negation (part b), analogically the negation of property P is ascribed to each atom a in the plurality A. Beck calls this all-or-nothing effect the presupposition of homogeneity.

(44) *P(A)
a. =1 iff $\forall x[x \in A \rightarrow P(x)]$
b. =0 iff $\forall x[x \in A \rightarrow \neg P(x)]$
c. undefined otherwise

The presupposition of homogeneity arises only for definite NPs, indefinite NPs allow wide or narrow scope of negation with respect to the plurality. Consider example (45)– *two actors* can have wide scope with respect to negation (there were two specific actors, that Peter didn't meet) or narrow scope which would be true e.g. in a situation where he met just one actor.

(45) Petr didn't meet two actors.

Building on the insights of Beck, I claim that the 'wide scope reading of universal quantifier' in sentences like (37), repeated here as (46) are another instantiation of the

homogeneity presupposition. (46) is interpreted as (47), because *to* marks the universal NP as definite and because of that, the homogeneity presupposition comes to play and the scope of negation must be low with respect to the universal NP. All the examples of sentences from the Czech National Corpus which were interpreted with the scope $\forall > \neg$ really witness same marking of definiteness – in most cases it is the demonstrative *to* like (46).

(46) *Měl jsem v Šanghaji svůj vlastní hotel. Ale to všechno dneska nic*
Had AUX in Shanghai my own hotel but that all today nothing
neznamená.
not-means
'I had my own hotel in Shanghai. But all that means nothing today.'

(47) $\forall x[x \in THING \rightarrow \neg MEAN(x)]$

Interesting examples are the sentences like (6), one example repeated here as (48), where the same effect of definiteness results from relative clause modification. I assume this can be explained by some mechanism of domain shrinking like the one proposed in von Fintel (1994).

(48) *Všichni, kteří ho spěchali pronásledovat, neopomněli nabídnout na*
all which him hurried-they to-pursue not-omited-they offer-to for
usmířenou malé dárky.
reconciliation small gifts
'All, who hurried to pursue him, didn't omit to offer small gifts as reconciliation.'

Interesting question, which as far as I know nobody in the literature answered, is the motivation for such rule as the homogeneity presupposition. The first thing to note is that it really concerns only the plural definite NPs. Singular definite NPs are famous for their ability to take either wide or narrow scope with respect to negation. Russell (1905) argues famously in support of the quantificational interpretation of definite NPs from data like (49). The negated sentences with definite NPs seem to have two scope readings: de re like in (49-a) and de dicto like in (49-b) (primary and secondary in Russell's terms). De re reading is false in the actual world but de dicto is true. So the ambiguity between negation and definite NPs does exists but is limited to singular definite NPs only.

(49) The present king of France isn't bald.
a. $\exists x[PKF(x) \wedge \forall y[PKF(y) \leftrightarrow y = x] \wedge \neg BALD(x)]$
b. $\neg\exists x[PKF(x) \wedge \forall y[PKF(y) \leftrightarrow y = x] \wedge BALD(x)]$

4.5.1 Independent evidence for the presupposition of homogeneity

If something like presupposition of homogeneity is operative in Czech, we should find another sentence interpretations influenced by it (for other pieces of evidence from Germanic languages which fall roughly under the same agenda see Löbner (1995) and Schwarzschild (1994)). And it seems to me that there really is another area of Czech grammar where the negation and definiteness interact differently than negation and indefiniteness. The case is illustrated by an example like (50). The prominent interpretation of (50) is a wide scope reading of the conjunction over the negated propositional variables (p ...Peter read Krakatit, q ...Peter read The Grandmother) – $\neg p \wedge \neg q$ in terms of propositional logic (he read neither of them). As for the possibility of another reading – (50-b), at least in my idiolect of Czech this isn't a grammatical interpretation of (50). Nevertheless more thorough empirical study would be needed to really prove that the reading is totally absent in Czech. But we can safely assume that the wide scope of negation for conjoined definite NPsin Czech is highly dis-preferred in Czech. This seems to be a particular property of Czech though, because a similar sentence in English, like (51) exhibits just the opposite reading: namely the wide scope of negation over the conjunction. The systematic difference between the interpretation of negation and conjunction in natural languages is reported in Szabolcsi and Haddican (2004). Szabolcsi and Haddican also link the absence of the wide scope interpretation of negation in Hungarian (which seems to behave like Czech in this respect) to Beck's presupposition of homogeneity. So we see another ban of wide scope interpretation for negation Czech. Which is the answer to the question of this subsection: yes, there is another part of Czech grammar which pays attention to the presupposition of homogeneity.

(50) *Petr nepřečetl Krakatit a Babičku.*
Petr not-read-he Krakatit and Gradnmother
'Peter didn't read Krakatit and The Grandmother.'

a. $\neg p \wedge \neg q$
'Petr didn't read Krakatit and Petr didn't read The Grandmother.'

b. $*\neg(p \wedge q) = \neg p \vee \neg q$
*'Petr didn't read Krakatit or Petr didn't read The Grandmother.'

(51) Mary didn't take hockey and algebra.

a. $*\neg p \wedge \neg q$
'Mary didn't take hockey and Mary didn't take algebra.'

b. $\neg(p \wedge q) = \neg p \vee \neg q$
'Mary didn't take hockey or didn't take algebra.'

But is there any reason why universal quantifiers and conjunctions should form a natural class with respect to their interaction with negation? The answer is positive: the universal quantifier and the conjunction are (for the finite number of elements in the discourse) equivalent. For instance in a universe of discourse with three individuals a, b and c the equivalence (52) holds

(52) $P(a) \wedge P(b) \wedge P(c) \leftrightarrow \forall x.P(x)$

It is expected then that universal definite NPs and conjoined definite NPs will always scope under negation. Another argument in the same direction comes from plurality frameworks: conjunction of definite NPs are (independently of formalizations) nearly universally accepted as the default way to form pluralities and the universal-quantified definite NPs are another way how to assemble pluralities from atoms (unlike regular quantifiers of the *every* type are stubbornly distributive). But if conjunction and universal quantified definite NPs behave similarly with respect to the scope of negation, then we expect that also conjunction of indefinite NPs will allow both narrow and wide scope reading when negated. And this is borne out – (53) allows both readings: wide scope of negation would be true in a scenario where Peter read less than two Jirásek's books and less than three Němcová's books. The narrow scope of negation would be true in a situation when Peter read all Jirásek's books except two and all Němcová's books except three. But again with definite NPs only the wide scope reading is possible – (54) has only the interpretation equivalent to (54-a) but lacks the interpretation equivalent to (54-b).

(53) *Petr nepřečetl dvě knížky od Jiráska a tři knížky od Němcové.*
Petr not-read-he two books from Jirasek and three books from Necmova
'Petr didn't read two books by Jirasek and three books by Nemcova.'

a. $\neg(p \wedge q)$
$\approx$'Petr read one book by Jirasek and Petr two books by Nemcova.'

b. $(p \wedge q) > \neg$
$\approx$ 'Petr all books by Jirasek with the exception of two and Petr read all books by Němcové with the exception of three.'

(54) *Petr nepřečetl Temno a Babičku.*
Petr not-read-he Darkness and Grandmother
'Petr didn't read The Darkness and The Grandmother.'

a. $\neg p \wedge \neg q$
'Petr didn't read The Darkness and Petr didn't read The Grandmother.'

b. $*\neg(p \wedge q) = \neg p \vee \neg q$
*'Petr didn't read The Darkness or Petr didn't read The Grandmother.'

4.6 Information structure and the scope of operators

In this section I will pursue the question of the relationship between the information structure and the scope of quantifiers. As I mentioned at the beginning of the chapter, there are numerous proposals like Jackendoff (1972), Hajičová (1975) and Büring (1999) who try to establish the thesis that the information structure desambiguates the scope of the operators represented by various scopal elements in sentences of natural languages. I'm not able to tackle all the subtle issues raised by different implementations of this thesis but I think that the basic correlation discussed in the previous sections

of this chapter – unmodified universal NP is in most cases interpreted with the scope $\neg > \forall$ unlike modified definite universal NP which obtains just the opposite scope – is unexplainable by any information structure based account of scope desambiguation.

For concreteness sake, let's take the Jackendoff's account of cases like (55) and (56). According to him, the focalization of the quantifier *all* leads to obligatory wide scope interpretation of the universal quantifier over negation. Focalization is in this concrete case realized by a specific English intonation. I assume that the same effects can be achieved by different phonological, morphological or syntactical strategies. For Slavic languages it is usually word order variation (linearization) what signals the topic-focus articulation (see Kučerová (2012) for a recent treatment and older references). In the language of predicate logic, according to Jackendoff, (55) has only the semantic interpretation in (55-a) and never (55-b) and (56) has only the interpretation in (56-a) and never the interpretation in (56-b) (of course (56-a) and (56-b) are beyond the expressive power of predicate logic, as Barwise and Cooper (1981) showed, but let's assume for easiness of reading that *most* in (56-a) and (56-b) are generalized quantifiers, not ordinary quantifiers of predicate logic).

(55) $[\text{All}]_F$ the men didn't go.
   a. $\forall x[man(x) \rightarrow \neg go(x)]$
   b. $*\neg\forall x[man(x) \rightarrow go(x)]$

(56) He doesn't hate $[\text{most}]_F$ of the songs.
   a. $most\ x[song(x) \rightarrow \neg hate(he, x)]$
   b. $*\neg most\ x[song(x) \rightarrow hate(he, x)]$

I think (contra Jackendoff) that what we really observe in examples like (56) and (55) is the homogeneity presupposition started by the definite article and that intonation which signals the exhaustive focus here just supports the definiteness marked already by the definite article. More serious research into English data would be needed here but I think that at least cross-linguistically the data discussed in the previous sections show that if there is a disambiguation of $\forall$ and $\neg$, then it results from other factors than topic-focus articulation. I do believe though that topic-focus articulation makes it easier for the speaker to grasp the relative scope because the articulation enforces particular set of alternatives (in other words, it makes some contexts more or less salient, see Rooth (1992a) for details) but it doesn't disambiguate. It's more likely that some scoping of elements can be hard to imagine with particular topic-focus articulation because the articulation suggests different context than what would be natural for the scope. But on the other hand, if we find genuine cases of scope fixation, the it's a result of something other than topic-focus structure.

This argumentation is in line with Kadmon and Roberts (1988) and Kadmon (2001) who argue also against Jackendoff's claim that focusing results in the obligatory wide scope reading of the focused operator. They discuss examples like (57) and (58) where even if the scopal element is focused, we can obtain the narrow scope reading for it if we supply the right context. So for instance (57-b) occurs in the context where it

is interpreted with wide scope of the *most* NP over negation. But in another context like (58) the same focused operator is interpreted with narrow scope with respect to negation.

(57) a. Well, he hates the last three songs I played. What songs [doesn't]$_F$ he hate?
b. He doesn't hate [most]$_F$ of the songs.
$most\ x[song(x) \rightarrow \neg hate(he, x)]$

(58) a. He likes 'Smooth Operator,' but [most]$_F$ of the 'Top 40' things he [hates]$_F$, right?
b. No.
c. What do you mean 'no'? He always has some disparaging remarks to make about them.
d. OK, so he hates [many]$_F$ of the songs. All I said was he doesn't hate [most]$_F$ of the songs.
$\neg most\ x[song(x) \rightarrow hate(he, x)]$

Let's summarize this section: focusing some expression makes some contexts salient (roughly the ones where alternatives to the focused expressions would be appropriate) but it doesn't really disambiguate the scope of operators. We observed this tendency in the data part of this chapter where we saw that 100 % of VS linearization containing unmodified universal NPs were interpreted with the $\neg > \forall$ scope. It is the case where the two factors (modification and the topic-focus articulation) go hand in hand, so it's impossible to obtain the $\forall > \neg$ scope. On the other hand, the finding that SV linearized sentences are (for unmodified universal NPs) in 74 % of cases interpreted with the $\neg > \forall$ scope is totally unpredictable from topic-focus positions, because the subject position in such linearization in Czech is most likely topical, so we would expect mostly $\forall > \neg$ reading if the information structure is the decisive factor.

4.7 Summary

In this chapter I examined a rather complicated question about the nature of interpretation of negated sentences containing plurality denoting NPs. Whether it were partitive NPs as in the section 4.2 or the universal quantifiers as in the rest of the chapter, it seems that many factors play a role in the interpretation of such sentences: implicatures, strengthening and concurrence in grammar. It would be too hasty to draw strict conclusions from the limited set of data I examined, but it's safe to say that such sentences are never interpreted literary, because such interpretation would be too weak. The strengthening of meaning can rescue these weak truth-conditions but the nature of the final interpretation depends on the particular strengthening strategy.

5 On negative manner and degree questions

In the last chapter of my book I will investigate the interaction between negation and wh-words in two types of wh-questions. The first type of the negative question I will focus on is the negative manner question exemplified by (1). The English negative manner questions (unlike their un-negated version as exemplified in (2)) are grammatical. This behaviour is usually subsumed under the label of weak islands (see Szabolcsi and Zwarts (1993), Rullmann (1995), Abrusán (2007) a.o. for the detailed discussion of weak islands phenomena and Szabolcsi (2006) for an extensive handbook introduction).

(1) *How didn't John repair the bike?

(2) How did John repair the bike?

The literature on the topic of weak islands is vast and most of the approaches treat weak islands in negative manner and degree questions as an evidence in favour of rather abstract semantic and logical constraints on the interpretation of wh-questions (contradictions, density of scales, and impossibility to define certain logical operations on the semantic objects corresponding to manners and degrees). Nevertheless the weak islands are subject to a high degree of cross-linguistic variation. In Czech (as in many other Slavic languages) negative manner degree questions are grammatical, which is not the case in English. Direct translation of (1) into Czech – (3)– is acceptable for most Czech speakers.

(3) *Jak John nespravoval to kolo?*
how John not-repaired the bike
'How didn't John repair the bike?'

The descriptive goal of this chapter is to provide a better description of the cross-linguistic properties of negative manner and degree questions. I will argue that English weak islands of the degree and manner kind are a result of the focus related properties of English wh-words. And because Czech and English wh-words differ in the their focus properties, we don't find island behaviour in Czech negative manner and degree questions. Theoretically I will build on work of Beck (2006) and will argue that weak islands in negative manner and degree questions fall under intervention effects. Further I will show that the difference between English and Czech isn't that simple as presence of weak islands in English and their absence in Czech, but that grammatical aspect plays a crucial role here and a specific form of the aspect can elicit the weak islands of the English type even in Czech. The problematic of weak islands explored in this chapter

is part of a bigger project which I work on with Ivona Kučerová (partial outcome was presented e.g. on the SynFonIJA conference: Dočekal and Kučerová (2012)). And of course the version of the ideas I present in this book borrows many times from our collaborative effort although the particular way I do it is solely on my responsibility and cannot be blamed on anyone else than me.

5.1 The data – landscape

As mentioned above, that weak islands are subject to a significant degree of cross-linguistic variation is rarely acknowledged (Schwarz and Shimoyama (2011) investigated a possibility to obviate weak islands in Japanese, Beck (2006) mentions a high degree of variation in the broad domain of weak islands without giving further details). But it seems (from the first empirical studies I conducted) that only some types of weak islands allow cross-linguistic variation. In an empirical survey I asked 10 native speakers of Czech for their judgements of various types of weak islands (for an extensive debate of the types of weak islands see Szabolcsi and Zwarts (1993)). Let's recall that weak islands are always composed of two factors: (i) intervener (another wh-element heading non-finite clause, negation, VP-adverbs, ...), (ii) specific type of wh-word. So unlike strong-islands where wh-movement of any type of wh-word leads to ungrammaticality, in weak islands only particular type of wh-word and its movement makes the sentence ungrammatical. So unlike (4)– an example of strong island – where movement of any wh-phrase from the relative clause causes ungrammaticality, only *how* in (5) makes the sentence ungrammatical. The square brackets mark the island, the underscore marks the source position of the wh-word (in other words the sentences are ungrammatical under the interpretation where the wh-words take the scope inside the islands).

(4) John saw [the man, who was reading a book on the corner during the whole evening]?
   a. *What did John see [the man who was reading _ on the corner during the whole evening]?
   b. *Where did John see [the man who was reading the book _ during the whole evening]?
   c. *When did John see [the man who was reading the book on the corner _]?

(5) a. Which man are you wondering [whether to invite _]?
   b. *How are you wondering [whether to behave _]?

I will go through the types of weak islands respectively, commenting on each type shortly.

5.1.1 Tenseless wh-questions

First type of wh-islands are tenseless wh-questions. The numbers at the right edge of Czech examples represent the number of people who consider the sentences: * – ungrammatical, ? – strange but marginally acceptable, ✓. As shown by (7), even in

Czech discourse linking of wh-words improves grammaticality in such questions. *Which student* as well as its Czech translation are discourse-linked in the sense coined by Pesetsky (1987): such wh-phrases (unlike simple wh-words like *who*, *why*, *when*, ...) imply existence of contextually given entities of the right type (denoted by the NP). But manner wh-movement in Czech seems to be ungrammatical from tenseless wh-questions, as (8) shows. From the ungrammaticality of (8) we can infer that manner wh-word *jak* 'how' isn't discourse linked in Czech, otherwise we would expect grammaticality of (8), contrary to facts.

(6) a. Which man are you wondering [whether to invite]?
b. *How are you wondering [whether to behave]?

(7) a. *Koho pochybuješ, jestli (máme) pozvat?*
who doubt-you whether (should-we) invite
'Who do you doubt whether to invite?' 4* 2? 4 ✓
b. *Kterého studenta pochybuješ, jestli (máme) pozvat?*
which student doubt-you whether (should-we) invite
'Which student do you doubt whether to invite?' 3? 7 ✓

(8) *Jak pochybuješ, jestli se (máš) chovat?*
how doubt-you whether REFL (should-you) behave
'How do you doubt whether to behave?' 5* 4? 1 ✓

5.1.2 VP-adverbs

Next type of weak islands are caused by VP-adverbs like *a lot* or *twice* . Dutch sentences from Szabolcsi and Zwarts (1993) representing this type is (9). Czech seems to behave similary to Dutch, see (10), neverthelless there is some variation between *hodně* 'a lot' and *dvakrát* 'twice' as witnessed in the grammaticval contrast between (12) vs. (13). *Hodně* 'a lot' seems to block manner wh-movement, unlike *dvakrát* 'twice', the reason of the variation is unclear to me but maybe can be attributed to different adjunction possibilities for *dvakrát* 'twice', which can modify either VP or the in-situ occurence of the wh-word *jak* 'how'.

(9) **Wat heb je [twee keer [voor boeken] gelezen]?*
what have you two times for books read
'What kind of books did you read twice?'

(10) *Které čteš dvakrát knihy?*
which read-you twice books
'Which books do you read twice?' 8* 2?

(11) a. *How did you [behave a lot]?
b. *How did you [behave twice]?

(12) *Jak ses choval hodně?*
How REFL behaved-you a_lot

'How did you behave a lot?' 9* 1?

(13) *Jak ses choval dvakrát?*
How REFL behaved-you twice
'How did you behave twice?' 1* 4? 5 ✓

5.1.3 Negatives and other affective operators

Under this type I subsume the different types of wh-questions where the intervention of negation, downward entailing quantifier or focus associated operator like *only* leads to ungrammaticality. As the data in (14) and (15) show, Czech negation unlike English negation doesn't create weak islands. I will focus on this variation in the next sections of this chapter. As the examples (17) show, the situation with other affective operators is more complex. *Málo lidí* 'few people' as well as *popřít* 'deny' are probably stronger interveners than *pouze* 'only' in Czech, as native speakers are more open to accept *pouze* islands unlike the downward entailing *málo lidí* and the presuppositional islands of the *deny* type. More empirical research would be needed here but it goes well with one of the main topics of this chapter: that weak islands are partially reducible to invervention effects and because intervention effects stem from focus and wh-question clash, we should observe weak islands improvements in Czech when it comes to focus and *only* (and its translations in any natural language), because *only* is maybe the best known focus-sensitive operator (see Rooth (1992a) a.o.).

(14) *I asked how John [didn't behave].

(15) a. *Ptal jsem se, jak se Karel nechoval.*
asked-I AUX REFL how REFL Karel not-behaved-he
'I asked how Karel didn't behave.' 1? 9 ✓

a' *Ptal jsem se, jak se nechoval Karel.*
asked-I AUX REFL how REFL not-behaved-he Karel
'I asked how Karel didn't behave.' 1* 1? 8 ✓

(16) a. *How did [few men think that you behaved]?
b. *How did [only John think that you behaved]?
c. *How did [you deny that you behaved]?

(17) a. *Jak si málo lidí myslelo, že ses choval?*
how REFL few people thought that REFL behaved-you
'How did few people think that you behaved?' 4* 4? 2 ✓

b. *Jak si pouze Petr myslel, že ses choval?*
how REFL only Petr thought that REFL behaved-you
'How did only Petr think thath you behaved?' 4? 6 ✓

c. *Jak jsi popřel, že ses choval?*
how AUX-you deny that REFL behaved-you
'How did you deny that you behaved?' 4* 1? 5 ✓

5.1.4 Presuppositional islands

This type of islands seems to be stable in English as well as in Czech. Presuppositional verbs like *accept* create islands for extraction of manner wh-words, see (18), unlike non-presuppositional verbs like *say* in (21). The same holds for Czech: *myslel* 'think' in (21-b) is totally acceptable with in-situ interpreted wh-words, unlike *přijmout* 'accept' in (19) and *zjistit* 'realize' in (20).

(18) a. *How did you accept that he behaved ?
b. *How did you realize that he behaved ?

(19) *Jak jsi přijal, že se choval?*
how AUX-you accept that REFL behaved
'How did you accept that he behaved?' 8* 1? 1 ✓

(20) *Jak jsi zjistil, že se choval?*
how AUX-you realize that REFL behaved
'How did you realize that he behaved?' 3* 1? 6 ✓

(21) a. How did you think that he behaved ?
b. *Jak jsi myslel, že se choval?*
how AUX-you thought that REFL behaved
'How did you think that he behaved?' 10 ✓

5.1.5 Extraposition islands

Another type of weak islands, extraposition islands seem to be again similar in English, see (22), as well as in Czech, see (23). And again discourse-linking repairs such islands, see (22-b) for English and (24) for Czech.

(22) a. *I wonder how tall it matters that Marcus is.
b. ?I wonder which opponent it matters that Marcus can beat.

(23) a. *Zajímalo by mě, jak vysoký je důležité, že Markus je?*
wonder AUX me how tall AUX-it matters that Markus is
'I wonder how tall it matters that Makus is?' 6* 3? 1 ✓
a' *Zajímalo by mě, jak vysoký je důležité, že je Markus?*
wonder AUX me how tall AUX-it matters that is Markus
'I wonder how tall it matters that Makus is?' 10*

(24) *Zajímalo by mě, kterého protivníka je důležité, že Markus porazí?*
wonder-it AUX me which opponent is important that Markus beats
'I wonder which opponent it matters that Markus will beat.' 1* 9 ✓

5.1.6 Comparative islands

This type of islands isn't created by wh-movement but it is similar to other discussed types because also here there is a syntactic dependency between the degree word and its place of origin (see Rullmann (1995) for detailed discussion). And again negation intervenes and leads to ungrammaticality here, see (25-a) and (25-b). Even if Czech data are not totally clear, it seems that people get some feeling of awkwardness even in this case, see (26-a) and (26-b).

(25) a. These people weigh more than Bill does(*n't).
b. Lou runs faster than Marcus can(*not) swim.

(26) a. *Tyhle lidi váží víc než Karel neváží.*
these people weigh more than Karel not-weigh
'These people weigh more than Karel doesn't weigh.' 3* 2? 5 ✓
b. *Karel běhá rychlejí než Marie nemůže plavat.*
Karel runs faster than Marie cannot-she swim
'Karel runs faster than Marie cannot swim.' 4* 3? 3 ✓

5.1.7 Interim summary

Even though the picture isn't totally clear and there is a lot of space for further empirical investigation, we can safely conclude that not only that negation is not a clear intervener in Czech, but it creates weak islands in English. Therefore I will focus on negative manner and degree questions in the rest of this chapter and will try to present an attempt of a theory of weak islands which will explain this cross-linguistic variation.

5.2 The data – zooming into negative manner and degree questions

Now I will shrink my attention to just two sub-types of negative islands discussed in the last section. As described shortly before, for English speakers **negative manner questions**, i.e. questions in which wh-phrase moves overtly over negation such as (27) – (29), sound distinctly odd. Theoretically speaking, if speakers (with big effort) try to understand such ungrammatical sentences, then they interpret the scope of wh-phrases differently from their positive counterpart (for example, as 'how come' questions or as subject-oriented adverbials). In other words, if it was possible to answer manner questions with speaker or subject-oriented adverbials as *frankly* or *intentionally*, then the negative manner questions would be acceptable. But because this is not an option for manner-questions, the negative manner questions are unacceptable. The effect persists irrespectively of whether the negative question is in the matrix or in an embedded clause.

(27) *How didn't John cook eggplant?

(28) *Do you know how John didn't behave at the party?

(29) *Do you know how Peter didn't come to Prague?

In contrast, a parallel structure in Czech is perceived as felicitous. (30) – (32), direct translations of (27) – (29) are acceptable for Czech speakers with the meaning paraphrasable as 'tell me, what was the manner in which the event wasn't carried out'. Such questions are the usual low-scope manner questions, not differing (in this respect) from their positive counterparts.

(30) *Víš, jak John nevařil lilek?*
know-you how John not-cooked eggplant
'Do you know how John didn't cook eggplant?'
(A possible answer: 'Well, you know John. He definitely didn't steam it because he hates steamed vegetables.')

(31) *Víš, jak se Petr nechoval na večírku?*
know-you how REFL Petr not-behaved on party
'Do you know how Petr didn't behave at the party?'
(A possible answer: 'Well, you know Petr. He definitely didn't throw chairs around or dance.')

(32) *Víš, jak Petr nepřijel do Prahy?*
know-you how Petr not-arrived to Prague
'Do you know how Petr didn't come to Prague?'
(A possible answer: 'Well, he definitely didn't drive because he hates the highway.')

Side-note on another type of negative wh-questions: the cross-linguistic contrast we observed in (27) – (29) vs. (30) – (32) arises only if we look at wh-phrases, that syntactically target high positions (presumably SpecCP) but semantically they want to be interpreted low in the tree (as VP adverbials). If the wh-phrase may be syntactically and semantically high, for example reason questions with wh-word *why*, neither English nor Czech displays the weak-island effects (Ko (2007), among others).

(33) Why didn't Peter come to the party?

(34) *Proč nepřišel Petr na večírek?*
why not-came Petr to party
'Why didn't Peter come to the party?'

Another sub-type of negative weak islands occurs with **negative degree questions**. The negative degree questions are theoretically ambiguous in a way parallel to their positive counterparts. For example, numerical NP *six dialogues* in (35), indicative sentence, can have either a wide or a narrow scope with respect to negation – both readings are formalized in LoP under (35). (35-a) is true if Peter read 30 out of 36 Plato's dialogues (situation in which (35-b) is false). (35-b) is true when Peter read less than 6 Plato's dialogues ($0 \ldots 5$). I discussed the issue of the interpretation of negated sentences with numerical NPs in the chapter 4.

(35) Peter didn't read six dialogues of Plato.

a. $\exists X[DIA\_OF\_PLATO(X) \wedge |X| = 6 \wedge \neg\exists e[READ(e) \wedge Ag(e) = Peter \wedge Th(e) = X]]$

b. $\neg\exists eX[READ(e) \wedge Ag(e) = Peter \wedge DIA\_OF\_PLATO(X) \wedge |X| = 6 \wedge Th(e) = X]$

Obenauer (1984/1985) notices (as first) this ambiguity even for questions and proposes that degree questions are systematically ambiguous, according to scope of degree wh-phrase – reading I, the wh-degree phrase is interpreted high (i.e., in the SpecCP) – in semantic terms, the negation has narrow scope, as in (35-a) . In the second reading, the indefinite part of the wh-phrase is interpreted low (i.e., at the VP level), in semantic terms the negation has the widest scope as in (35-b).

English negative degree islands show themselves in a more subtle way than negative manner islands. A question like (36) isn't grammatical, but it lacks one of the interpretations possible for its indicative counterpart. This has a consequence for the range of possible answers to such questions. So if you know that John, expert in Plato, read 30 out of Plato's 36 dialogues, you can answer a question like (36) only with (36-a), never with (36-b). Crucially, (36-b) would be an answer to negation scoping over the degree word in (36). So again we detect the same pattern as with negative manner questions: English blocks the wide scope of negation in negative degree questions.

(36) How many dialogues of Plato did John not read?

a. 6

b. #31 (≈ no felicitous answer)

In contrast, Czech under the same scenario allows for both scopes, the question like (37) allows both answers in (37-a) and (37-b).

(37) *Kolik* *Platonových dialogů* *John nepřečetl?*
how-many Plato's dialogues John not-read
'How many dialogues of Plato did John not read?'

a. 6

b. 31 (or 32, 33, ...)

Interestingly, in Czech negative concord questions (triggered, for instance, by a negative phrase in the subject position), speakers strongly prefer reading II, i.e., the so-called weak-island reading in English:

(38) *Kolik* *Platonových dialogů* *nikdo* *nepřečetl?*
how-many Plato's dialogues nobody not-read
'How many dialogues of Plato did nobody read?'

a. #6 (≈ no felicitous answer)

b. 31

The arising pattern we do get from the two negative island data discussed in the current section is a restriction on the scope of wh-phrases with respect to negation.The restriction is operative in English, in Czech it's not. Notice, that if the event-related adverbials have to be interpreted under the existential closure of the event variable (and hence under the scope of negation), as argued by Landman (2000) among others, the semantic anomaly of English negative manner questions isn't that surprising. The high-scope reading for manner questions like (39-a) would lead to answers like (39-b). But because such answers are ungrammatical, the English negative manner questions are ungrammatical as well.

(39) a. How did John cook the eggplant?
b. #Frankly.

The restriction on scope can be summarized as in the table (40). The crucial questions seems to be now: what is the reason of English ban on wh-degree and manner phrases in the scope of negation? And why this restriction isn't operative in Czech?

(40) Summary of the available scopes in Czech and English

	High scope	Low scope
English manner	*	*
Czech manner	*	OK
English degree	OK	*
Czech degree	OK	OK

5.3 Intervention effects

As I stated at the beginning of the current chapter, the analysis of weak islands is done in many flavours (Szabolcsi and Zwarts (1993), Rullmann (1995), Fox and Hackl (2006), Abrusán (2007) among others). What I attempt to do here, is to subsume the weak islands under intervention effects in the style most recently discussed in Beck (2006), for the other references see Beck (2006), Beck and Kim (2006) and Beck (1996). Intervention effects in English wh-questions are examples like (41) ((Beck and Kim, 2006, ex. 24) attributed to D. Pesetsky). Negation in (41-a) and *only* in (41-b) together with the wh-phrase *which student* and *which girl* respectively causes unacceptability of the wh-questions. Notice that violations of superiority are otherwise harmful as both (42-a) and (42-b) demonstrate. The problem we see here is extraordinarily close to negative manner and degree islands discussed in the previous sections: intervention effects as well as negative manner and degree islands exhibit the same pattern: interpretation of wh-words in situ is blocked by interveners like negation or focus sensitive operators like *only*.

(41) a. ?*Which book didn't which student read _?
b. ?*Which boy did only Mary introduce which girl to _?

(42) a. Which book did which student read _?
b. Which boy did Mary introduce which girl to _?

So let's assume that (43) (intervention effect) and (44) (weak-island) share the same source of their ungrammaticality; I will examine the similarity in the current section.

(43) German (Beck 2006):

a. **Wen hat niemand wo gesehen?*
whom has **nobody where** seen
'Where did nobody see whom?'

b. *Wen hat Luise wo gesehen?*
whom has **Luise where** seen
'Where did Luise see whom?'

c. *Wen hat wo niemand gesehen?*
whom has **where nobody** seen
'Where did nobody see whom?'

(44) *How are you wondering [whether to behave]?

The basic idea of the reduction of weak islands to intervention effects is the following: manner and degree islands arise because *wh*-word needs to be interpreted low but in such a position it is subject to intervention effect caused by negation. Let's now introduce basic theoretical assumptions of the intervention effects framework: first, a sentence with a focused element associated with two semantic objects – the ordinary semantic value (a proposition) and a focus semantic value (a set of alternative propositions). Let's demonstrate the framework step by step on a simple sentence like (45). Its ordinary semantic value is in (45-a) and its focus semantic value is in (45-b).

(45) John$_F$ left.

a. ordinary semantic value: proposition (set of possible worlds) – {John left}
b. focus semantic value: set of propositions – {that John left, that Bill left, that Amelie left ...}

According to Beck (2006) wh-words don't have any ordinary semantic value and this is inherited in the composition of their sentences. Consequently, a wh-question is associated only with a set of alternatives:

(46) Who left?

a. ordinary semantic value: undefined
b. focus semantic value: set of propositions – {that John left, that Bill left, that Amelie left ...}

But question operator Q, defined as in (52-a) and (52-b) copies the focus value into the ordinary semantic value and the question has the ordinary denotation of the set alternatives, as demonstrated in (47).

(47) [Q_1 [who$_1$ left]]

a. ordinary semantic value: $\lambda p \exists x[p = \lambda w.x \text{ left in } w]$
b. focus semantic value: undefined

But what happens if some focus sensitive operator stands between the question operator Q and the wh-phrase? The ungrammaticality arises and Beck calls this configuration intervention effect. A nice illustration of the intervention effect is Korean, exemplified in (48), because in Korean as in in situ wh-language, the wh-words are by default not moved to the left periphery of the sentence. But if a focus sensitive operator like *only* intevenes between the wh-in situ and the Q operator, the sentence becomes ungrammatical, as in (48-a). The ungrammaticality is saved either by removing the focus-sensitive operator, as in (48-b) or by the overt movement of the wh-word across the intervener, as in (48-c). The general pattern of the intervention effect is then stated in (49-a) and (49-b). Intervention effects are not so well detectable in Indoeuropean languages, because these languages don't leave the wh-words in situ, so the intervention effects are ameliorated by the overt movement, as in Korean (48-c).

(48) Korean (Beck 2006):

a. **Minsu-man nuku-lûl po-ass-ni?*
Minsu-only who-Acc see-Past-Q
'Who did only Minsu see?'

b. *Minsu-nun nuku-lûl po-ass-ni?*
Minsu-Top who-acc see-Past-Q
'Who did Minsu see?'

c. *nuku-lûl Minsu-man po-ass-ni?*
who-Acc Minsu-only see-Past-Q
'Who did only Minsu see?'

(49) a. A quantificational or focusing element may not intervene between a wh-phrase and its licensing complementizer.

b. *[Q_i [... [intervener [... wh-phrase$_i$ ...]]]]

Let's now look at the intervention effects in a more formal way: the general structure of intervention effects is like (50-a), a prototype of an intervention effect in (50-b). The syntactic projection IP_1 contains the wh-phrase *who*, whose semantic value is undefined. Rooth's $\sim$ operator evaluates all foci in IP_1, namely $John_{F1}$ but also focus value of *wh*-phrase *who* (which is assumed to be just Hamblin set denoted by the pronoun *who*, e.g. set of individuals in the universe of discourse). The evaluation of $\sim$ proceeds according to the definitions in (51-a) and (51-b). Crucially, as the ordinary semantic value of IP_1 is undefined, $[\![_{IP2} \sim C\phi]\!]^o$ remains undefined as well according to (51-a). $[\![_{IP2} \sim C\phi]\!]^f$ is also (equally) undefined, because it contains just singleton ordinary semantic value of IP_1. The focus semantic value of IP_3 becomes argument of the question operator Q, as defined in (52-a) and (52-b), but because it inherits undefined focus and ordinary semantic values, the whole question is uninterpretable.

(50) a. Only JOHN invited who?

b. $[_{CP} Q_2\ [_{IP3}\ only_C\ [_{IP2} \sim C\ [_{IP1}\ John_{F1}\ saw\ who_2]]]]$

(51) a. $[\![\sim C\phi]\!]^o = [\![\phi]\!]^o if [\![C]\!]^o \subseteq [\![\phi]\!]^f$, undefined otherwise.

b. $[\![\sim C]\!]^f = \{[\![\sim C\phi]\!]^o\}$

(52) a. $[\![Q\phi]\!]^o = [\![\phi]\!]^f$
b. $[\![Q]\!]^f = \{[\![Q\phi]\!]^o\}$

Let's apply the same reasoning to weak islands like (53-a) and (53-b) with the structures in (53-c) and (53-d). The low scope of manner and degree wh-words is forced by the low scope of event modifying adverbs and collective interpretation of the predicate in (53-b) and (53-c) respectively (see Landman (2000)). This is the reason why an individual question like (54) is grammatical and doesn't elicit intervention effect – here *who* allows high scope interpretation, leaving a variable in the scope of $\sim$ operator, so no intervention effect arises, as the variable is interpreted as a variable bound by the wh-phrase interpreted with high scope and such variable has well-defined ordinary semantics.

(53) a. *How didn't John behave at the party?
b. *How many men don't make up football team?
c. $[_{CP}Q_2[_{IP3}\neg_C[_{IP2}\sim C[_{IP1}$ John behaved at the party how$_2$]]]]
d. $[_{CP}Q_2[_{IP3}\neg_C[_{IP2}\sim C[_{IP1}$ How many men$_2$ make up football team]]]]

(54) Who didn't come to the party?

But for manners, such as in (53-a), this high scope is unavailable because manners of events must scope below the existential closure of the event variable which syntactically corresponds to the T head. Compare the LoP of (55-a) in (55-b). So for manners the high scope interpretation comparable with (54) is unavailable. As for degrees like in (53-b), the high scope is out as well, because the scope higher then the existential closure of the event variable would lead to the distributive reading (as discussed in the chapter 1), which is incompatible with the collective semantics of the predicate *make up the football team*. In cases like (56), the low scope of the degree is ungrammatical in English but the sentence is acceptable because there is the high scope reading of the degree word, which is the distributive reading: the question asks for the plurality of Plato's dialogues such that the hearer didn't read any of them (the atoms of the plurality).

(55) a. John behaved nicely.
b. $\exists e[Ag(e) = JOHN \wedge BEHAVE(e) \wedge NICELY(e)]$

(56) How many dialogues of Plato did you not read?

What about Czech? Recall that Czech negative manner and degree questions are grammatical (the examples discussed in the section 5.2 are repeated here as (57) and (58)). My working hypothesis builds on the following empirical fact: Czech and English wh-words differ as to their intonation, generally Slavic wh-words are classified as focused elements, which is discussed extensively in the syntactic literature (see Bošković (1999) and many subsequent works). This focus marking of Slavic wh-words is used to explain the difference between Slavic wh-movement and English wh-movement, where Slavic wh-phrases are known to move all to the left periphery of the sentence and at least in th clause-bounded version of wh-movement they freely violate superiority (again see Bošković (1999) for further details).

(57) *Víš, jak John nevařil lilek?*
know-you how John not-cooked eggplant
'Do you know how John didn't cook eggplant?'
(A possible answer: 'Well, you know John. He definitely didn't steam it because he hates steamed vegetables.')

(58) *Kolik Platonových dialogů John nepřečetl?*
how-many Plato's dialogues John not-read
'How many dialogues of Plato did John not read?'
a. 6
b. 31 (or 32, 33, ...)

Let's interpret this obligatory focus on Slavic wh-words as a signal of contrastive focus and assume that unlike in English, Czech negation associates with the focus value of the wh-words and computes well-defined ordinary semantic value. Then the computation of both ordinary semantic value focus semantic value continues up to Q and no intervention effect arises. The details and proper formalization of this idea must wait for further work but let's examine further positive consequences of such idea.

5.3.1 Consequences of the reduction of weak islands to the intervention effects

In the literature it is discussed (see Rullmann (1995), Abrusán (2007) a.o.) that discourse linking rescues weak islands, this holds in English, see (59-a) vs. (60-a) as well as in Czech, see (59-b) vs. (60-b):

(59) a. ???Who are you wondering whether to invite? English
b???*Koho pochybuješ, jestli (máme) pozvat?*
who wonder-you whether (should-we) invite
'Who do you wonder whether to invite?' Czech

(60) a. Which student are you wondering whether to invite? English
b. *Kterého studenta pochybuješ, jestli (máme) pozvat?*
which student wonder-you whether (should-we) inivte?
'Which student do you wonder whether to invite?' Czech

This is compatible with the current reasoning in that I assume that wh-islands are instances of Beck's intervention effect. Why? Because the non-d-linked wh-word cannot be reset to its ordinary semantic value, in contrast, the d-linked wh-word since it is not a simple variable can be bound by some form of an existential closure of choice function (see Beck (2006, p. 28–29)). The existential closure of choice function allows the interpretation of wh-phrase in situ avoiding the intervention effect – the Q operator isn't needed for integrating the focus value and the ordinary value.

But it is not the case that d-linking is the reason of manner/degree obviation of weak islands in Czech: look at (61) where the manner wh-item causes ungrammaticality. It shows that the Czech counterpart of *how* is not a d-linked item as such: if it was, it

should behave like (60) and the sentence like (61) should be grammatical, which isn't the case, the point discussed already at the beginning of the current chapter.

(61) **Jak pochybuješ, jestli se (máš) chovat?*
how wonder-you whether REFL (should) behave
'*How are you wondering whether to behave?'

Czech manner islands of the tenseless wh-question type like (61) are ungrammatical unlike the negative manner islands, because Czech negation unlike the wh-question associates with the focus on the manner wh-word, so the derivation of truth-conditions after the negation applies to the logical form is well-defined, as discussed in the last section. But in (61) there is no association with focus on the manner wh-word, it has to be interpreted low, because of the semantics of manner, but here it is subject to intervention effect – schematically we obtain the classical intervention effect configuration formalized in (62): Q_j is the embedded question Q operator in SpecCP, the embedded complementizer *whether* is in the C head of the embedded projection; the root question operator Q_i would copy the focus semantic value of its sister node into the ordinary semantic value, but there isn't any, because the embedded Q_j resets the focus semantic value of its sister node and the undefined focus/ordinary semantic value is passed up the tree leading to uninterpretability caused by the intervention effect.

(62) *[Q_i [... [Q_j whether [... wh-phrase$_i$ ...]]]]

The prediction of the reduction of the weak islands to intervention effects is clear: when the weak island is caused by an element which associates with focus and in a particular language, the element associates with the focus on the wh-word, then the weak island should disappear, because no intervention effect arises. This prediction is verified with respect to Czech focus sensitive operator *pouze* 'only', see (63), which is (again unlike in English) grammatical: since *pouze* associates with focus, we get our familiar focus operator associated with the focus on the wh-word structure in (63). In other words, a structure with a focus sensitive particle behaves in Czech exactly as a structure with an intervening negation, the reason being that we can have an additional focus marking on the wh-word, which is lacking in English. So even if there is an intervener in (63), the focus sensitive operator, it doesn't cause intervention effect, because it associates with the focus on the wh-word and unlike in English, it passes up well defined ordinary semantic value which becomes the argument of the question Q operator.

(63) *Jak si pouze Petr myslel, že ses choval?*
how REFL only Petr though that REFL behaved-you
'*How did only Petr think that you behaved?'

The situation changes when we plug in other interveners of the downward entailing type or the presuppositional type e.g., see (64) and (65). As none of them associates with focus, they cannot work with the focus semantic value on the manner wh-word, so no comparable lift of intervention effect which we detected in (63) is available. But there is a real problem which we face here as well as Beck herself as far as I can see – because

we observe ungrammaticality with items which don't associate with focus (at least not in the manner of *only*), so it's not totally clear whether the intervention effects should be blamed for this. But because Beck argues for the intervention effects even in cases of quantifiers not usually associated with focus, like *always* (see her discussion on pages 24 and further in Beck (2006)), I stick to the intervention effect explanation even here and will postpone the discussion of this issue for further work again (see Beaver and Clark (2003) for a very different opinion).

(64) **Jak si málo lidí myslelo, že ses choval?*
how REFL few people thought that REFL behaved-you
'*How did few men think that you behaved?'

(65) *???Jak jsi popřel, že ses choval?*
how AUX-you deny that REFL behaved-you
'*How did you deny that you behaved?'

5.4 Aspect and weak islands

As I discussed in the previous sections, negative manner and degree islands are grammatical in Czech and the variation between Czech and English follows from the reduction of weak islands to intervention effects. But if we look at the data more carefully, the pattern is more complicated: the dissapearance of weak islands in Czech happens only if the main verb occurs in an the imperfective aspect. This is demonstrated with the data in (66) and (67). This tendency holds irrespective of whether the imperfective verb is primary (66) or secondary imperfective (67).

(66) a. *Jak Petr nepsal článek?*
how Petr not-wrote-imperf article
'How didn't Petr write the article?'

b. **Jak Petr nenapsal článek?*
how Petr not-wrote-perf article
'How didn't Petr write the article?'

c. *Poučoval nás o tom, jak nepsat článek.*
lectured-he us about that how not-write-imperf article
'He lectured us how not to write an article.'

d. **Poučoval nás o tom, jak nenapsat článek.*
lectured-he us about that how not-write-perf article
'He lectured us how not to write an article.'

(67) a. *Jak Petr neopravoval kolo?*
how Petr not-repaired-imperf bike
'How didn't Petr repair the bike?'

b. **Jak Petr neopravil kolo?*
how Petr not-repaired-perf bike
'How didn't Petr repair the bike?'

c. *Poučoval nás o tom, jak neopravovat kolo.*
lectured-he us about that how not-repair-imperf bike
'He lectured us how to not repair a bike.'

d. **Poučoval nás o tom, jak neopravit kolo.*
lectured-he us about that how not-repair-perf bike
'He lectured us how to not repair a bike.'

The data in (66) and (67) were collected through a small empirical survey (10 native speakers of Czech judged their acceptability), so I feel confident to postulate a first empirical generalization in (68). The generalization simply states the relationship between imperfective aspect and dissapearance of weak islands in Czech. The goal of this section is to explain this generalization. I will do so in the usual way – first I will collect all the formal tools I will need, in concreto formal semantics of questions, theory of exhaustivity in questions and last, formal theory of aspect which is compatible with the plurality framework adopted in this book. Second I will explain, how the combination of these independently motivated tools can be used to explain the puzzling generalization in (68).

(68) Negative manner and degree islands in Czech can be rescued only by imperfective verbs. Perfective verbs elicit the weak islands, as observed in Germanic languages.

5.4.1 Semantics of questions

The first ingredient I need is a semantics for questions. I will sketch the approach which goes back to Karttunen (1977) but with some modifications building on the insights of Rullmann (1995) and Beck and Rullmann (1999). The intuition behind the Kartttunen's framework is that the meaning of a question is the set of true answers to the question. For yes/no questions it would be a two-member-set – the indicative version of the question and its negation. For wh-questions, which are the main topic of this chapter, it is again the set of true answers (propositions). Question like (69-a) has the Karttunen meaning in (69-b). More generally, as in (69-c), the formal semantics of questions is the function from propositions (λp) which assings each proposition p truth or falsehood depending on whether the proposition p (in the actual world ($p(w)$) assigns a person x the property of being the American president in the 90s. Such semantics gives us (in the actual world) the set (69-b), because propositions like {It is raining, Ronald Reagan was the president of USA in 90s} don't have the appropriate form or they are false respectivelly.

(69) a. Who were the presidents of the USA in the 90s?

b. {George W. Bush was the president of the USA in the 90s, Bill Clinton was the president of the USA in the 90s}

c. $\lambda p \exists x[person(w)(x) \wedge p(w) \wedge p = \lambda w'$[x was the president of USA in the 90s in w']]

The Karttunen semantics for questions is formalized through total functions, so the denotation of a question is the set of all true propositions denoting true answers to the

question. Because of that set like {George W. Bush was the president of the USA in the 90s} wouldn't count as the proper meaning of the question (69-a) because it's not the set of all true answers. This effect of maximality is particullary well operative in the case of degree questions, as discussed in bigger detail in Rullmann (1995). Question like (70-a) has the Karttunen semantics in (70-b) – I assume the 'at least' semantics for numerical NPs, which is motivated by the one event – one semantic role methodology of Landman (2000) – sentence like *Two USA presidents were elected in the 90s* is true because the sentences *George W. Bush was elected as the president of the USA in the 90s* and *Bill Clinton was elected as the president of the USA in the 90s* are true. But (70-b), the Karttunen semantics for question (70-a), is far from intuitions we do get about the meaning of degree question like (70-a). Intuitively (70-a) is truthfully answered by a sentence like (70-c). Rullmann (1995) and Beck and Rullmann (1999) note this and diagnose the problem with Karttunen's semantics as the maximality requirement on the answer to degree questions. In other words: the speaker who utters (70-a) asks for the maximal number of USA presidents in the 90s and the answer like *One* would be considered false, even though the proposition that the USA had one president in the 90s is literally speaking true.

(70) a. How many presidents did the USA have in the 90s?
b. {The USA had 1 president in the 90s, The USA had 2 presidents in the 90s}
c. The USA had 2 presidents in the 90s.

Rullmann's way to formalize the maximality requirement for degree questions is to implement the maximality straight into the question denotation. (71-a) can then be semi-formally represented as (71-b) and the full Karttunen denotation is in (71-c). Intuitively, (71-a) asks for the greatest number of dialogues such that Plato wrote them. The answer 36 (as far as I know) is the true historical option and 1 ... 35 even though they are part of the Karttunen semantics of questions, they are discarded by the max operator.

(71) a. How many dialogues did Plato write?
b. ?n : n = max(λ n'[Plato wrote n' dialogues])
c. λp$\exists$ n[p(w) $\wedge$ p = λ w'[n = max(λ n'[Plato wrote n' dialogues in w'])]]

The definition o max operator from Rullmann (1995, p.55) is given in (72). Rullmann (1995) defends a view that maximalization, particularly the lack of it is the reason of ungrammaticality of questions like (73) because negation reverses ordering of degrees and max isn't defined, as there is no maximal degree for which it can be said that Peter doesn't weigh such a degree.

(72) Definition of the Maximality Operator *max*:
Let DEG be a set of degrees ordered by the relation $\leq$, then max(DEG)=ιd[d $\in$ DEG $\wedge$ $\forall$d' $\in$ DEG[d' $\leq$ d]]

(73) *How many kilograms doesn't Peter weigh?

Even though Rullmann's maximalization strategy works in many types of questions, it gives wrong predictions for questions like (74) (after (Beck and Rullmann, 1999, ex.13)). First, it's not clear whether such a question shouldn't be ungrammatical under Rullmann's assumptions (like (73)). But even if we granted some contextual restriction on the number of eggs which are used to bake cake, ι from the definition of max operator would pick up the largest element (let's say 100). Then the semantics for max-operator would produce an undesired interpretation, because (74) asks not for the maximal but for the minimal number of eggs sufficient for baking the cake.

(74) How many eggs are sufficient to bake this cake?

This is the main reason why Beck and Rullmann (1999) change the maximality requirement to a maximally informative constraint on the denotation of answer. They adopt the notion of maximally informative answer from Heim (1994), who calls it answer1, see (75). Q in (75) is the Karttunen intension and (75) basically outputs the conjunction of all true propositions in the question denotation.

(75) answer1(w)(Q) = $\cap${p: Q(w)(p) $\wedge$ p(w) }

Let's demonstrate the working of answer1. The easier case, the positive question, is in (76-a), its Karttunen semantics is in (76-b). Recall that for Landman each thematic role is defined only for one atom, from this it follows that sentence *Plato wrote 36 dialogues* logically implies that Plato wrote 35, 34, 33, ..., 1 dialogues. The conjunction of all true answers in (76-b) gives (76-c) – result of answer1 applied to (76-b) and also the maximally informative answer to (76-a).

(76) a. How many dialogues did Plato write?
b. {Plato wrote 1 dialogue, Plato wrote 2 dialogues, ..., Plato wrote 36 dialogues }
c. {Plato wrote 36 dialogues}

The same logic can be applied to examples like (77-a) (repeated example (74)). Its Karrtunen denotation is in (77-b) and the most informative answer in (77-c).

(77) a. How many eggs are sufficient to bake this cake?
b. {4 eggs are sufficient to bake this cake, 5 eggs are sufficient to bake this cake, ..., 100 eggs are sufficient to bake this cake, }
c. {4 eggs are sufficient to bake this cake}

Let's summarise: the Karttunen semantics for questions plus the exhaustive requirement is the tool I will need in the next section to explain why the negative degree and manner questions are (at least in English) unnacceptable and are subsumed under the weak islands phenomena.

5.4.2 Exhaustivity and negative degree and manner questions

Let's begin with the negative manner questions like (78-a). And let's consider the context where it's true that Peter repaired the bike carefully and slowly. Then its Karttunen set is semi-formally defined in (78-b). The result of answer1 would be (78-c) – the set of all manners such that Peter didn't repair the bike in those manners. Such set seems to be pretty big even though not necessarily infinite, because it would contain all manners in which the event was about to take place, but eventually it didn't. And as there is no ordering in the domain of manners, the result of answer1 applied to such set is again something hard to comprehend: conjunction of all manners in which the event wasn't realised, I think this is the explanation of negative manner islands in the spirit of Rullmann (1995) even though the realizations bears more from Beck and Rullmann (1999). Negative manner islands are ungrammatical from this point of view, because there is no maximally informative answer to them. This is in accordance with the intuitions of English native speakers who consider such quesitons more unanswerable than ungrammatical.

(78) a. How didn't Peter repair the bike?
b. ?m : m = max(λ m'[Peter didn't repair the bike in the manner m'])
c. {Peter didn't repair the bike quickly, Peter didn't repair the bike drunkenly, Peter didn't repair the bike impulsively, ...}
d. {Peter didn't repair the bike quickly $\wedge$ Peter didn't repair the bike drunkenly $\wedge$ Peter didn't repair the bike impulsively $\wedge$ ...}

As for the negative degree questions, the predictions of Beck and Rullmann (1999) are more surprising, as the authors themselves acknowledge. Consider their example (49) form page 266, repeated here as (79-a). Let's consider a context where the maximal number of questions answered by someone is 10, the Karttunen set assembeld by (79-b) will be (79-c) and the maximally informative asnwer will be (79-d). Beck and Rullmann (1999) then predict that negative degree questions should be grammatical under the reading (79-b). I think that this shows that some way of deriving intervention effects is unevitable at the end, otherwise we would lack any explanation of the negative degree island phenomena. In other words: negative degree questions do have a perfectly well-defined maximally informative answer, so the logic of the explanation which I used in the case of negative manner questions – they are unanswerable because the maximally informative answer would contain all manners which were not instantiated by the event – cannot apply here. But the ungrammaticality of negative degree questions is still explainable by the intervention effects: English degree wh-words do have only the focus semantic value and as the negative operator (carried by the negative NP *nobody* in (79)) stands between the question operator Q, the focus semantic value is reset, but the ordinary semantic value is still undefined, so ungrammaticality arises.

(79) a. How many questions did nobody answer?
b. ?n : n = max(λ n'[Nobody ansered n' questions])
c. {Nobody answered 11 questions, Nobody answered 12 questions, ...}

d. {Nobody answered 11 questions}

But if negative manner questions are ungrammatical because of the unaswerability of such questions and negative degree questions are ungrammatical because of the intervention effects, how come that Czech counterparts of English negative manner and degree questions are acceptable? I will consider the answer to this question in the next section but let's say that it will rely on the operation of getting-rid of maximality. Because as we saw in the case of negative manner questions, such questions are unanswerable, not ungrammatical, if we interpret them as asking for maximally informative answer. If we bypass the exhaustivity somehow, the questions should become answerable.

5.4.3 Perfective aspect as an exhaustive marker

5.4.3.1 Non-exhaustive operator answer3

Before I proceed with spelling my assumptions about aspect and its significance for Czech negative manner and degree questions; let me shortly introduce a counterpart of the exhaustive answer1 operator, its non-exhaustive version, answer3. Answer3 is introduced by Beck and Rullmann (1999) because of examples like (80-a) and (80-b) – their examples (77) and (90).

(80) a. John knows where you can buy New York Times.
b. Who for example was at the party last night?

These examples intuitivelly don't ask for maximal set of places or maximal set of individuals. Instead any true answer to them would be appropriate. These intuitions are formalized with answer3, see (81), which is the set of all those sets of propositions that contain at least one true Karttunen denotation from the set of all answers.

(81) $\text{answer3}(w)(Q) = \lambda P[\exists p[P(w)(p) \wedge Q(w)(p) \wedge p(w)]]$

To give a concrete example, (80-b) repeated as (82-a) would, in a context where John and Mary were at the party last night and nobody else was, have Karttunen denotation in (82-b), answer1 applied to (82-b) is in (82-c), answer3 applied to (82-b) is in (82-d). The distinction between the output of answer1 and answer3 is twofold: answer1 outputs the maximal and unique element of the Karttunen set, in other words, one element (even if the element is composed of nearly infinite conjunction of atomic elements); answer3 gives out set of sets, where each set in the set of sets contains at least one true answer, so the type of the answer3 is set, not individual proposition, namely set of sets of propositions.

(82) a. Who was at the party last night?
b. {John was at the party last night, Mary was at the party last night}
c. {John was at the party last night $\wedge$ Mary was at the party last night} answer1
d. {{John was at the party last night}, {Mary was at the party last night}, {John was at the party last night $\wedge$ Mary was at the party last night}}

answer1

Beck and Rullmann (1999) discuss what force which operator (answer1/answer3) in unembedded questions like (82). Their answer is pragmatic: when a speaker S asks a question Q, he wants to know a satisfactory answer to Q. In many cases this seems to be the most informative answer, in technical terms speaker S assumes that the answer is the result of the application of the operator answer1. In case of degree questions this seems to be most transparent: the question like *How old are you?* would be inappropriately answered by any number lesser than the real age of the speaker. Questions of course can contain explicit triggers of non-exhaustivity, words like *for example*, modal verbs and as I will suggest later, even grammatical triggers as the imperfective aspect in Czech. So questions like (80) explicitly trigger answer3 operator when they are answered.

Let me demonstrate the connection between the aspect and the exhaustive/non-exhaustive operators answer1/answer3. Even though the picture isn't totally clear to me and is blurred even more by the fact that morphological imperfective aspect in Slavic languages can be in some contexts interpreted with the perfective semantics (see von Stechow (2002)), I think that questions with perfective aspect generally ask for exhaustive answers, unlike questions with imperfective aspect, where both exhaustive and non-exhaustive answer is acceptable. Consider for instance a question like (83), where what is questioned is the incremental theme of the verb. (83-a) with the perfective verb *přečíst* 'to read' disallows exemplar answer, unlike (84-a) with the imperfective verb *číst* 'to be reading'. In theoretical terms: perfective aspect in a question enforces the exhaustive maximal answer (answer1 from Beck and Rullmann (1999)) unlike imperfective aspect which is at least compatible with the non-exhaustive answer (answer3) even though the exhaustive answer would be appropriate as well.

(83) a. *Koho jsi přečetl na střední škole?*
who AUX-you read-perf on high school
'Who did you read at high school?'
b. Kafku, Dostojevského, Foglara, ??# možná i další autory.
'Kafka, Dostoyevsky, Foglar, ??# maybe even other writers.'

(84) a. *Koho jsi četl na střední škole?*
who AUX-you read-imperf on high school
'Who did you read at high school?'
b. Kafku, Dostojevského, Foglara, možná i další autory.
'Kafka, Dostoyevsky, Foglar, maybe even other writers.'

In the next subsection I will introduce basic notions of telicity framework, building on the work of Filip and Rothstein (2006), Rothstein (2004) and Rothstein (2008), which will allow me to link aspect and exhaustivity formally.

5.4.3.2 Telicity and exhaustivity

The literature on aspectual composition is huge (for a recent survey see Filip (2012)) and even introducing basic concepts would lead me beyond the scope of my book. So I

will only pick up totally eclectically the concepts which I need to interpret the data I'm interested in. In doing so I hope to do as little harm to the theories of aspect as I can.

The case of English : aspectual literature since Vendler (1957) agree on one important fact shared by all types of formal frameworks dealing with aspect: the telicity of English sentences is compositional, so (85-a) reports finished and telic event, unlike (85-b) which can be true even in the situation where Mary bit into two sandwiches and she didn't eat anything else. The telicity of (85-a) is tested by the appropriateness of modification with time adjuncts of *in an hour* type. The atelicity of (85-b) is demonstrated with the modification by the durative adverbial of the *for an hour* type.

(85) a. Mary ate three sandwiches in an hour/*for an hour.
b. Mary ate sandwiches *in an hour/for an hour.

The source of the telicity/atelicity of (85) is clearly the difference between the object NPs – (85-a) contains the NP *three sandwiches*, (85-b) contains the NP *sandwiches*. (85-a) is telic, (85-b) is atelic, but with the exception of different NPs (and let's ignore the modifying time adjuncts) are both sentences identical. This empirical observation led to many theoretical explanations (Verkuyl (1993), Krifka (1989b) and many others, see again Filip (2012) for references). I will follow the line of event semantics pursued originally by Krifka (1989b) and extended further in the work of Filip (1999), Filip (2003), Filip (2005), Filip (2008), Filip and Rothstein (2006) and Rothstein (2004) among others. For concreteness sake let's follow the formalization in Filip and Rothstein (2006) and Rothstein (2008). They propose that telic events are maximal, formally they use the maximalization operator MAX_E, which maps set of events to their maximal event. Their formalization (Filip and Rothstein, 2006, def.2) is repeated here in (86).

(86) *The maximalization operator MAX_E* is a monadic operator, such that $\mathrm{MAX}_E(\Sigma) \subset \Sigma$. It maps sets of events, (partially) ordered by an ordering criterion for objects on a scale, onto sets of maximal events.

The definition (86) sanctions the application of MAX_E to such events which are (partially) ordered. That is the reason why MAX_E can be applied to the VP *eat three apples* but not to a VP like *eat apples*. The first VP contains the NP *three sandwiches* which provides the ordering criterion for events. For example, event e_1, an event of Mary eating first sandwich, event e_2, an event of Mary eating second sandwich, e_3 an event of Mary eating third sandwich, are ordered in the sense of subevents = events which develop one into the other: $e_1 \leq e_2 \leq e_3$. MAX_E singles out the largest unique event (e_3 in this case). The formal definition of stages from (Filip and Rothstein, 2006, def.5) building on Landman (2000) is in (87):

(87) If e_1 and e_2 are events and e_1 is a **stage** of e_2 ($e_1 \preceq e_2$) then:
a. *Part of*: $e_1 \leq e_2$, e_1 is part of e_2 (and hence $\tau(e_1) \subseteq \tau(e_2)$).
b. *Cross-temporal identity*: e_1 and e_2 share the same essence: they count intuitively as the same event or process at different time.

c. *Kinesis*: e_1 and e_2 are qualitatively distinguishable, e_1 is and earlier version of e_2, e_1 grows into e_2.

Let's formalize now the two English sentences (85-a) and (85-b). I follow Rothstein (2008) in taking telic sentences as reporting singular events, unlike atelic sentences reporting plural events. From Landman's requirement for one thematic role per one event then it follows that telic sentences must interpret the incremental themes as groups, not as sums. So (85-a) repeated here as (88-a) has the logical form in Language of plurality enhanced with the aspect information, as in (88-b).

(88) a. Mary ate three sandwiches in an hour.

b. $\exists x \exists e[EAT(e) \wedge Ag(e) = MARY \wedge Th(e) = x \wedge x =\uparrow y : y \in^* SANDWICHES \wedge |y| = 3 \wedge MEAS(e) =< 1, \lambda x \lambda e.EAT(e) \wedge Th(e) = x \wedge x =\uparrow y : y \in^* SANDWICHES \wedge |y| = 3 > \wedge MAX_E(e) \wedge \tau(e) \subseteq ONE\ HOUR]$

(88-b) says: there was an event e, with Agent Mary and Theme collective group atom ($\uparrow y$ from the plurality of sandwiches ($^*SANDWICHES$)). The cardinality of the atoms composing the group is three and the ordering of the events comes from the set of events of eating three sandwiches. The event e is maximal (MAX_E) and its time trace is lesser or equal to one hour. In this case the MAX_E operator can be applied as the NP *three sandwiches* contributes the ordering criterion for events.

The atelic sentence (85-b) repeated here as (89-a) is formalized in (89-b).

(89) a. Mary ate sandwiches for an hour.

b. $\exists x \exists e[^*EAT(e) \wedge^* Ag(e) = MARY \wedge^* Th(e) = x : x \in^* SANDWICHES \wedge \forall e'[EAT(e') \wedge e' \preceq e] \wedge \tau(e) \subseteq ONE\ HOUR]$

(89-b) says that there was a plural event e ($^*EAT(e)$) with plural agent Mary and plural Theme x ranging over sandwiches. The event e comprises of a non-specified number of subevents *e'*, where each $e' \preceq e$ (all e' are stages of e), and the time trace of the whole event e was smaller than one hour. As the bare plural *sandwiches* doesn't supply any ordering scale for events, subevents e' cannot be measure and the whole e is just a sum of all e' which cannot be maximalized and collectivized. The whole event e cannot be maximalized, so it is interpreted as a sum of its stages without any supremum (maximal element) and the sentence is atelic.

The case of Czech : the difference between Slavic and Germanic languages with respect to aspectual composition can be demonstrated on the following sentences in (90), translation of sentences (85-a) and (85-b). As we see from the contrast between (90-a)/(90-b) vs. (90-c)/(90-d), the decisive factor for the telicity/atelicity of the sentence is the grammatical aspect of the verb. Imperfective verbs in (90-a) and (90-b) produce atelic sentences according to the *in an hour/for an hour* test (I judge the sentences as reports of a single event, generic or ability readings blur the picture – see Dočekal and Kučerová (2009)). And perfective verbs in (90-c) and (90-d) give raise to

telic sentences.

(90) a. *Marie jedla tři sendviče hodinu/???za hodinu.*
Marie ate-imperf three sandwiches hour/in hour
'Marie ate three sandwiches for an hour/???in an hour.'
b. *Marie jedla sendviče hodinu/*za hodinu.*
Marie ate-imperf sandwiches hour/in hour
'Marie ate three sandwiches for an hour/*in an hour.'
c. *Marie snědla tři sendviče *hodinu/za hodinu.*
Marie ate-perf three sandwiches *hour/in hour
'Marie ate three sandwiches *for an hour/in an hour.'
d. *Marie snědla sendviče *hodinu/za hodinu.*
Marie ate-perf sandwiches *hour/in hour
'Marie ate three sandwiches *for an hour/in an hour.'

This happens irrespective of the nature of object NP – bare NPs like *sendviče* 'sandwiches' and numerical NPs *tři sendviče* 'three sandwiches' don't make any distinction. This behaviour of Slavic languages is known at least since Krifka (1992) and is studied in detail in many works by Hana Filip. I will again stick to the formalization in Filip and Rothstein (2006) where the distinction between Slavic and Germanic languages is spelled as a semantic parameter (91)– from (Filip and Rothstein, 2006, def. (1))

(91) *The semantic telicity parameter.* In Germanic languages, the maximalization operator MAX_E applies at the level of VP (or V') denotations. In Slavic languages, it applies at the level of V denotations.

The relationship between the telicity parameter and imperfective/perfective morphology in Slavic languages is straightforward: because MAX_E applies at V-level denotation of Slavic verbs, verbs already have the maximality (and in many cases also ordering) hardwired. In particular, perfective verbs are according to Filip and Rothstein (2006) atomic and imperfective verbs are pluralized (non-atomic). In this sense perfective Slavic verbs are like English achievements, which unlike accomplishments have the atomicity lexically encoded, so sentences like *Guests/help arrived in a few minutes* are grammatical and telic even though their only arguments are homogeneous: bare NPs and mass nouns.

Formalization of these assumptions, demonstrated for examples (91-b) and (91-c) is in (92) and (93) respectively.

(92) $\exists x \exists e[{}^*EAT(e) \wedge^* Ag(e) = MARY \wedge^* Th(e) = x : x \in^* SANDWICHES \wedge \forall e'[EAT(e') \wedge e' \preceq e] \wedge \tau(e) \subseteq ONE\ HOUR]$

(92), the formalization of atelic Czech sentence with an imperfective verb is: there is a plural event e (sum of events e'), there is no maximalization, but this time because the verbal root is non-atomic, not because the verb has the bare NP as its argument. So again, as in case of English sentences with the consumption verb *eat* and bare NP argument – there is no ordering criterion which would be used for the construction of the maximal element, therefore the sentence is interpreted as a sum of events which equals

atelic. The logical form for the perfective sentence is (93).

(93) $\exists x \exists e[EAT(e) \wedge Ag(e) = MARY \wedge Th(e) = x \wedge x =\uparrow y : y \in^* SANDWICHES \wedge MAX_E(e) \wedge \tau(e) \subseteq ONE\ HOUR]$

In (93) there is only singular event e (of eating) with theme x, which is a group atom composed of sandwiches ($\uparrow y$). Unlike in English there is no ordering relation, but as the verb already comes from the lexicon as maximalized (again on parallel with English achievements, where the verb like *die* already denotes the atomic event where entity changes its status from live to death), the MAX_E operator can be applied and the event denoted by the sentence is interpreted as maximal and telic. I will not go into details of the aspectual composition in Slavic, see Filip (1999) and all her subsequent work where she convincingly shows how different types of Slavic prefixes code different ordering relations (paradigm examples are the (acc)cumulative uses of the prefix *na-* and the attenuative use of the prefix *po-*). For my purposes it is sufficient to analyse, how perfective Slavic verbs force the maximal interpretation of the event and the incremental theme denotation. Consider again (93). The logical form for perfective sentences, as already Krifka (1992) noticed, the perfective verbs with incremental themes not only force the maximality of the event, they transfer this maximality also to the denotation of its object. So in a situation with three sandwiches, not any sub-group of three sandwiches would do as the interpretation of the numerical NP *three sandwiches* 'three sandwiches', but only the maximal group of three sandwiches. This is not reflected in the formalization so far, so lets correct it to (94).

(94) $\exists x \exists e[EAT(e) \wedge Ag(e) = MARY \wedge Th(e) = x \wedge x =\uparrow (\sigma(^*SANDWICHES)) \wedge MAX_E(e) \wedge \tau(e) \subseteq ONE\ HOUR]$

The difference between (93) and (94) lies in the usage of maximality operator σ which picks up the maximal sum of atoms, the $\uparrow$ operator makes groups atom from this and the group-atom becomes then the Theme of the event e. Generally: perfective verbs force the maximal interpretation of the denotation of their events, but this maximality is transfered (as homomorphism – see Krifka (1992)) to the maximal interpretation of their affected objects.

From type shifting perspective, the same process can be seen as the shift from the property type $\langle e, t\rangle$ (default interpretation of bare NPs like *sandwiches*) to the entity type: $\langle e\rangle$ type. Imperfective verbs can have both $\langle e, t\rangle$ and $\langle e\rangle$ type objects, but perfective verbs only have the $\langle e\rangle$ type objects.

5.4.3.3 Perfective aspect forces exhaustivity

After the lengthy excursus into the semantics of questions and into the semantics of aspect composition, let me repeat the main topic of the current chapter: why are Czech negative manner questions like (31) repeated here as (95) and Czech negative degree questions like (37) repeated here as (96) grammatical (for the degree questions like (96) let's interpret grammaticality in the sense of narrow scope interpretation of the degree

wh-word with respect to negation)? And why the same grammaticality isn't observed in English?

(95) *Víš, jak se Petr nechoval na večírku?*
know-you how REFL Petr not-behaved-imperf on party
'Do you know how Petr didn't behave at the party?'
(A possible answer: 'Well, you know Petr. He definitely didn't throw chairs around or dance.')

(96) *Kolik Platonových dialogů John nepřečetl?*
how-many Plato's dialogues John not-read-perf
'How many dialogues of Plato did John not read?'

The second part of the puzzle is: why imperfective verbs cause acceptability in negative manner questions like (95), but perfective verbs elicit ungrammaticality of such questions – see (97). But as for degree questions, aspect doesn't seem to play any role – (98) with the imperfective verb *nečíst* 'not-read' is no way worse or better than its perfective counterpart in (96).

(97) **Víš, jak se Petr nezachoval na večírku?*
know-you how REFL Petr not-behaved-perf on party
'Do you know how Petr didn't behave at the party?'

(98) *Kolik Platonových dialogů John nečetl?*
how-many Plato's dialogues John not-read-imperf
'How many dialogues of Plato did John not read?'

I suggested the answers to the two parts of the puzzle already but let me now systematically apply the introduced frameworks and explain in detail how everything works. First I will go into the relation between manner islands and aspect. Second I will explain why degree islands behave differently from manner islands with respect to aspect.

Manner islands and aspect : the main idea suggested in the previous sections is that perfective aspect, because it maximalizes the event, also (in case of the questions) forces the answer1 operator as the only possible operator which ranges over the propositions in the Karttunen denotation of the questions. Let's examine this idea carefully. Indicative sentences with perfective verb – like (99-a) – would have the event semantics in (99-b).

(99) a. *John neuvařil ten lilek pomalu.*
John not-cooked the eggplant slowly
'John didn't cook the eggplant slowly.'
b. $\exists x \neg \exists e[COOK(e) \wedge Ag(e) = JOHN \wedge Th(e) = x \wedge x =\uparrow (\sigma(EGGPLANT)) \wedge MAX_E(e) \wedge SLOWLY(e)]$

Let's assume that the existential presupposition associated with the demonstrative pronoun *ten* 'this/the' allows the object NP to scope the x variable over the negation of

the event variable. The whole maximal event is characterized by the manner SLOWLY in (99-b). The indicative sentence doesn't implicate that the event was realized by all other types of manners different from slowly, but this is because indicative sentences don't have exhaustivity as an integral part of their meaning (unless this is triggered by some grammatical means like focus sensitive particles of the *only* type or some sort of intonation). But what would be the Karttunen denotation of question like (100)? In Beck and Rullmann (1999) style such a question can be formalized as the maximal manner m which would be sum of all manners in which the event of cooking the eggplant wasn't realized – see (100-b). The answer to such a question should be maximally informative – we apply the operator answer1. But because manners are not ordered, this is simply the sum of all possible manners. That sum is a huge conjunction of all manners in the natural language (something like a set suggested in (100-c)).

(100) a. *Jak John neuvařil ten lilek?*
how John not-cooked the eggplant
'How didn't John cook the eggplant?'

b. ?m : m = max(λm'[John didn't cook the eggplant in the manner m'])

c. {John didn't cook the eggplant quickly ∧ John didn't cook the eggplant carefully ∧ ...}

Why we cannot use the non-exhaustive operator answer3, which would produce the set of all sets of propositions with at least one manner in which the event wasn't realized? Non-exhaustive answer to such a question is perfectly meaningful: tell me some of the manners which were not used during the cooking of the eggplant. Because the type of answer3 is $\langle\langle e,t\rangle,t\rangle$ – set of sets, but maximalization of the event (which is caused by the perfective verb) is incompatible with such a type. As in case of maximalization of the denotation of direct object (see the last section), the type of the answer must be entity/individual – $\langle e\rangle$ and only answer1 fits such a type. Why? Because the maximal entity is always one-member set: even if its sum of all the atoms and one-member-sets can be conceived as ordinary individuals (see Schwarzschild (1996)). I use the individual type $\langle e\rangle$ even in the case of question denotation, which is strictly speaking wrong, as the type of proposition isn't entity, but for easiness of reading and clearer way to state the parallel between the maximal interpretation of the perfective verb and the exhaustive interpretation of the questions with perfective verbs, let's simplify, because the real distinction is the distinction between the entity and the set, no matter whether the individual or the proposition.

As for the imperfective aspect in sentences like (95), repeated here as (101), because logical form of their aspectual composition doesn't contain the MAX_E operator (the verb is imperfective), the verb doesn't force the shifting of its argument into the $\langle e\rangle$ type. And also the question allows both maximal answers (sum of all manners) but also exemplar answers (mentioning some of the manners in which the event didn't take place). In the type shifting perspective: negative manner questions with imperfective verbs allow both maximal answers (entity/individual $\langle e\rangle$ type) but also exemplar answers (set of sets type $\langle\langle e,t\rangle,t\rangle$), it allows exhaustive (answer1) answer but also mention-some (answer3)

answers.

(101) *Víš, jak se Petr nechoval na večírku?*
know-you how REFL Petr not-behaved-imperf on party
'Do you know how Petr didn't behave at the party?'

Summary: negative manner questions in Czech are grammatical because the imperfective verb doesn't force the maximal informative answer as the only sensible continuation of the dialogue. Perfective verbs on the other hand force only the maximal answer which in case of unordered manners leads to the effect of unanswerability of such questions. This unanswerability I think is the real reason of the ungrammaticality of negative manner questions. As for English, my hypothesis is that because the simple past is interpreted as perfective (by default), the same problem arises here as with Czech perfective verbs. If this view is correct, we should expect that various changes of telicity/atelicity in English negative manner questions should repair the negative manner islands in the same way we observed in Czech. I will postpone verification of this prediction for the future work.

Degree islands and aspect : as for the degree questions like (96), repeated here as (102). The change of aspect doesn't make any difference in grammaticality because the degrees (numbers) are ordered, so even a perfective sentence like (102) can be appropriately answered by the maximally informative answer, which is just one degree on scale and because this degree is in logical relation to the other degrees, the unanswerability problem, which is the reason of unacceptability of negative manner questions with perfective verbs, doesn't arise here.

(102) *Kolik Platonových dialogů John nepřečetl?*
how-many Plato's dialogues John not-read-perf
'How many dialogues of Plato did John not read?'

The question: why negative degree questions are ungrammatical in English has already been discussed – the answer to this question follows from the intervention effects – the wh-phrase cannot carry its focus semantic value to the question operator in CP, because negation resetes the focus semantic value and because the ordinary semantic value of wh-words is undefined. This leads to undefined ordinary value of all constituents containing negation. This doesn't seem to happen in Czech, because focus on wh-word allows negation to assemble the ordinary semantic value of the wh-phrase from its focus semantic value. The ordinary semantic value is then passed to the question operator which gives out well-defined Karttunen denotation of the question.

5.5 Summary

The summary of the current chapter is the following idea: what was called negative weak islands before an independent phenomenon which has to be explained in a sui generis

manner (contra Szabolcsi and Zwarts (1993) and Abrusán (2007) among others). On the opposite: negative weak islands can be reduced to two sources: intervention effects and unanswerability (the effect of the expectation of an exhaustive answer).

English data are misleading for linguists who pursued the sui generis explanation, because in English both maximality (stemming from the default perfective interpretation of simple tenses) and intervention effects are not very well visible, so previously nobody attempted to reduce weak islands to any of them. But languages like Czech offer a window into a hopefully better explanation which classifies negative weak island as an epiphenomena of the two mentioned factors: manner weak islands reduce to exhaustivity, which we observed in connection with the imperfective aspect – as Czech imperfective aspect allows non-exhaustive answers, negative manner islands disappear if used with an imperfective verb.

The negative degree islands are different: they allow well defined exhaustive answers, so no matter of aspect, they should be grammatical, on the condition that the only factor is maximal informativeness. But the reason of their ungrammaticality in English are the intervention effects: the low scope interpretation of the degree wh-word is banned, as it would be impossible to connect the question operator Q in SpecCP with the focus semantic value of the wh-word (negation intervenes). This doesn't happen in Czech, because here the focus on the wh-word associates with negation and no intervention effect arises. The overall conclusion: not only we can reduce the weak islands to maximality and intervention effects but we should do that, otherwise we lack any linguistic description of the cross-linguistic variation of weak islands, as reported in the current chapter.

Summary

The starting point of the investigations in this book was the model-theoretic approach to negation in natural language, particularly the application of the Language of Events and Plurality to Czech negation. In this framework I examined four different areas of natural language where negation leads to non-trivial (and hence linguistically interesting) problems – especially when we attempt to explicitly model the compositional building of the truth-conditions of the whole sentences.

The four areas were: interpretation of morphological negation occurring on verb and/or on noun phrases simultaneously (Chapter 2), interpretation of apparent aspectual properties of negation (Chapter 3), prediction of the scope possibilities of negation and other quantified noun phrases in natural language – especially universal quantifiers (Chapter 4) and finally the cross-linguistic variation with respect to negative manner and degree questions ungrammaticality.

All these problems surely require more research by linguists and the certainty of my conclusions holds only relatively to the data I examined. Nevertheless, I think it's safe to conclude that the semantics of natural language negation corresponds to the truth-reverting function of formal logic. All the apparent counterexamples to such a claim can be explained away if we take into account syntactic agreement and the logical type of negation which lead to its interpretation at the appropriate place in the formula (which can be pretty far from its surface position in natural language). The alleged aspectual shifting properties of negation are simply reducible to its inference reversal property which makes the telic environments homogeneous. The mysterious wide scope interpretation of negation with respect to the universal quantifier follows from the competence between universal NPs and negative NPs, which (with the negation on verb caused by the negative concord in languages like Czech) express the opposite scope of negation and the universal quantifier more economically. And finally the negation as the source of negative manner and degree questions ungrammaticality in English results from the independent focus-related properties of English and their different distribution in Czech.

At a more general level, I tried to solve all empirical puzzles of Czech negation which I came across during my investigation in the most conservative manner (relative to the framework I have chosen) as I was able to do. All the complications were blamed on the independent parts of natural language. This is just one of the ways to go, which is clear from the alternative hypotheses I mentioned in the previous chapters. But it's the one which strikes me as the best because of its elegance and simplicity, as no additional machinery was postulated beyond the tools which were independently needed in other areas of the natural language semantics.

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