ON SYNTAX, ALTERNATIVE SEMANTICS, AND COMPUTATION IN COORDINATION

by

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ABSTRACT

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This dissertation tackles various puzzles at the syntax-semantics interface in coordination. The first question is whether different readings of natural language conjunction, such as coordinate and subordinate interpretations, can be deduced from a unifying syntax-semantics. I explore the behavior of both types of coordinate structures and attribute their distinct properties to the difference in syntactic representations. The new approach does not solve all puzzles, but it challenges the power of the standard semantics of conjunctions. This challenge is then addressed by the second research question.

The second question is what is the appropriate semantics for natural language conjunctions. The traditional semantic approach assumes natural language conjunctions to be logical operators. However, it fails to capture various meanings of conjunctions and their scopal properties, asking for an alternative approach. I propose that natural language conjunction is a set forming operator and conjoined structures denote the set whose members are Hamblin alternatives created by the conjuncts. The new approach provides a better explanation of scope ambiguities in coordination. I further address this type of ambiguity in the third research question.

The third question is how to implement a solution to the mapping problem from a computational point of view. The problem is that ambiguities in natural language create possible readings which can grow exponentially. Enumerating such readings is an onerous task. A much more efficient solution is to use underspecified semantic representations within a Minimalist Grammars formalism.

To my family.

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Chapter 1

INTRODUCTION

One of the well-known properties of natural languages is that there is no one-to-one mapping from meaning (semantics) to form (syntax). One meaning can be rendered by different sentences or a sentence can have different interpretations. In linguistic theory, the mapping problem is addressed at syntax-semantics interface. This dissertation tackles various puzzles at the syntax-semantics interface in coordination. In this chapter, I provide a brief background on coordination, lay out main research questions, and discuss how these questions are addressed in the chapters to follow.

There are two principal ways to view the syntax of coordination, sentential and phrasal. According to the sentential view, all coordination is sentential and phrasal coordination is derived from corresponding sentential coordination. For instance, the sentences in (1.2) are underlying structures for the sentences in (1.1).[1]

(1.1) a. John and Bill went to the store.
b. John ate cake and drank bear.
c. Bill is old and fat.
d. John talked to Bill and Fred.

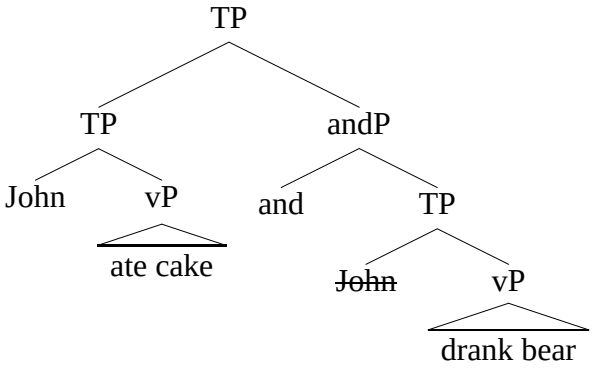
(1.2) a. John went to the store and Bill went to the store.
b. John ate cake and John drank bier.
c. Bill is old and Bill is fat.
d. John talked to Bill and John talked to Fred.

There are two main approaches within the sentential view of coordination. The first approach is the standard conjunction reduction approach (Chomsky, 1957; Gleitman, 1965; Ross, 1967; Wilder, 1994, 1997; Schwarz, 2000). According to this approach, phrasal coordination is derived from sentential coordination by deletion under identity or ellipsis of material. The second approach is the parallel or multi-dominance approach (Goodall, 1987; Muadz, 1991; Moltmann,

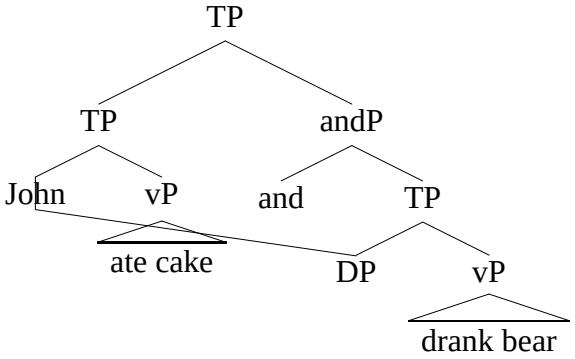
[1]The sentences in (1.1) and (1.2) come from Munn (1993).

1992; Wilder, 1999; Citko, 2000). According to this approach, the material is shared by more than one node. The tree structures in (1.3) show how coordination is treated within each of the approaches.

(1.3) a. Conjunction Reduction



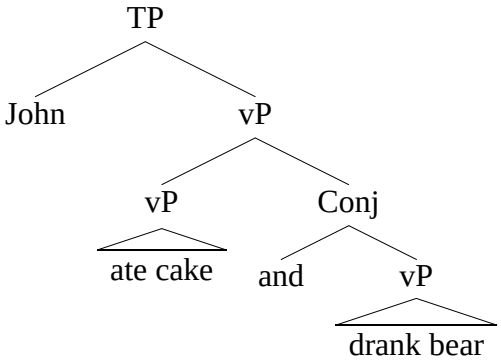
b. Multi-dominance



According to the phrasal view of coordination, phrases of any size can be coordinated (Gazdar, 1985; Sag et al., 1985; Munn, 1993). According to this view, the sentence in (1.4a) is a vP conjunction (1.4b).

(1.4) a. John ate cake and drank bear.

b.



The sentential approaches are consistent with the traditional approach to the meaning of natural

language conjunctions (Grice, 1975; Schmerling, 1975; Posner, 1980). This approach assumes that the semantics of a conjunction is equivalent to its logical counterpart. The natural language conjunction *and* is equivalent to the logical operator $\wedge$ and the natural language disjunction *or* is equivalent to the logical operator $\vee$ and the following statements hold (1.5). According to this approach, p and q are propositions and conjunctions operate on propositions.

(1.5) a. p and $q = p \wedge q$, which is true if and only if p is true and q is true.
b. p or $q = p \vee q$, which is true if and only if p is true or q is true.

A traditional problem for the sentential approaches and the standard logical semantics of conjunctions is presented by such sentences as (1.6).

(1.6) a. John and Bill met in the park.
b. *John met in the park and Bill met in the park.

The conjunction reduction approach fails because (1.6a) is not derived from a well-formed sentence (1.6b). The apparent interpretation of (1.6a) is the reading where two individuals *John* and *Bill* are conjoined. However, this reading is not predicted under the traditional logical semantics of conjunctions, which operates on propositions.

Sentences involving a quantificational subject create a similar problem for sentential approaches (Rooth and Partee, 1982).

(1.7) a. Someone fed the dog and hit it.
b. Someone fed the dog and someone hit it.

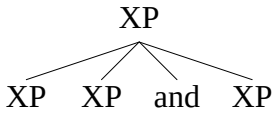
The sentence (1.7a) does not have the denotation of the sentential paraphrase (1.7b). If we assume that what is coordinated in (1.7a) is not sentences, then the problem for the standard logical semantics arises since whatever is coordinated in (1.7a) does not denote propositions.

In the dissertation, I defend the phrasal view to coordination. In particular, chapter 3 discusses gapping constructions in English and Russian. It shows that scope effects and binding facts are not predicted in the sentential view. It is argued that the phrasal view provides a better account for distribution of gapping data in both languages.

Before I proceed to how semantics of conjunctions can be treated within the phrasal view, I briefly discuss phrase structure research. There are two main approaches to deal with structural representation of coordination, symmetric and asymmetric.

Traditionally, most studies have assumed a flat or symmetric structural representation of coordination (Chomsky, 1965), as in (1.8).

(1.8)

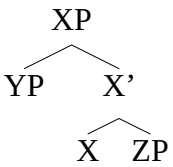


According to the traditional symmetric approach, coordinate structures are multiply headed, as in (1.9).

(1.9) John saw Mary and Peter and Harry and...

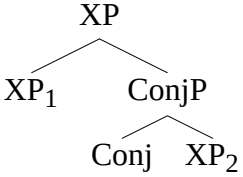
Later on, the X-bar theory of phrase structure was introduced (Jackendoff, 1977) and the traditional symmetric approach to coordination was abandoned. Under the X-bar theory, a phrase has to have a unique head and the representation has to be binary. According to the X-bar approach, coordination has received the tree representation in (1.10), where the first conjunct is a specifier and the second conjunct is a complement of the XP phrase (Kayne, 1994; Munn, 1987; Johannessen, 1998).

(1.10)



However, Munn (1993) provided three arguments (binding facts, across-the-board extraction, and unlike category coordination) against the structural representation in (1.10); instead he argued for the asymmetric adjunction approach. According to this approach, the conjunction and the second conjunct adjoin to the first conjunct, as schematized in (1.11).

(1.11)



According to the adjunction approach, XP is a projection of the first conjunct XP_1 and XP_1 dominates XP_2. The structure of coordination is asymmetric. In the dissertation, I adopt the adjunction approach to coordination. In particular, chapter 2 argues for an event control approach, according to which the event argument of the first conjunct dominates the event argument of the second conjunct. Such a relationship is only possible if the adjunction phrase structure of coordination is assumed.

Now, I discuss different ways to deal with semantics of conjunctions if a phrasal approach to coordination is assumed. The phrasal approach predicts that phrases of any type can be conjoined, not just sentences. There are then two principal ways to derive the semantics of conjunctions. One way is to assume that all conjunctions are propositional (cf. Schein, 1994). The generalized conjunction approach works in this way (Keenan and Faltz, 1978; Gazdar, 1980; Partee and Rooth, 2002). If conjoined phrases are not sentences, i.e. they are not of the type <t>, an operator (*join* $\sqcap$ for conjunction and *meet* $\sqcup$ for disjunction) generalizes over them recursively by lambda abstraction until they reach the type <t>. The generalized conjunction approach works if two conjoined phrases are of the same type. If the conjoined phrases are of unlike semantic category, coordination may need to be accounted for by type-shifting (Rooth and Partee, 1982; Partee and Rooth, 2002). For instance, in order to interpret the phrase *John and every woman*, we need to type-shift *John* from the individual *j* to the generalized quantifier λP[P(j)].

The other way assumes that all conjunctions are group-forming or of the type *e* (Krifka, 1990; Munn, 1993). The question is how the phrasal coordination in (1.12a) receives its sentential interpretation in (1.12b).

(1.12) a. John and Bill went to the store.
b. John went to the store and Bill went to the store.

According to Munn (1993), coordination should be treated as a plural and the sentential interpretation of coordination does not need to be explicitly represented in the syntax or semantics. He claims that the case with coordination can be viewed in parallel to the universally quantified sentence in (1.13).

(1.13) Every student in the class sat down.

In (1.13), *every student* picks out whatever students are in the class in the relevant domain of discourse as in (1.14).

(1.14) a. Patrick sat down.
b. Julie sat down.
c. Gus sat down.
d. Charlie sat down.

However, the sentences in (1.14) do not need to be present at any level of representation.

In this dissertation, a different semantic approach to conjunctions is proposed, a Hamblin semantics (Hamblin, 1973). According to this approach, conjunctions are not propositional or individual denoting; rather conjunctions are set-forming operators and conjoin Hamblin alternatives. The alternatives can be of different semantic types, including individuals, properties and propositions. The new semantic approach of coordination is developed in chapter 3.

Finally, it is important to briefly discuss the relationship between conjunction and disjunction. In syntax, conjunction and disjunction are usually treated in parallel. However, as noted by Rooth and Partee (1982), conjunction and disjunction differ with respect to their semantics, including scopal properties. It has been observed that disjunction behaves as a scope-bearing element, whereas conjunction does not show such behavior (Larson, 1985).

(1.15) a. Bill hopes that someone will hire a maid and a cook.
b. Bill hopes that someone will hire a maid or a cook.

In (1.15), only the disjunction sentence (1.15b) has a wide scope reading, which can be paraphrased with *. . . , but I don't know which*.

In English, conjunction and disjunction are associated with *both* and *either*, which Larson (1985); Higginbotham (1991); Munn (1993) treat as scope indicators. According to Higginbotham (1991), every disjunction is an *either*/*or* and *either* is like an indefinite *any*. Similarly, every conjunction is *both*/*and*, where *both* parallels *each* or *all*. In chapter 4, I discuss scope effects in

disjunction and provide an account within direct compositional semantics and Minimalist Grammars formalism.

The background on coordination I have provided in this chapter allows to formulate the following three research questions. The first question is whether different readings of natural language conjunction, such as coordinate and subordinate interpretations, can be deduced from a unifying syntax-semantics. I explore the behavior of both types of coordinate structures and attribute their distinct properties to the difference in syntactic representations. The new approach does not solve all puzzles, but it challenges the power of the standard semantics of conjunctions. This challenge is then addressed by the second research question.

The second question is what is the appropriate semantics for natural language conjunctions. The traditional semantic approach assumes natural language conjunctions to be logical operators. However, it fails to capture various meanings of conjunctions and their scopal properties, asking for an alternative approach. I propose that natural language conjunction is a set forming operator and conjoined structures denote the set whose members are Hamblin alternatives created by the conjuncts. The new approach provides a better explanation of scope ambiguities in coordination. I further address this type of ambiguity in the third research question.

The third question is how to implement a solution to the mapping problem from a computational point of view. The problem is that ambiguities in natural language create possible readings which can grow exponentially. Enumerating such readings is an onerous task. A much more efficient solution is to use underspecified semantic representations within a Minimalist Grammars formalism.

The dissertation is organized as follows. Chapter 1 provides a brief background on coordination and delimits the scope of the dissertation. Chapter 2 deals with symmetric and asymmetric coordination and their syntactic and semantic properties. The chapter states that there exists a dependency between syntactic properties of (a)symmetric coordination and the way the coordination is interpreted. I argue for an event control approach to (a)symmetric coordination and show that the approach provides better explanation for the data both in English and Russian.

Chapter 3 makes an argument for the alternative semantics (Hamblin, 1973) for conjunction. Recently, indeterminate phrases (Kratzer and Shimoyama, 2002; Shimoyama, 2006) and disjunction (Alonso-Ovalle, 2006; Hulsey, 2008) have been reanalyzed as operators introducing sets of Hamblin alternatives. The new approach helps to solve several otherwise puzzling facts about indeterminate phrases and disjunction. I adopt a Hamblin semantics and extend the approach to conjunction. I propose that natural language conjunction is a set forming operator and conjoined structures denote the set whose members are Hamblin alternatives created by the conjuncts. The new approach gives a natural explanation for the syntax-semantics of gapping constructions in English and Russian. It provides further evidence for Hamblin alternatives as an analytical tool and sheds light on the nature of existential closure by addressing why a logical possibility people do not normally attend to – that there might be closure operations with other quantificational force, such as universal – might actually be realized.

In chapter 4, I address scope ambiguity in coordination. I adopt a Minimalist Grammars formalism (Stabler, 1997; Stabler and Keenan, 2003; Kobele, 2006), which uses underspecification in semantic representations. I use the formalism to account for different readings in gapping constructions with disjunction embedded under a modal verb. I extend the coverage of the approach to other scope ambiguity cases in disjunction. Chapter 5 concludes and discusses future research questions.

Chapter 2

SYMMETRIC AND ASYMMETRIC COORDINATION

2.1 Introduction

This chapter deals with symmetric and asymmetric coordination and their syntactic and semantic properties. The chapter states that there exists a dependency between syntactic properties of (a)symmetric coordination and the way the coordination is interpreted. I argue for an event control approach to (a)symmetric coordination and show that the approach provides better explanation for the data both in English and Russian.

2.2 The phenomenon

Many researchers (Ross, 1967; Schmerling, 1975; Goldsmith, 1985; Lakoff, 1986; Culicover and Jackendoff, 1997) have pointed out that coordinate structures conjoined with natural language conjunction *and* can sometimes trigger subordinate interpretations such as (2.1).

(2.1) John drank the poison and died.
(= John drank the poison and as the result he died.)

In a subordinate interpretation there is some logical dependency between the conjuncts such that the event denoted by the second conjunct is understood as following the event of the first conjunct and the two conjuncts together describe a single situation. Coordinate structures that allow subordinate interpretations are sensitive to the change of the order of the conjuncts, as illustrated in (2.2).

(2.2) # John died and drank the poison.

The coordinate structure in (2.2) does not have the denotation of (2.1). I will call the coordination that allows a subordinate interpretation *asymmetric coordination*. Asymmetric coordination contrasts with *symmetric coordination* (Posner, 1980) in (2.3).

(2.3) Paris is the capital of France and Rome is the capital of Italy.

In symmetric coordination, there is no logical connection between the two conjuncts; rather, each of the conjuncts is treated independently. In symmetric coordination, switching the order of the conjuncts does not affect interpretation of the coordinate structure (2.4).

(2.4) Rome is the capital of Italy and Paris is the capital of France.

(2.4) has the same denotation as (2.3).

(A)symmetric coordination has been found in many typologically different languages, including Welsh (Sadler, 2006), Korean (Kwon, 2004), and German (Höhle, 1990). In the next subsections, I sample (a)symmetric coordination from a set of languages. I observe that there is a correlation between the syntactic properties of (a)symmetric coordination and whether the coordination is interpreted (a)symmetrically. I draw a preliminary generalization that in symmetric coordination each conjunct is finite that allows a coordination to have an independent or symmetric interpretation, whereas in asymmetric coordination the second conjunct[1] is non-finite and is dependent on a selecting category.

2.2.1 Welsh

(A)symmetric coordination has been found in Welsh.[2] One characteristic property of asymmetric coordination in Welsh is that only the verb of the first conjunct is marked for tense. The verbs of the second and any following conjuncts occur in the non-finite form (Sadler, 2006).

(2.5) a. **Trodd** John a **baglodd** ar y pafin.
turn.past.3sg John and stumble.past.3sg on the pavement
'John turned and stumbled on the pavement.'

b. **Trodd** John a **baglu** ar y pafin.
turn.past.3sg John and stumble on the pavement
'John turned and stumbled on the pavement.'

[1] In head final languages, such as Korean, it is the first conjunct that is tenseless.
[2] Welsh is a head initial language.

In (2.5a), both verbs are marked for tense and the sentence has a symmetric interpretation. On the other hand, (2.5b) is an asymmetric coordination, in which a finite verb occurs only in the first conjunct and the verb in the second conjunct is non-finite.

2.2.2 Korean

In Korean[3] (Kwon, 2004), in case only the final conjunct is marked for tense, the sentence renders an asymmetric interpretation (2.6a). If a tense morpheme appears in both conjuncts, the sentence is forced to have a symmetric interpretation, thus (2.6b) is infelicitous.

(2.6) a. Payksel kongcwu-ka sakwa-lul mek-ko cwuk-**ess**-ta
white-snow princess.nom apple.acc eat-ko die.past.decl
'Princess Snow White ate an apple and died.'

b. #Payksel kongcwu-ka sakwa-lul mek-**ess**-ko cwuk-**ess**-ta
white-snow princess.nom apple.acc eat.past-ko die.past.decl
'Princess Snow White ate an apple and she died.'

Korean confirms to the generalization that in asymmetric coordination the 'dependent' conjunct is non-finite, whereas in symmetric coordination each conjunct is finite.

2.2.3 German

(A)symmetric coordination can be found in German. Höhle (1990) first observed that some coordinate structures in German do not comply with standard assumptions about coordination. Whereas symmetric coordination has a symmetric interpretation[4] and standard word order[5] in each conjunct, asymmetric coordination does not follow the general rule. In asymmetric coordination in non-initial conjuncts the finite verb is fronted and a coordinate structure receives a 'one-event' interpretation (Reich, 2007).

[3]Korean is a head final language.

[4]Under symmetric interpretation I assume the reading, in which each of the conjuncts is interpreted independently.

[5]A standard word order in German corresponds to V-fronted in root clauses and V-final in complement clauses.

In the sentences below (2.7), coordination is embedded within the scope of the complementizer *wenn*. The expected word order is V-final and V-final, but only the sentence in (2.7a) complies with the requirement. The sentence in (2.7b) conjoining V-final and V-fronted is an asymmetric coordination.[6]

(2.7) a. wenn jemand nach Hause kommt und da der Gerichtsvollzieher vor der Tür steht
wenn someone to home comes and there the bailiff at the door stands
'If someone comes home and the bailiff is standing at the door…'

b. wenn jemand nach Hause kommt und da steht der Gerichtsvollzieher vor der Tür
wenn someone to home comes and there stands the bailiff at the door
'If someone comes home and the bailiff is standing at the door…'

According to the remnant movement approach (Hallman, 2004), the sentences in (2.7) conjoin two FinP phrases embedded under the complementizer *wenn*. The complementizer checks the categorial feature [+IP], triggering IP raising to a local position of FinP – SpecFinP.[7] The result is a symmetric coordination (2.8).

[6]Another instance of asymmetric coordination is the so called Subject Lacking in F-structure or SLF-coordination (Höhle, 1983), which shows similar distribution as asymmetric coordination.

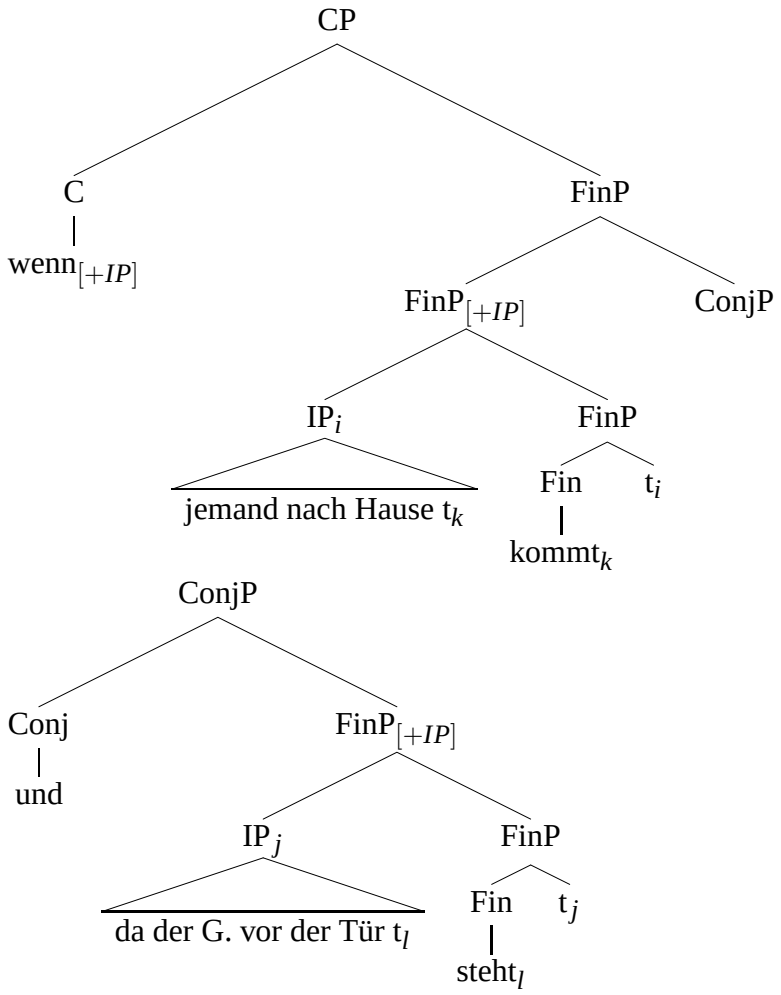
(2.1) a. wenn jemand nach Hause kommt und den Gerichtsvollzieher vor der Tür sieht
wenn someone to home comes and the bailiff at the door sees
'If someone comes home and sees the bailiff at the door…'

b. wenn jemand nach Hause kommt und sieht den Gerichtsvollzieher vor der Tür
wenn someone to home comes and sees the bailiff at the door
'If someone comes home and sees the bailiff at the door…'

I assume that SLF-coordination is a special case of asymmetric coordination.

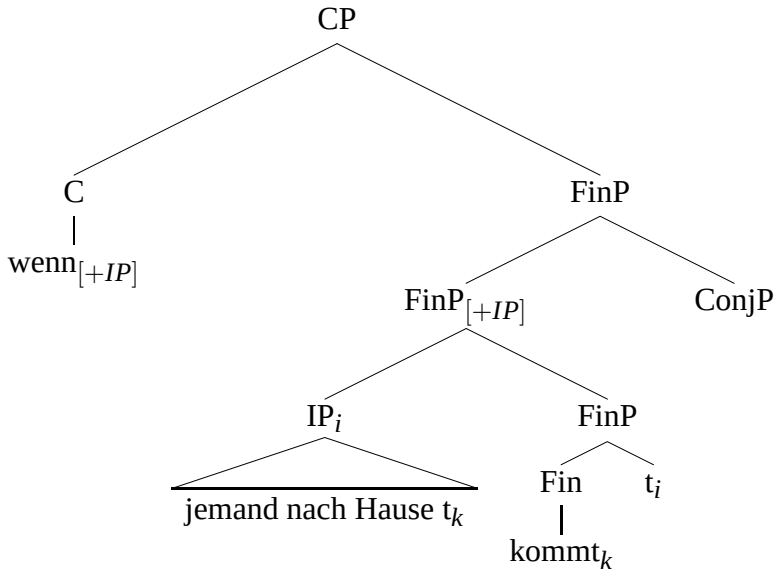
[7]According to Hallman (2004), FinP is a 'locus of finiteness'.

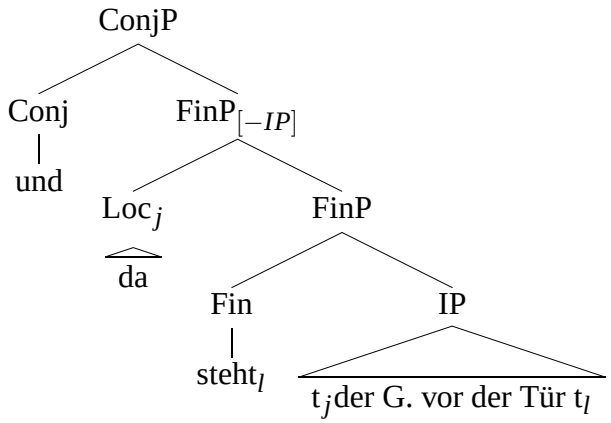
(2.8)



In asymmetric coordination, the SpecFinP in the second conjunct is occupied by a locative adverb (2.9), which does not check feature [+IP].

(2.9)





IP clauses are tensed clauses, i.e. they are finite. In symmetric coordination, *wenn* occurs with a finite complement. In asymmetric coordination, it appears with a non-finite complement in the second conjunct. The German data reveal that in asymmetric coordination, the non-initial conjunct is non-finite, whereas it is finite in symmetric coordination.

To summarize briefly, the data from typologically different languages suggest that there is dependency between syntactic properties of (a)symmetric coordination and the way the coordination is interpreted. In asymmetric coordination, the second conjunct is non-finite and is dependent on a selecting category, such as tense or a complementizer, that scopes over the entire coordinate structure. In symmetric coordination, each conjunct is finite that allows a coordination to have an independent or symmetric interpretation.

2.3 Properties of (a)symmetric coordination

(A)symmetric coordination shows different syntactic and semantic distribution properties, including restrictions on verbs that may occur in the second conjunct, subject restrictions and semantic restrictions. In this section, I discuss the properties of (a)symmetric coordination and hypothesize that in asymmetric coordination there is a syntactic control relationship between the first and second conjuncts. No such relationship holds in symmetric coordination.

2.3.1 Restrictions on the predicate

It is only with non-stative verbs as the main verb of the second conjunct that asymmetric coordination can be constructed. Ross (1967) has observed that on one reading, the sentence in (2.10a) is synonymous with the sentence in (2.10b), which is a purpose clause.

(2.10) a. I went to the store and bought some whisky.
b. I went to the store to buy some whisky.

However, if the predicate of the second conjunct is stative, as in (2.11a), the asymmetric reading of the sentence is unavailable and the corresponding purpose clause is ill-formed (2.11b).

(2.11) a. Tony has a Fiat and yearns for a tall nurse.
b. *Tony has a Fiat to yearn for a tall nurse.

(2.11a) is a symmetric coordination, in which conjuncts are interpreted as denoting independent states.

2.3.2 Restrictions on tense

(Aspectual) auxiliaries are prohibited in the second conjunct of asymmetric coordination. The sentences in (2.12) form a minimal pair with the sentences in (2.13) differing only in tense of the second conjunct.

(2.12) a. I went to the store and bought some whisky.
b. I went to the store to buy some whisky.

(2.13a) does not have an asymmetric reading and a grammatical purpose clause (2.13b) cannot be formed.

(2.13) a. *I went to the store and **have** bought some excellent whisky.
b. *I went to the store to **have** bought some excellent whisky.

On the other hand, symmetric coordination can license different tenses in each conjunct, as shown in (2.14).

(2.14) I went to the store and Mike has bought some excellent whisky.

2.3.3 Restrictions on subject

Asymmetric coordinate structures share the subject which appears in the first conjunct but also refers to the second conjunct. However, the subject cannot appear overtly in the second conjunct.

(2.15) a. Someone$_i$ drank the poison and e$_i$ died.
b. Someone$_i$ drank the poison and someone$_{*i/j}$ died.

If the subject is overt in the second conjunct, as in (2.15b), the asymmetric reading of the sentence is unavailable; rather the sentence is interpreted as conjoining two independent events and in each conjunct *someone* has to refer to a different person.

2.3.4 Semantic restrictions

In symmetric coordination each of the conjuncts is interpreted independently, whereas in asymmetric coordination the event denoted by the second conjunct follows the event denoted by the first conjunct and the entire coordinate structure has a one-event interpretation. The observation can be stated as simultaneity condition (2.16).[8]

(2.16) The event denoted by the second conjunct includes the event denoted by the first conjunct.

2.3.5 Interim summary

To summarize briefly, the prohibition of stative verbs in the second conjunct, unavailability of tense licensing and no licensing of overt subjects in the second conjunct of asymmetric coordination suggest that this type of constructions should be viewed as a control structure. On the other hand, in symmetric coordination both stative and auxiliary verbs are allowed and the overt subject is licensed in the second conjunct indicating that this type of constructions conjoins full clauses, i.e. TPs. Based on the observations in this section, I hypothesize as follows (2.17).

(2.17) Asymmetric coordination is an instance of a control configuration; symmetric coordination is a non-control configuration.

[8] Inspired by Felser (1998); Stowell (2007); Reich (2007).

In section 2.4 I discuss syntactic structure of (a)symmetric coordination.

2.4 The structure of (a)symmetric coordination

Asymmetric coordination does not allow modals or other non-finite complement taking verbs in the second conjunct, suggesting that asymmetric coordination is coordination of vPs.

(2.18) a. John could drink the poison and *could die.
b. John wants to drink the poison and *wants to die.

However, position of adverbs in the second conjunct shows that the size of conjuncts in asymmetric coordination is bigger than vPs.

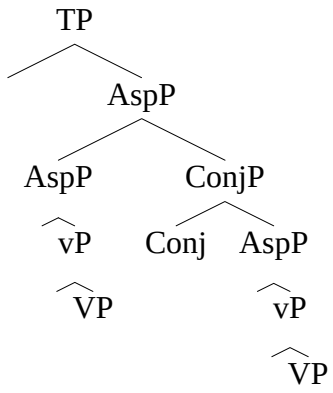
(2.19) John drank the poison and **died**$_i$ immediately **t**$_i$.

In (2.19), *immediately* is a manner adverb which has a fixed position in the sentence. It is assumed that manner adverbs adjoin to vPs. In the sentence (2.19), there is a movement of the main verb and this movement occurs to a position outside of vP.

On the other hand, the control properties of asymmetric coordination make it similar to control properties of infinitival constructions. One can assume that asymmetric coordination should be analyzed as conjoining TP phrases. However, no auxiliary or *to* marker are allowed in the second conjunct of asymmetric coordination, suggesting that the size of the conjuncts is smaller than TP.

We are left with a contradictory statement that on the one hand, asymmetric coordination is bigger than vPs; on the other hand, it is smaller than TPs. I suggest that asymmetric coordination should be viewed as conjoining aspect phrases that is posited between vP and TP in the structure. According to this proposal, asymmetric coordination conjoins clauses but it fails to project the T-level. The basic internal structure of asymmetric coordination is (2.20).

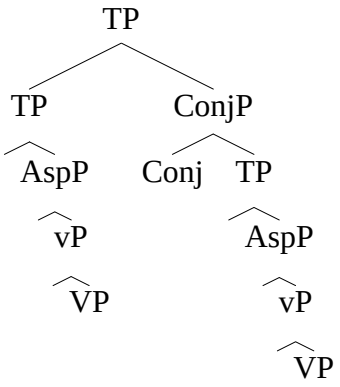
(2.20)



The structure (2.20) captures the absence of overt tense marking in asymmetric coordination and creates conditions for licensing the null subject in the second conjunct.

Symmetric coordination projects T-level and has the basic structure as in (2.21).

(2.21)

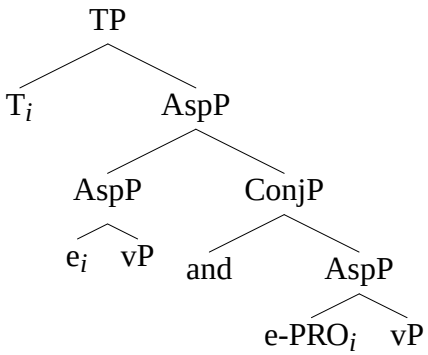


2.5 Towards an event control analysis

Apart from asymmetric coordination, non-finite sentences can appear as the complements of perception verbs. It has been shown that perception constructions can appear in control configurations (Felser, 1998), i.e. as an event control. In this section, I adopt the event control approach and apply it to (a)symmetric coordination.

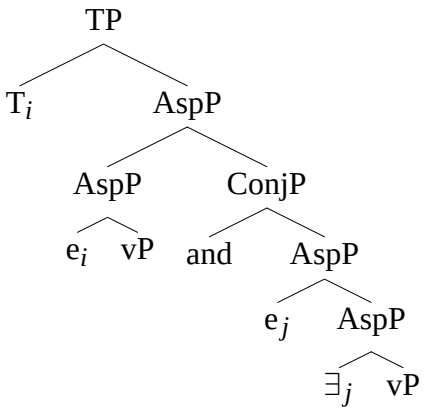
Following Felser (1998), I assume that each of the vP conjuncts in coordination has an event argument. According to the approach, the control relation holds between two event arguments, between *e* and *e*-PRO. The event of the second conjunct receives its temporal index from the higher event argument of the first conjunct. The latter inherits the index that is assigned to the main verb's event position by the matrix T, as schematized in (2.22).

(2.22)



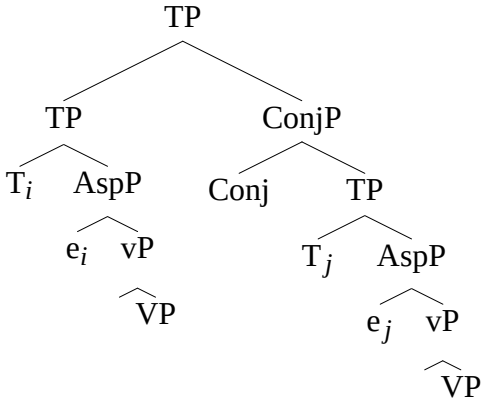
However, I depart from the proposal in Felser (1998) in the following respect. According to her analysis, only stage-level predicates take an event argument. Individual-level predicates do not take the event argument and do not project AspP. On the other hand, I assume that both types of predicates project an event argument. According to this view, individual-level predicates host an existential closure, which will bind the event variable (2.23).

(2.23)



In symmetric coordination, each of the conjuncts projects its own TP phrase and the event variables are bound by the respective tense operators (2.24).

(2.24)



According to the proposal, TPs and non-aspectual sentences will render an independent or symmetric interpretation, whereas aspectual coordinate structures will produce dependent or asymmetric reading. The prediction is borne out.

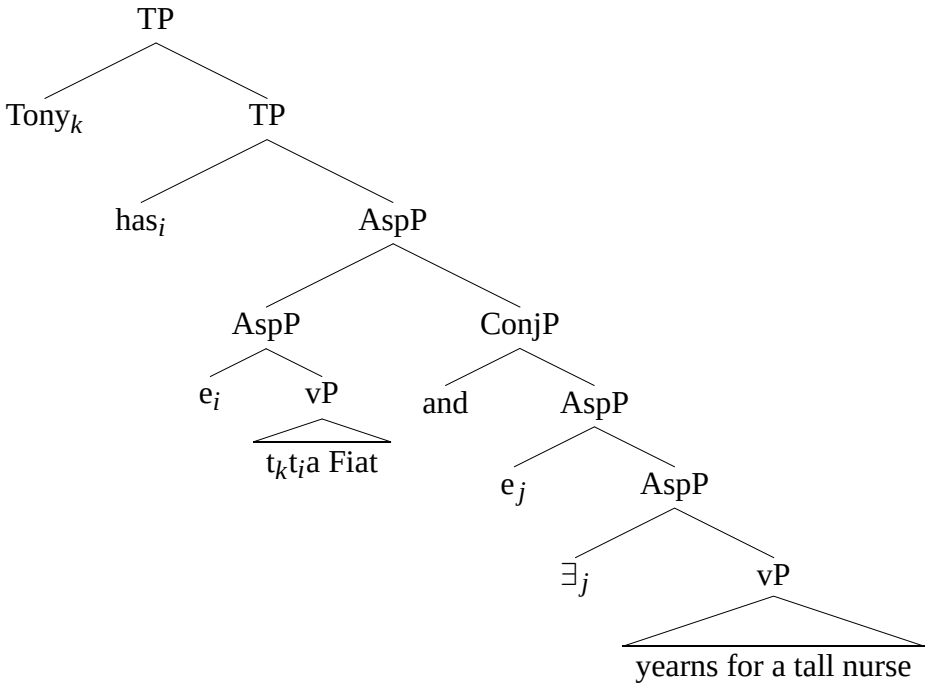
2.6 Attesting the analysis

The proposed analysis correctly predicts the syntactic and semantic distribution of (a)symmetric coordination.

2.6.1 Restrictions on the predicate

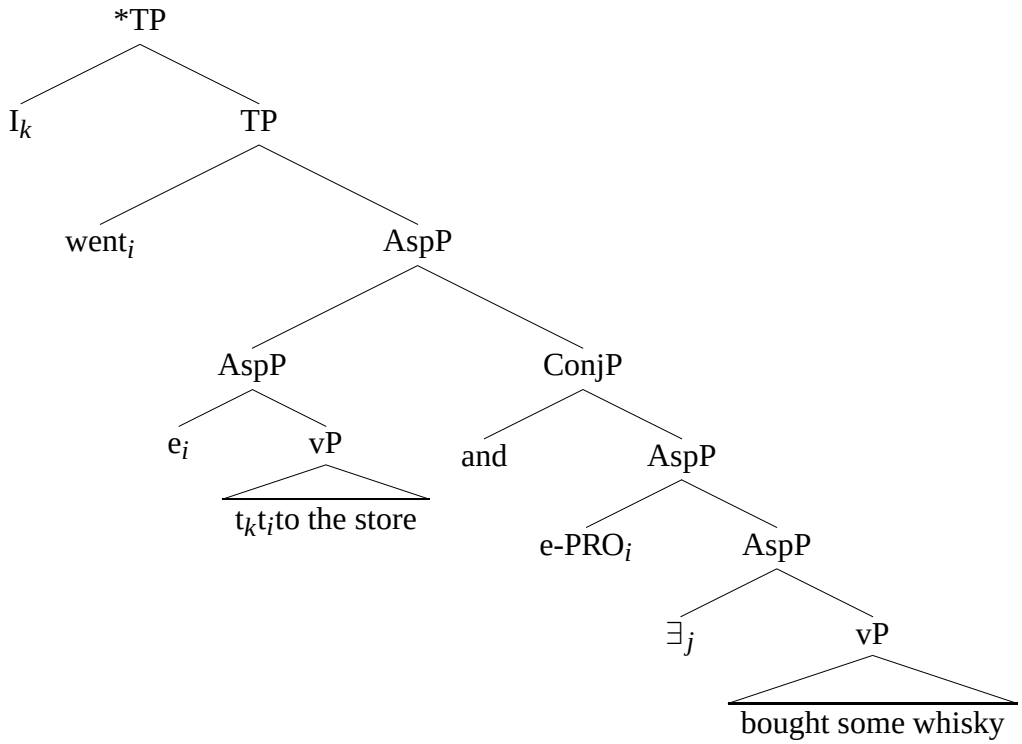
Recall that asymmetric coordination can host only non-stative verbs as the main verb of the second conjunct. If the predicate of the second conjunct is stative, the asymmetric reading of the sentence is unavailable. According to the proposal, stative predicates project an aspect phrase, but also host an existential operator that can bind the event variable in the second conjunct. Each of the event variables is bound by different operators which results in a symmetric or independent reading, as shown in (2.25).

(2.25)



Notice that in asymmetric coordination, the event variable in the second conjunct is bound by the event variable of the first conjunct. If asymmetric coordination occurs with a stative predicate, two binders will bind the same event variable in the second conjunct (or alternatively, the existential operator won't have a variable to bind), resulting in the ungrammaticality of the sentence (2.26).

(2.26)



2.6.2 Restrictions on tense

The proposed analysis correctly predicts restrictions on tense in (a)symmetric coordination. Since asymmetric coordination does not project tense level, there is no position for auxiliary or modal verbs in the second conjunct. On the contrary, in symmetric coordination, two TPs are conjoined and each of the conjunct can host an independent tense or modal verb.

2.6.3 Restrictions on subject

The aspect phrase in asymmetric coordination can host a PRO subject which requires [-tense, +event] context. To license the overt subject, the licensing conditions should satisfy the require-

ment [+tense, +event]. The latter is only satisfied in symmetric coordination, where tense is present in each of the conjuncts.

2.6.4 Semantic restrictions

The proposed analysis nicely captures the (in)dependent interpretation of (a)symmetric coordination. In asymmetric coordination, the event argument of the first conjunct binds the event argument of the second conjunct, creating the dependency context. In symmetric coordination, each of the event arguments is independently bound by tense or existential operators.

I now turn to (a)symmetric coordinate constructions in Russian and extend the proposed analysis to Russian.

2.7 (A)symmetric coordination in Russian

2.7.1 Basic Conjunctions in Russian

There are two basic conjunctions in Russian *i* 'and' and *a*, which correspond to the English *and*. In this respect, Russian is different from English. The distribution and interpretation of *i* patterns essentially after the English *and*. Less is clear about the behavior of *a*. In this subsection, I compare both *i* and *a* to *and*.

2.7.1.1 Distribution and Interpretation

Distribution of *i* patterns identically with *and* in that both can conjoin noun phrases (2.27a), verb phrases (2.27b) or sentences (2.27c).

(2.27) a. Petja i Vanja prišli.
Petja and Vanja came
'Petj and Vanja came.'

b. Petja kupil knigu i podaril ee Vane.
Petja bought book and gave it Vanja
'Petja bought a book and gave it to Vanja.'

c. Petja pozvonil Vane i on (Vanja) prišel.
Petja called Vanja and he Vanja came
'Petja called Vanja and he (Vanja) came.'

In this respect, *a* does not behave like *and*. It does not conjoin noun phrases (2.28a) and verb phrases (2.28b) but sentences (2.28c). The contrast between (2.28a) and (2.28b), on the one hand, and (2.28c), on the other hand, suggests that *a* is a sentential conjunction.

(2.28) a. *Petja, a Vanja prišli.
Petja and Vanja came
'Petj and Vanja came.'

b. *Petja kupil knigu, a podaril ee Vane.
Petja bought book and gave it Vanja
'Petja bought a book and gave it to Vanja.'

c. Petja pozvonil Vane, a Vanja pozvonil Pete.
Petja called Vanja and Vanja called Petja
'Petja called Vanja and Vanja called Petja.'

Another relevant fact about *a* is that it requires the conjoined predicates or contrasting elements within the predicates to be different. Consider the contrast between (2.29a) and (2.29b), on the one hand, and (2.29c) and (2.29d), on the other hand.

(2.29) a. *Petja prišel, a Vanja prišel.
Petja came and Vanja came
'Petja came and Vanja came.'

b. Petja prišel, a Vanja ušel.
Petja came and Vanja left
'Petja came and Vanja left.'

c. *Petja kupil knigu, a Vanja kupil knigu.
Petja bought book and Vanja bought book
'Petja bought the book and Vanja bought the book.'

d. Petja kupil knigu, a Vanja kupil gazetu.
Petja bought book and Vanja bought newspaper
'Petja bought the book and Vanja bought the newspaper.'

In (2.29a), what is predicated about the subject *Petja* in the first conjunct is predicated about the subject *Vanja* in the second conjunct. The use of *a* in such context is impossible, as the ungrammaticality of (2.29a) indicates. If predicates are different, as in (2.29b), the sentence with *a* becomes grammatical. Similarly, in (2.29c) the same direct objects are used and the sentence is marked as ungrammatical. As soon as the direct objects denote different things, as in (2.29d), the sentence improves significantly. Apparently, *a* requires more than one meaning difference between the two conjuncts.

Related to this observation is the fact that *a* does not license the particle *toǧe* 'too', which is obligatory after sentential conjunctions with exactly one meaning difference (Kaplan, 1984).

(2.30) a. Jo had fish and Mo did too.
b. *Jo had fish and Mo did.

In the sentences in (2.30), the same property of having fish holds of both subjects *Jo* and *Mo*. The presence of *too* is obligatory in English as the ungrammatical (2.30b) signals. The Russian particle *toǧe* 'too' behaves in the same way as the contrast between (2.31a) and (2.31b) indicates. In (2.31a), the same property of ordering fish is attributed to both *Petja* and *Vanja* and the use of *toǧe* is necessary to mark the similarity. If *toǧe* 'too' is omitted, as in (2.31b), the sentence becomes ungrammatical.

(2.31) What did Petja and Vanja order?
a. Petja zakazal rybu i Vanja toǧe.
Petja ordered fish and Vanja too
'Petja ordered fish and Vanja did too.'

b. *Petja zakazal rybu i Vanja.
Petja ordered fish and Vanja
'*Petja ordered fish and Vanja did.'

In the case of *a*, sentences with the *toǧe* 'too' particle are marked as ungrammatical (2.32).

(2.32) What did Petja and Vanja order?

a. *Petja zakazal rybu, a Vanja toğe.
Petja ordered fish and Vanja too
'Petja ordered fish and Vanja did too.'

b. Petja zakazal rybu, a Vanja sup.
Petja ordered fish and Vanja soup
'Petja ordered fish and Vanja ordered soup.'

If the same property is ascribed to both subjects, as in (2.32a), the use of *a* is not permitted. If different properties hold of each subject (2.32b), the sentence with *a* becomes grammatical. Both facts in (2.29) and (2.32) point out to another property of *a*, namely that *a* requires at least two meaning differences.

One of the contexts where *a* is used, corresponds to the 'non-temporal' reading of *and*. Compare the contrast below.

(2.33) a. John poisoned Bill and Bill poisoned John.
b. John poisoned Bill and he (Bill) died.

The sentence in (2.33a) has a non-temporal reading, where the two events expressed by the two conjuncts are understood as independent. On the other hand, the sentence in (2.33b) has a dependent reading. According to this reading, the first event precedes the second event and the coordinate structure has a one-event interpretation. In (2.33b), John poisoned Bill and as the result Bill died. The *a* conjunction only conveys the non-temporal reading, as shown by the contrast in (2.34).

(2.34) a. Petja otravil Vanju, a Vanja otravil Petju.
Petja poisoned Vanja and Vanja poisoned Petja
'Petja poisoned Vanja and Vanja poisoned Petja.'

b. # Petja tolknul Vanju, a on (Vanja) upal.
Petja pushed Vanja and he Vanja fell
'Petja pushed Vanja and he (Vanja) fell.'

In (2.34a), the first event that *Petja poisoned Vanja* is interpreted as temporally independent of the second event that *Vanaj poisoned Petja*. The use of *a* is licit in this case. On the other hand,

if there is a sequence of events as in (2.34b) that *Vanja fell after Petja pushed him*, the use of *a* is infelicitous. In the latter case, the *i* conjunction is used in Russian (2.35).

(2.35) Petja tolknul Vanju i on (Vanja) upal.
Petja pushed Vanja and he Vanja fell
'Petja pushed Vanja and he (Vanja) fell.'

To summarize this section briefly, the Russian conjunction *i* pattern essentially after English *and* in its distribution and interpretation. As for *a*, it shows properties of *and*, but it also differs from the *and* conjunction. The data above show that the following properties can be attributed to *a*. It is a sentential conjunction, it requires more than two meaning differences and it cannot occur in asymmetric readings; rather it requires a context of a symmetric interpretation.

2.7.2 Possible analysis and its problems

In the previous section, we have established that *a* is part of the contrastive relationship and is excluded from the temporal or causal contexts. On the other hand, *i* can be used in those contexts. The data suggest that in Russian, *a* is used in symmetric coordination, whereas *i* is used in asymmetric coordination. Recently, a semantic/pragmatic approach – Discourse Coherence approach (Kehler, 2000) – has been proposed that makes connection between discourse relations, on the one hand, and syntactic and semantic properties of constructions, on the other hand.

Under the approach, clauses are divided according to the coherence relations that hold between them. Each group of the coherence relations shows particular semantic and syntactic distribution. In this section, I apply the Discourse Coherence approach to Russian data, first. I show that the approach does not predict all the semantic and syntactic properties of the two Russian conjunctions. Then, I turn to an alternative approach. I show that the event control approach to (a)symmetric coordination provides better explanation of the data.

2.7.2.1 Background on Discourse Coherence approach

According to the Discourse Coherence approach (Kehler, 2000), there exist Cause-Effect, Resemblance and Contiguity relations that one can identify between clauses to establish their coherence.

The Cause-Effect relation requires that implication relations be identified between the propositions denoted by the utterances. For instance, in the sentence (2.36) the Result relation, a prototypical case of the Cause-Effect relation, is established between the two clauses. The Result relation triggers the implicature that *if Bill is about to be impeached, then it plausibly follows that Bill will call his lawyer*.

(2.36) Bill was about to be impeached. He called his lawyer. (Result)
Implicature: If Bill is about to be impeached, then he will call his lawyer.

Other Cause-Effect coherence relations include Explanation, Violated Expectation and Denial of Preventer, which can be generated by simply reversing the clausal order and optionally negating the second proposition in the conditional implicature.

(2.37) a. Bill called his lawyer. He was about to be impeached. (Explanation)
Implication: If Bill called his lawyer, then he was about to be impeached.

b. Bill was about to be impeached, but he didn't call his lawyer. (Violation of Expectation)
Implication: If Bill was about to be impeached, then he didn't call his lawyer.

c. Bill didn't call his lawyer, even though he was about to be impeached. (Denial of Preventer)
Implication: If Bill called his lawyer, then he wasn't about to be impeached.

The second class of relations is Resemblance. According to Kehler, the Resemblance relation is fundamentally different from the Cause-Effect and Contiguity relations. Resemblance requires that commonalities and contrasts among corresponding sets of parallel properties be recognized. The prototypical case of the Resemblance relation is the Parallel relation.

(2.38) Bill likes to play golf. Al enjoys surfing the net. (Parallel)

In (2.38), participation in a recreational activity is the common relation attributed to parallel

entities *Bill* and *Al*. Another Resemblance relation is Contrast. Kehler distinguishes two types of the Contrast relation. Either the relation can be contrasted (2.39a), or properties of the parallel entities (2.39b) can be contrasted.

(2.39) a. John supports Clinton, but Mary opposes him.
b. John voted for Clinton, but Mary voted for Dole.

In (2.39a), the relation between parallel entities (*John* and *Mary* and *Clinton* and *him*) are contrasted (*support* vs. *oppose*). In (2.39b), the property of an entity in the first conjunct (*vote for Clinton*) stands in a contrast relation to the property of the parallel entity in the second conjunct (*vote for Dole*).

The third class of relations distinguished by Kehler is Contiguity. Contiguity includes the sole relation of Narration, which expresses a coherent sequence of events.

(2.40) Ken Starr convened his grand jury this morning. Vernon Jordan was subsequently called to testify. (Narration)

The Narration relation requires that the events show forward movement in time as in (2.40).

According to Kehler (2000), coherence relations apply at different levels. For instance, establishing the Resemblance relation requires access to the subclausal constituents in sentences or conjuncts. On the other hand, the Cause-Effect relation requires access only to the clause-level semantics. This affects how syntactic and semantic properties distribute, depending on a coherence relation. Kehler argues that the discourse coherence analysis predicts no requirements for constituent parallelism or syntactic reconstruction in the case of the Cause-Effect relation. In the case of the Resemblance relation, the coherence analysis predicts parallelism between the constituents. In other words, if there is a mismatch of syntactic form between the constituents, the sentence is predicted to be ungrammatical.

Now, we can turn to (a)symmetric coordination in Russian. First, I show that *a* patterns with the Resemblance coherence relation, whereas *i* patterns with the Cause-Effect coherence relation. Then, I try to account for syntactic and semantic distribution of (a)symmetric coordination based on the predictions of the approach. The approach predicts that *a* requires syntactic parallelism,

whereas *i* does not. I show that the prediction does not hold for (a)symmetric coordination and that a different explanation is required. I propose a new approach – an event control approach – for Russian data.

2.7.2.2 Discourse Coherence approach to (a)symmetric coordination in Russian

Recall that one of the contexts where *a* can be used is a contrastive context.

(2.41) a. John voted for Clinton and Mary voted for Dole. (Contrast)
(Kehler, 2000)

b. Petja progolosoval za El'tsina, a Vanja progolosoval za Putina. (Contrast)
Petja voted for Yeltsin but Vanja voted for Putin
'Petja voted for Yelzin but (in contrast) Vanja voted for Putin.'

According to Kehler, contrastive reading signals the Contrast relation. Notice that the use of *a* is felicitous as the Contrast relation (2.41b). It can be used in both types of Contrast. Consider examples below.

(2.42) a. Petja podderğivaet El'tsina, a Vanja vystupaet protiv nego.
Petja supports Yeltsin but Vanja opposes against him
'Petja supports Yeltsin but (in contrast) Vanja opposes him.'

b. Petja progolosoval za El'tsina, a Vanja progolosoval za Putina.
Petja voted for Yeltsin but Vanja voted for Putin
'Petja voted for Yelzin but (in contrast) Vanja voted for Putin.'

In (2.42a), the relation between parallel entities (*Petja* and *Vanja* and *Yeltsin* and *him*) is contrasted (*support* vs. *oppose*). In (2.42b), the property of an entity in the first conjunct (*vote for Yeltsin*) stands in a contrast relation to the property of the parallel entity in the second conjunct (*vote for Putin*). The data above show that *a* is part of the Contrast relation.

On the other hand, *i* fails in contexts of the Contrast relation (2.43).

(2.43) a. #Petja podderğivaet El'tsina i Vanja vystupaet protiv nego.
Petja supports Yeltsin but Vanja opposes against him
'Petja supports Yeltsin but (in contrast) Vanja opposes him.'

b. #Petja progolosoval za El'tsina i Vanja progolosoval za Putina.
Petja voted for Yeltsin but Vanja voted for Putin
'Petja voted for Yelzin but (in contrast) Vanja voted for Putin.'

On another use, *a* cannot occur in the concessive contexts. In Kehler's analysis, the concessive reading such as (2.44) corresponds to the Violation of Expectation relation and can be paraphrased with *but nevertheless*. The Violation of Expectation relation is part of the Cause-Effect coherence relation.

(2.44) Bill was about to be impeached but (nevertheless) he didn't call his lawyer. (Violation of Expectation)

Compare the sentences in (2.45) that for a minimal pair differing only in conjunctions. Notice that the use of *a* is infelicitous in the context (2.45b).

(2.45) a. Borisa čut' bylo ne otstranili ot dolğnosti, no on ne sdalsja.
Boris about was not dismissed from duties but he not gave-up
'Boris was about to be dismissed from his duties but (nevertheless) he didn't give up.'

b. #Borisa čut' bylo ne otstranili ot dolğnosti, a on ne sdalsja.
Boris about was not dismissed from duties but he not gave-up
'Boris was about to be dismissed from his duties but (nevertheless) he didn't give up.'

According to Kehler, sentences in (2.45) imply that *If Boris was about to be dismissed from his duties, then he didn't give up*. The use of *a* does not license the conditional implication, as the marked (2.45b) suggests. The contrast between (2.45a) and (2.45b) indicates that *a* does not license the Violation of the Expectation relation. So far Kehler's analysis has shown that *a* signals Resemblance and is excluded from the Cause-Effects relations, whereas *i* cannot be used in the Resemblance relations.

On the next reading, *i*, but not *a* can appear in temporal or causal contexts.

(2.46) Petja tolknul Vanju. Vanja upal. (Result)
Petja pushed Vanja Vanja fell
'Petja pushed Vanja. Vanja fell.'

The sentence in (2.46) has an asymmetric reading, i.e. the Result reading in Kehler's terms. The Result relation is part of the Cause-Effect coherence relation. Only *i* is licensed in this context.

Compare the sentences in (2.47), forming a minimal pair.

(2.47) a. # Petja tolknul Vanju, a Vanja upal. (Result)
Petja pushed Vanja and Vanja fell
'Petja pushed Vanja and Vanja fell.'

b. Petja tolknul Vanju, i Vanja upal. (Result)
Petja pushed Vanja and Vanja fell
'Petja pushed Vanja and Vanja fell.'

As the infelicity of (2.47a) shows, the use of *a* is not possible in the Cause-Effect context. However, the use of *i* is felicitous.

To summarize briefly, the use of *a* patterns with the Resemblance coherence relations, whereas the use of *i* patterns with the Cause-Effect relations. According to the coherence approach, *a*-coordination is predicted to have syntactic parallelism between the constituents, whereas *i*-coordination does not require syntactic parallelism. However, the prediction is not borne out.

First, there is an asymmetry in the use of passive in *i*-coordination. Consider the following pair of sentences (2.48), where the first or the second conjunct is passivized.

(2.48) a. *Vor byl pojman i raskajalsja.
thief was caught and confessed
'*The thief was caught and confessed.'

b. Vor raskajalsja i byl nakazan.
thief confessed and was punished
'The thief confessed and was punished.'

In (2.48a), the first conjunct occurs in passive and the coordinate structure is ungrammatical. The opposite holds of (2.48b). According to the Discourse Coherence theory, the sentences in (2.48) represent the Cause-Effect relation which does not require syntactic parallelism to hold between the constituents. The theory predicts the sentence in (2.48a) to be grammatical, which is not the case.

On the other hand, the sentences in (2.49) correspond to the Resemblance relation and require syntactic parallelism between the constituents.

(2.49) a. Leningrad byl polnost'ju razrušen, a Moskva ustojala.
Leningrad was completely destroyed and Moscow survived
'Leningrad was destroyed completely and Moscow survived.'

b. Moskva ustojala, a Leningrad byl polnost'ju razrušen.
Moscow survived and Leningrad was completely destroyed
'Moscow survived and Leningrad was completely destroyed.'

Notice, that one of the conjuncts in each coordination is used in passive, however both coordinate structures are grammatical. The Discourse Coherence approach predicts the sentences in (2.49) to be ungrammatical.

Second, the sentences in (2.50) represent the Cause-Effect relation. According to the approach, the requirement on the syntactic parallelism between the two conjuncts does not have to be satisfied. The approach predicts that the pronoun in the second conjunct of (2.50b) is properly licensed and the sentence should be grammatical. However, if co-indexed as (2.50b), the sentence is bad.

(2.50) a. Kto-to tolknul Vanju i upal.
someone pushed Vanja and fell
'Someone$_i$ pushed Vanja and he$_i$ fell.

b. *Kto-to$_i$ tolknul Vanju i on$_i$ upal.
someone pushed Vanja and he fell
'Someone$_i$ pushed Vanja and he$_i$ fell.

Third, the sentence (2.51) is an instance of the Resemblance relation. According to the approach, the Resemblance relation requires syntactic parallelism between the constituents. The particle *too* in the second conjunct is anaphoric to the VP *bought house* of the first conjunct and upon reconstruction of the VP ensures the entire parallelism between the conjuncts. The approach predicts the sentence to be grammatical, however it is not the case.

(2.51) *Petja kupil dom v ponedel'nik, a Vanja toğe vo vtornik.
Petja bought house on Monday and Vanja too on Tuesday
'Petja bought the house on Monday and Vanja bought the house on Tuesday.'

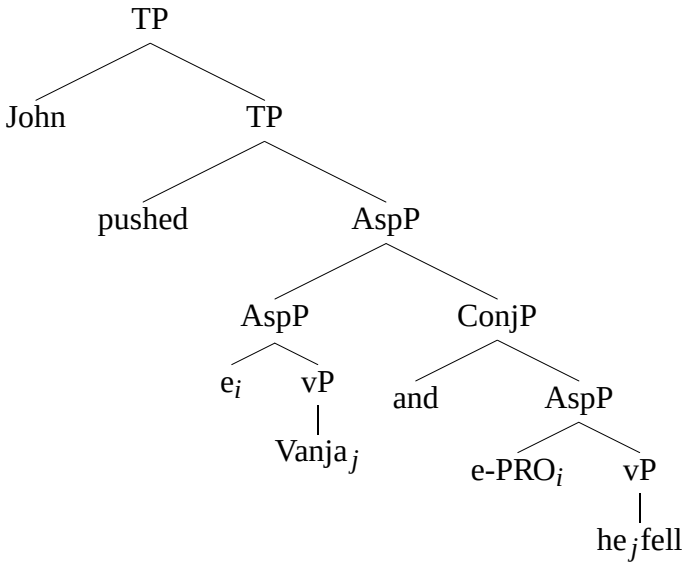
The data in (2.48)-(2.51) show that the Discourse Coherence approach makes incorrect predictions and cannot be adopted for (a)symmetric coordination in Russian. In the next subsection, I

apply the event control approach to the data and show that the analysis provides better explanation for the distribution of (a)symmetric coordination in Russian.

2.7.3 An event control analysis of (a)symmetric coordination in Russian

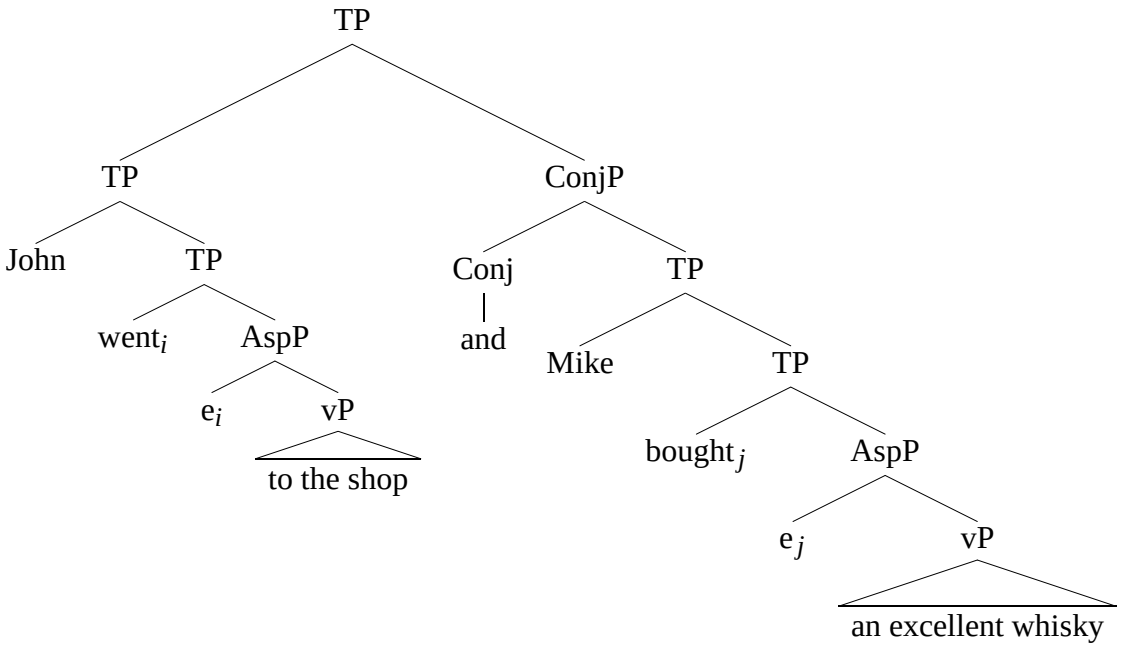
Recall that according to the event control approach, (a)symmetric coordination has different structural representations. The key point is that in asymmetric coordination, the event argument of the first conjunct is binding the event argument of the second conjunct resulting in a dependent interpretation. In symmetric coordination, each of the conjuncts either has an independent tense head licensing the event arguments or, in case of non-eventive predicates, an existential operator binds the event variable in each conjunct, rendering independent reading. The approach naturally derives the two kinds of readings without any stipulation. According to the approach, the asymmetric coordination has the representation as (2.52)

(2.52)



Symmetric coordination has the structure as (2.53).

(2.53)



Now we can explain discrepancies of the data that cannot be accounted for by the Discourse Coherence approach.

2.7.3.1 Restrictions on passive

We have observed that asymmetric coordination does not allows passive in the first conjunct. I assume that passive participles do not project the event argument (Burzio, 1986). If this is true, then the explanation follows straightforwardly. In asymmetric coordination, passive verbs in the first conjunct fail to license the event argument in the second conjunct, resulting in ungrammaticality of the sentence. Notice that if both conjuncts are used in passive, the sentence is grammatical (2.54).

(2.54) Vor byl pojman i nakazan.
thiefe was caught and punished
'the thiefe was caught and punished.'

2.7.3.2 Subject restrictions

In asymmetric coordination, the event argument of the first conjunct licenses the subject of the second conjunct. This explains why the only possible co-indexation in the sentence (2.55) is with the object.

(2.55) a. *Kto-to$_i$ tolknul Vanju i on$_i$ upal.
someone pushed Vanja and he fell
'Someone$_i$ pushed Vanja and he$_i$ fell.

b. Kto-to tolknul Vanju$_j$ i on$_j$ upal.
someone pushed Vanja and he fell
'Someone pushed Vanja$_j$ and he$_j$ fell.

2.7.3.3 The use of *too*

The use of *too* involves anaphoric relationship between the particle and the antecedent vP. In symmetric coordination, whole sentence or TP phrases are conjoined and *too* cannot access into the first conjunct.

2.7.4 Summary

To summarize briefly, (a)symmetric coordination in Russian shows different syntactic and semantic distribution. The Discourse Coherence approach that makes connection between semantic/pragmatic relations, on the one hand, and semantic/syntactic properties of the respective constructions, on the other hand, fails to provide correct predictions with respect to the Russian (a)symmetric coordination. I have applied the event control approach that naturally derives the difference in interpretation between the two types of coordination and provides better account for syntactic and semantic behavior of (a)symmetric coordination in Russian.

2.8 Conclusions

In this chapter, I started with the phenomenon of (a)symmetric coordination. (A)symmetric coordination is found in many typologically different languages, but they share one characteristic property. In symmetric coordination, each of the conjuncts is interpreted independently. In asymmetric coordination, there is a dependency between the conjuncts. I have established that there is a correlation between syntactic and semantic distribution of (a)symmetric coordination and the way

the coordination is interpreted. In particular, in asymmetric coordination the second conjunct is non-finite and is dependent on the first conjunct, resulting in a dependent reading of the coordinate structure. This property makes asymmetric coordination similar to other tenseless constructions such as perception constructions. I adopted an event control approach proposed for perception constructions (Felser, 1998) and applied the approach to (a)symmetric coordination. The approach provides a natural explanation for syntactic and semantic properties of (a)symmetric coordination both in English and Russian. I have shown that in asymmetric coordination, the event argument of the first conjunct binds the event argument of the second conjunct, creating the dependency relation between the two events. In symmetric coordination, each event variable introduced by an event argument is bound by an independent tense head or, in case of non-aspectual predicates, by an existential operator. The latter fact results in an independent interpretation. The proposed analysis provides better explanation for the data than the analogous Discourse Coherence approach that states the connection between semantic/pragmatic relations and semantic/syntactic properties of sentences.

Chapter 3

TOWARDS AN ALTERNATIVE SEMANTICS FOR CONJUNCTION

This chapter makes an argument for an alternative semantics (Hamblin, 1973) for conjunction. Recently, indeterminate phrases (Kratzer and Shimoyama, 2002; Shimoyama, 2006) and disjunction (Alonso-Ovalle, 2006; Hulsey, 2008) have been reanalyzed as operators introducing sets of Hamblin alternatives. The new approach helps to solve several otherwise puzzling facts about indeterminate phrases and disjunction. I examine gapping constructions in English and Russian and extend the approach to conjunction.

3.1 Introduction

Recently, an alternative semantics originally proposed for questions in English (Hamblin, 1973) has been extended to natural language quantification (Ramchand, 1997; Hagstrom, 1998) including indeterminate phrases (Kratzer and Shimoyama, 2002; Shimoyama, 2006) and disjunction (Alonso-Ovalle, 2006; Hulsey, 2008). The key idea behind the alternative semantics is that linguistic items of the different categories have "denotation-sets" rather than denotations. For instance, the proper name 'Mary' stands not for the individual 'Mary' but for the set whose only member is 'Mary'. Similarly, indeterminate phrases and disjunction denote sets whose members are Hamblin alternatives created by an indeterminate phrase and by disjuncts, respectively. For example, a disjunction phrase 'Mary or John' is a set where 'Mary' and 'John' are two members of the set. Hamblin alternatives combine with other elements of the sentence (by pointwise function application) until they are caught by an operator that selects them. Only the closest available operator is able to associate with alternatives. According to this approach, several facts about the interpretation and distribution of indeterminate phrases and disjunction fall out naturally (for more details see Kratzer and Shimoyama, 2002; Alonso-Ovalle, 2006).

In this chapter, I adopt a Hamblin semantics and extend the approach to conjunction. I propose

that natural language conjunction is a set forming operator and conjoined structures denote the set whose members are Hamblin alternatives created by the conjuncts.[1] The new approach gives a natural explanation for the syntax-semantics of gapping constructions in English and Russian, which I discuss in this chapter. It provides further evidence for Hamblin alternatives as an analytical tool and sheds light on the nature of existential closure by addressing why a logical possibility people do not normally attend to – that there might be closure operations with other quantificational force, such as universal – might actually be realized.

The chapter is organized as follows. Section 3.2 introduces core gapping data in English and Russian that produce different readings when embedded under a modal verb. Section 3.3 provides a brief background on gapping constructions and discusses two main approaches to gapping. I then discuss properties of gapping in Russian and argue for the small-conjunct approach for gapping in Russian. The syntactic structure for gapping motivated in section 3.3 produces some puzzling interpretation facts that are noted in section 3.4. Section 3.5 proposes an alternative semantics for conjunction and reanalyzes the puzzling data. Some implications for the omitted coordinators are drawn in section 3.6. Section 3.7 concludes and discusses future prospectives.

3.2 An argument from gapping

This section presents the observation that modals in gapping with conjunction have both wide and narrow scope readings in Russian. The core data are given in (3.1).[2]

[1] It has been hinted in Munn (1993) that it might be conceptually and empirically preferred to view conjunction and disjunction as forming a set.

[2] There is speakers' variation of the acceptability of the sentence in (3.1) and its possible readings. A simple google search indicates that constructions with a modal scoping over coordination and a non-finite main verb in each conjunct do occur in Russian, e.g.:

(3.1) Politik možet govorit', čto narod dolžen znat' pravdu, a žurnalist zajavljat', čto
politician can say that people must know truth and journalist state that
'A politician can say that people must know the truth and a journalist state that . . . '

I leave a more detailed investigation of the variation for future research.

(3.1) Odni mogut **est'** ikru, a drugie **est'** boby.
some can eat caviar and others eat beans
'Some can eat caviar and others eat beans.'

a. Odni mogut est' ikru v to vremja kak drugie edjat boby.
some can eat caviar at the time as others eat beans
'Some can eat caviar while others eat beans.'

b. Vse gosti mogut est' bljudo na vybor.
all guests can eat dish for choice
'All guests can eat a dish of their choice.'
Odni mogut est' ikru, a drugie mogut est' boby.
some can eat caviar and others can eat beans
'It is permitted for some to eat caviar and it is permitted for others to eat beans.'

c. U kogo na čto (est') allergija?
by who to what has allergy
'Who has allergy to what?'
Odni mogut est' ikru, a drugie mogut est' boby.
some can eat caviar and others can eat beans
'Some can eat caviar and others can eat beans.'

The sentence in (3.1) is a gapping sentence where the modal appears in only the first conjunct. The non-finite main verb is present in both conjuncts. The sentence has three possible readings. On first reading (3.1a), the modal takes wide scope over the entire coordinate structure. We find the wide scope reading of the modal in English, as shown in (3.2a).[3]

(3.2) Ward can't **eat** caviar and Sue **eat** beans. (Siegel, 1987; Oehrle, 1987)
a. Ward can't eat caviar while Sue eats beans.
b. Impossible reading: Ward can't eat caviar and Sue can't eat beans.

The two readings in (3.1b) and (3.1c) correspond to narrow scope of the modal with respect to conjunction. There is no narrow scope reading of the modal in English gapping sentences, as indicated by (3.2b). To elaborate on two possible readings, (3.1b) denotes that any choice is a

[3]The wide scope reading is also possible with non-negative auxiliaries. The following sentence asserts the possibility of a conjunction (Siegel, 1984).

(3.1) Ward can eat caviar and Sue eat beans.

permissible option. Finally, (3.1c) has conjunction scoping over the ability modal. On this reading, the sentence can be paraphrased as having the ability to eat the respective foods.

The narrow scope reading of the modal is also possible if the modal is negated in Russian. Consider the following sentence.

(3.3) Odni ne mogut **est'** ikru, a drugie **est'** boby.
some not can eat caviar and others eat beans
'Some can't eat caviar and others eat beans.'

a. Odni ne mogut est' ikru, v to vremja kak drugie edjat boby.
some not can eat caviar at the time as others eat beans
'Some can't eat caviar while others eat beans.'

b. Iz dvuh bljud možno vybrat' tol'ko odno bljudo.
of two dishes allowed to-choose only one dish
'It is permitted to choose only one dish.'
Odni ne mogut est' ikru, a drugie ne mogut est' boby.
some not can eat caviar and others not can eat beans
'It is not permitted for some to eat caviar and it is not permitted for others to eat beans.'

c. U kogo na čto (est') allergija?
by who to what has allergy
'Who has allergy to what?'
Odni ne mogut est' ikru, a drugie ne mogut est' boby.
some not can eat caviar and others not can eat beans
'Some can't eat caviar and others can't eat beans.'

On first reading (3.3a), the sentence has a denotation of the corresponding English sentence in (3.2). On this reading, the negated modal takes scope over the entire coordination. On second reading (3.3b), the negated modal takes narrow scope with respect to conjunction. The sentence implies that guests are allowed to choose caviar or beans. (cf. free choice effects in Fox, 2007). On third reading (3.3c), the sentence has an interpretation which corresponds to the non-gapped version. The two (narrow scope) readings of the modal are not available in English.

To summarize briefly, gapping with conjunction has both wide and narrow scope readings of the modal in Russian, but only wide scope reading of the modal in English. In the rest of the chapter, I develop an approach to conjunction which will account for the data. I adopt a Hamblin semantics (Hamblin, 1973) for conjunction and argue that conjunction denotes the set of Hamblin

alternatives. The new approach will account for the data without complicating the syntax of gapping constructions. According to this approach, both conjunction and disjunction are set forming operators whose members are Hamblin alternatives formed by conjuncts and disjuncts, respectively. To distinguish between conjunction and disjunction, I claim that there might be closure operations with different quantificational force. Whereas the set of Hamblin alternatives formed by disjunction is closed by existential closure, the 'conjunction' set must be 'universally' closed (cf. Chierchia, 2004). I now provide a brief background on gapping constructions and introduce two main approaches – the large-conjunct and small-conjunct approaches to gapping. I then discuss gapping constructions in Russian and argue for the small-conjunct approach for gapping in Russian.

3.3 Background on gapping

3.3.1 What is gapping?

Starting with Ross (1970), sentences such as (3.4) have been referred to as gapping.[4] In (3.4), the verb *ate* in the second conjunct is omitted but it is interpreted as if it were there.

(3.4) Some ate natto and others rice.

In a gapping construction, a verb and other material can go unpronounced if their content can be recovered from the preceding conjunct. In the example (3.4), the underlined verb *ate* of the first conjunct is the antecedent for the gap in the second conjunct. In case only a verb is gapped, the gap is called a single gap (3.5a). When more material is gapped, the gap is referred to as a complex gap (3.5b).

[4]The "gapping" rule, which "operates to delete indefinitely many occurrences of a repeated main verb in a conjoined structure", has been proposed by Ross (1967) (p.250) to derive sentences like (3.1a) from (3.1b).

(3.1) a. Jessica ate an apple and Joanne, an orange.
b. Jessica ate an apple and Joanne ate an orange.

(3.5) a. Some ate natto and others rice. (single gap)
b. Some ate the natto hungrily and others timidly. (complex gap)

Gapping can target finite verbs (3.6a), or finite auxiliaries or modals (3.6b).[5] In the latter case, the main verb may retain in the second conjunct. In this chapter, I will primarily be dealing with gapping structures such as (3.6b).

(3.6) a. Jill watched the hockey game and Jori the luge race.
b. Jill will **referee** the hockey game and Jori **time** the luge race.

In the theory of gapping, there are two main questions with regard to properties of gapping constructions. First question is about the size of the conjunct containing the gap. There are two main approaches to the size question. On the one hand, it is assumed that the conjunct containing the gap is much larger than it appears on the surface and that it is of the size of the ungapped conjunct. This approach is usually referred to as the large-conjunct approach (Ross, 1967; Neijt, 1979; van Oirsouw, 1987; Wilder, 1994, 1997; Hartmann, 2000). On the other hand, it is hypothesized that the gapped conjunct is smaller than its ungapped counterpart. This approach has been called the small-conjunct approach to gapping (Johnson, 1996, 2009; Coppock, 2001; Lin, 2002). Second question asks how the gap is produced. There are three approaches to the way the gap in the second conjunct is derived. According to the first approach, the gap is the result of ellipsis (Coppock, 2001). According to the second approach, the 'shared' material in gapping constructions moves across-the-board (Johnson, 2009). Third approach assumes that the gap is a null pro-form (Williams, 1997). In this chapter, I will be dealing with the size question.[6] In the next subsection (3.3.2), I introduce the large-conjunct and small-conjunct approaches to gapping in more detail. In subsection 3.3.3, I extend the small-conjunct approach to gapping in Russian and argue for a unified analysis of gapping cross-linguistically.

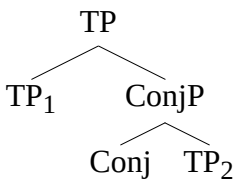
[5]These sentences are from Lin (2002) (p.10).

[6]For the proposal in this chapter, it is not relevant whether the gap is derived through VP-ellipsis or through ATB-movement. The Russian data of the chapter do not provide conclusive evidence for or against one or the other approach. I leave this interesting question for future research.

3.3.2 Approaches to gapping

There are two principal ways to analyze gapping constructions. On the one hand, the large-conjunct approach (Ross, 1967; Neijt, 1979; van Oirsouw, 1987; Wilder, 1994, 1997; Hartmann, 2000) suggests that bigger phrases, such as TPs, are coordinated (3.7).[7]

(3.7)



Some kind of a (syntactic) reduction mechanism derives the gap, by which the verb and other material of the second conjunct get deleted under identity with material in the first conjunct. Correspondingly, the sentence in (3.8a) receives the parse as in (3.8b), where the strike-out represents reduced material.

(3.8) a. John ate natto and Bill rice.
b. [$_{TP}$ John <u>ate</u> natto] or [$_{TP}$ Bill ~~ate~~ rice]

The large-conjunct approach predicts that no item of the first conjunct will be able to bind an element or to scope over an element of the second conjunct. However, the prediction is not born out. The following scope and binding facts pose a problem for the large-conjunct approach (Siegel, 1984, 1987; Oehrle, 1987; McCawley, 1993; Johnson, 1996; Lin, 2002).

3.3.2.1 Cross-conjunct binding: large-conjunct approach

In gapping, the subject of the first conjunct binds the pronoun in the subject of the second conjunct (3.9).

(3.9) a. No woman$_i$ can join the army and her$_i$ girlfriend the navy.
b. Not every student$_i$ bought a hat, and her$_i$ brother a sweatshirt.

[7]Following Munn (1993), I assume that conjunction phrase is an adjunction in the syntax. According to this view, the conjunction and the second conjunct adjoin to the first conjunct.

Standard assumptions about how binding works suggest that in the sentences (3.9), the subject of the first conjunct c-commands the subject of the second conjunct. Notice that binding is not possible in corresponding non-gapped sentences (3.10).

(3.10) a. *[$_{TP}$ No woman$_i$ can join the army] and [$_{TP}$ her$_i$ girlfriend can join the navy.]
b. *[$_{TP}$ Not every student$_i$ bought a hat] and [$_{TP}$ her$_i$ brother bought a sweatshirt.]

In (3.10), the whole sentences (TPs) are coordinated and a quantifier of the first conjunct cannot bind into the second conjunct. On the large-conjunct approach, the sentences in (3.9) are analyzed as conjoined TPs and are wrongly predicted to be ungrammatical.

3.3.2.2 Wide scope of modals: large-conjunct approach

In the gapping sentence in (3.11), the negated modal takes wide scope with respect to coordination, receiving the non-distributed modal reading (paraphrased with *while* as in Lin (2002)).

(3.11) Ward can't eat caviar and Mary eat beans.
a. Ward can't eat caviar while Mary eats beans.
b. Impossible reading: Ward can't eat caviar and Mary can't eat beans.

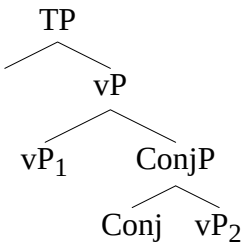
On the contrary, the corresponding non-gapped sentence, conjoining two TPs, has the distributed modal reading.

(3.12) [$_{TP}$ Ward can't eat caviar] and [$_{TP}$ Mary can't eat beans.]

On the large-conjunct approach, (3.11) is analyzed as (3.12), but they do not mean the same thing.

On the second approach to gapping (Coppock, 2001; Lin, 2002; Johnson, 2009), called the small-conjunct approach, smaller phrases are conjoined and "shared" material lies outside coordination (3.13).

(3.13)



According to this approach, the sentence in (3.14a) is a vP-coordination and has a parse as in (3.14b).

(3.14) a. John ate natto and Bill rice.
b. John$_i$ ate [$_{vP}$ t$_i$ natto] and [$_{vP}$ Bill rice]

The approach makes correct predictions about wide scope modals and cross-conjunct binding.

3.3.2.3 Wide scope of modals: small-conjunct approach

On the small-conjunct approach, finite auxiliary and modal verbs lie outside coordination (3.15). This allows the modals or other auxiliary operators to take scope over the coordination.

(3.15) a. Ward can't eat caviar and Mary eat beans.
b. Ward can't [$_{vP}$ eat caviar] and [$_{vP}$ Mary eat beans.]

3.3.2.4 Cross-conjunct binding: small-conjunct approach

The subject of the first conjunct moves out of its vP and c-commands the subject of the second conjunct correctly predicting the binding fact (3.16).

(3.16) a. No woman$_i$ can join the army and her$_i$ girlfriend the navy.
b. No woman$_i$ can [$_{vP}$ t$_i$ join the army] and [$_{vP}$ her$_i$ girlfriend the navy.]

3.3.2.5 Interim summary

The wide scope of modals and cross-conjunct binding facts show that a small-conjunct approach should be adopted to analyze gapping constructions in English (Coppock, 2001; Lin, 2002; Johnson, 2009). We now discuss properties of gapping constructions in Russian. We show that proper-

ties of gapping in Russian can be accounted for if we use the small-conjunct approach. We extend the analysis to gapping in Russian and argue for a unified treatment of gapping cross-linguistically.

3.3.3 Gapping in Russian

Although a well-known phenomenon, gapping in Russian has not been given a proper analysis yet. In this subsection, I discuss gapping constructions in Russian and show that they share several properties with gapping in English. We will see that scope effects and cross-conjunct binding prevent us from adopting the large-conjunct approach for gapping in Russian. I extend the small-conjunct approach to gapping in Russian and argue for a unified analysis of gapping cross-linguistically.

3.3.3.1 Licensing environments

There are two conjunctions in Russian, *i* and *a*, that correspond to the English conjunction *and*, but only the *a* conjunction can be used in gapping in Russian (3.17).

(3.17) Kto čto zakazal?
who waht ordered
Who ordered what?

a. Ženščiny zakazali vino, a mužčiny kon'jak.
women ordered wine and men cognac
'Women ordered wine and men cognac.'

b. # Ženščiny zakazali vino i mužčiny kon'jak.
women ordered wine and men cognac
'Women ordered wine and men cognac.'

(3.17) is a multiple wh-question requiring a pair-list answer. The question can be answered with the gapping sentence conjoined with the *a*-conjunction (3.17a), but not with the *i*-conjunction (3.17b). Similarly, the minimal pair in (3.18) (from Kazenin, 2009) shows that gapping is possible with *a*, but not with *i*.[8]

[8]We cannot say that *a* is exclusively reserved for gapping in Russian, whereas *i* is used everywhere else. Notice that *a* can also be used with ellipsis such as (3.1)

(3.18) a. Vasja podaril Maše knigu, a Kolja kompakt-disk.
V. gave M. book and K. CD
'As a present, V. gave M. a book and K. a CD'

b. *Vasja podaril Maše knigu i Kolja kompakt-disk.
V. gave M. book and K. CD
'As a present, V. gave M. a book and K. a CD'

Another characteristic property of gapping is a restriction to coordination (Jackendoff, 1971; Hudson, 1976; Johnson, 2009).

(3.19) a. Some had eaten mussels and others shrimp.
b. *Some had eaten mussels because others shrimp.

(3.19a) is a gapping structure with coordination and it is grammatical. On the other hand, (3.19b) is a subordinating clause with gapping and it is ungrammatical. We observe the same distribution in Russian (3.20).

(3.20) a. Petja kupil dom, a Vanja yahtu.
P. bought house and V. yacht
'P. bought a house and V. bought a yacht.'

b. *Petja kupil dom, potomučto Vanja yahtu.
P. bought house because V. yacht
'*P. bought a house because V. a yacht.'

Compare the grammatical coordinate structure with gapping (3.20a) and the ungrammatical subordinating clause with gapping (3.20b).

Gapping in Russian and English share syntactic properties, including locality constraints. In both languages, gapping obeys subjacency.

(3.21) a. * Kolja sel na poezd, iduščij v Peterburg, a Vanja v Moskvu.
Kolja sat on train going to Petersburg and Vanja to Moscow
'Kolia took the train going to St.Petersburg and Vanja took the train going to Moscow.'
(complex NP island)

(3.1) Petja ljubit moloko, a Vanja net.
P. likes milk and V. not
'P. likes milk and V. does not.'

b. * Ja ušël, kogda prišël Petja, a ty Vanja.
I left when came Petja and you Vanja
'I left when Petja came and you left when Vanja came.' (wh-island)

(3.21) shows that gapping is not possible out of an island.[9] We observe the same effects in English (Johnson, 2004).

(3.22) a. *John wondered what to cook today and Peter tomorrow. (wh-island)
b. *I read out the order to fix tortillas, and Mary beans. (complex NP island)

Gapping in Russian shares scope and binding facts with gapping in English.

3.3.3.2 Cross-conjunct binding

The subject of the first conjunct is able to bind a pronoun in the subject of the second conjunct (3.23a). The corresponding non-gapped sentence does not allow cross-conjunct binding (3.23b). This is similar to cross-conjunct binding fact in English.

(3.23) a. Ne každyj mal'čik$_i$ budet igrat' v kukly, a ego$_i$ sestra v zvezdnye vojny.
not every boy will play in dolls and his sister in star wars
'Not every boy$_i$ will play dolls and his$_i$ sister – star wars.'

b. *Ne každyj mal'čik$_i$ budet igrat' v kukly, a ego$_i$ sestra budet igrat' v zvezdnye vojny.
not every boy will play in dolls and his sister will play in star wars
'*Not every boy$_i$ will play dolls and his$_i$ sister will play star wars.'

The contrast in (3.23) indicates that subject should occur outside of coordination in gapping in Russian.

3.3.3.3 Wide scope of modals

When embedded under a modal verb (3.24a), a wide scope reading of the modal is one of the possible readings (3.24b).

[9]These examples are due to K. Kazenin

(3.24) a. Odni ne mogut **est'** ikru, a drugie **est'** boby.
some not can eat caviar and others eat beans
'Some can't eat caviar and others eat beans.'

b. Odni ne mogut est' ikru, v to vremja kak drugie edjat boby.
some not can eat caviar at the time as others eat beans
'Some can't eat caviar while others eat beans.'

In order to take a wide scope, the modal verb should outscope coordination. This is similar to what we see in English.

Cross-conjunct binding and wide scope of modals suggest that coordination should be smaller (such as coordination of vPs) in gapping in Russian. We claim that the small-conjunct approach should be adopted for the Russian gapping constructions. This is favorable since it provides a unified analysis of gapping in English and Russian.

3.4 Puzzle

If we are going to adopt the small-conjunct approach to gapping in Russian, then interpretation facts of the sentence in (3.25) are puzzling. In particular, the narrow scope reading of modals is not accounted for under this approach.

(3.25) Odni mogut est' ikru, a drugie est' boby.
some can eat caviar and others eat beans
'Some can eat caviar and others eat beans.'

a. Odni mogut est' ikru v to vremja kak drugie edjat boby.
some can eat caviar at the time as others eat beans
'Some can eat caviar while others eat beans.'

b. Vse gosti mogut est' bljudo na vybor.
all guests can eat dish for choice
'All guests can eat a dish of their choice.'
Odni mogut est' ikru, a drugie mogut est' boby.
some can eat caviar and others can eat beans
'It is permitted for some to eat caviar and it is permitted for others to eat beans.'

c. U kogo na čto net allergii?
by who to what no allergy
'Who has no allergy to what?'
Odni mogut est' ikru, a drugie mogut est' boby.
some can eat caviar and others can eat beans
'Some can eat caviar and others can eat beans.'

Recall, that the sentence in (3.25) has three possible readings. On the first reading (3.25a), the modal takes wide scope over the entire coordinate structure. The two readings in (3.25b) and (3.25c) correspond to narrow scope of the modal with respect to conjunction. (3.25b) denotes that any choice is a permissible option. (3.25c) has conjunction scoping over the ability modal. On this reading, the sentence can be paraphrased as having the ability to eat the respective foods. We find the wide scope reading of the modal in English (3.26a). However, there is no narrow scope reading of the modal in English gapping sentences (3.26b).

(3.26) Ward can't eat caviar and Sue eat beans. (Siegel, 1987; Oehrle, 1987)
a. Ward can't eat caviar while Sue eats beans.
b. Impossible reading: Ward can't eat caviar and Sue can't eat beans.

The small-conjunct approach to gapping predicts a modal to always have wide scope with respect to coordination. On this approach, only the reading in (3.25a) is derived. The narrow scope readings of the modals in (3.25b) and (3.25c) are not predicted, which is puzzling. Another puzzling fact is why narrow scope reading of modals is available in Russian but not in English. In the next section we provide a solution to the puzzles. We argue that adopting a Hamblin semantics (Hamblin, 1973) for conjunction will account for the data without abandoning the small-conjunct approach to gapping constructions. To account for the difference between English and Russian, we refer to selectivity implemented as feature checking mechanism (Kratzer and Shimoyama, 2002).[10] We propose that conjunctions can be selective in a way that they carry uninterpretable features corresponding to the interpretable features on operators. In English, *and* has an uninterpretable feature [∀] which has to be checked by its interpretable counterpart such as the universal quantifier *both*. In Russian, *a* has also an uninterpretable feature [∀], but it has to be checked against an 'inflectional

[10]Thanks to Ezra Keshet for a hint at selectivity.

category' such as aspect. The interaction between the features and corresponding operators is subject to syntactic constraints. The latter explains why there is no wide scope conjunction reading in English.

3.5 An alternative semantics for conjunction

Recently, it has been argued that a set-based approach should be adopted for disjunction (Aloni, 2002; Alonso-Ovalle, 2006). In particular, a Hamblin semantics (Hamblin, 1973) has been extended to disjunction (Alonso-Ovalle, 2006; Hulsey, 2008). On this approach, disjunction does not denote the truth-conditional logical operator $\vee$; rather it introduces a set of Hamblin alternatives. Hamblin alternatives combine with other elements of the sentence (by function application) until they are caught by an operator that selects them. Only the closest available operator is able to associate with alternatives. On this approach, several facts about the interpretation and distribution of disjunction fall out naturally, including locality conditions (for more details see Alonso-Ovalle, 2006; Hulsey, 2008).

If we are going to adopt a Hamblin semantics for disjunction, it is conceptually preferred to have the alternative semantics analysis for both disjunction and conjunction. In this section we extend the approach to conjunction.[11] I propose that natural language conjunction is a set forming operator and conjoined structures denote the set whose members are Hamblin alternatives created by the conjuncts. I show that adopting a Hamblin semantics for conjunction will account for the puzzling gapping data (section 3.4) without abandoning the small-conjunct approach.

In the following, first I provide a background on Hamblin semantics. Next, I reanalyze puzzling gapping constructions applying a Hamblin semantics to conjunction. I address the closure issue and claim that there might be closure operations with different quantificational force. Whereas the set of Hamblin alternatives formed by disjunction is closed by existential closure, the 'conjunction'

[11] Cf. Kaplan (2007a,b) who suggests a Hamblin semantics for coordination. This has been recently pointed out to me by Jason Merchant. The argument in this chapter has been developed long before I came across these papers.

set must be ‘universally’ closed (cf. Chierchia, 2004). The new approach provides further evidence for Hamblin alternatives as an analytical tool and sheds light on the nature of existential closure by addressing why a logical possibility people don’t normally attend to – that there might be closure operations with other quantificational force, such as universal – might actually be realized. Finally, I address the question why the narrow scope reading of modals is available in Russian, but not in English.

3.5.1 A Hamblin semantics

Originally, the Hamblin semantics has been proposed for questions in English (Hamblin, 1973). For example, the question in (3.27a) has the denotation as in (3.27b).

(3.27) a. What dog walks with Mary?

b. The denotation-set whose members are the propositions that Rover is a dog and walks with Mary, that Fido is a dog and walks with Mary, and so on for all possible individuals. (Hamblin, 1973)

Recently, the Hamblin semantics has been extended to natural language quantification (Ramchand, 1997; Hagstrom, 1998) including indeterminate phrases (Kratzer and Shimoyama, 2002; Shimoyama, 2006) and disjunction (Alonso-Ovalle, 2006; Hulsey, 2008). The key idea behind the Hamblin semantics is that linguistic items of the different categories have “denotation-sets” rather than denotations. For instance, a proper name ‘Mary’ stands not for the individual ‘Mary’ but for the set whose only member is ‘Mary’.

(3.28) $[\![\textit{Mary}]\!] = \{\text{m}\}$

More formally, expressions of type τ are mapped to sets of objects of type D_τ. Individual denoting NPs are mapped to singletons containing an individual (3.29a). Verbs are mapped to singletons containing a property (3.29b). Modals are mapped to singletons containing a function from propositions to propositions (3.29c).

(3.29) a. $[\![\textit{John}]\!] = \{\text{j}\}$

b. $[\![eat]\!] = \{\lambda y.\lambda x.\lambda w.\mathbf{eat}_w(x, y)\}$
c. $[\![can]\!] = \{\lambda p_{<s,t>}.\lambda w.\exists w'[w' \in D_w \ \& \ p(w')]\}$

On this approach, indeterminate phrases and disjunction denote sets whose members are Hamblin alternatives created by an indeterminate phrase and by disjuncts, respectively. For instance, a disjunction phrase 'Mary or John' is a set where 'Mary' and 'John' are two members of a set (3.30).

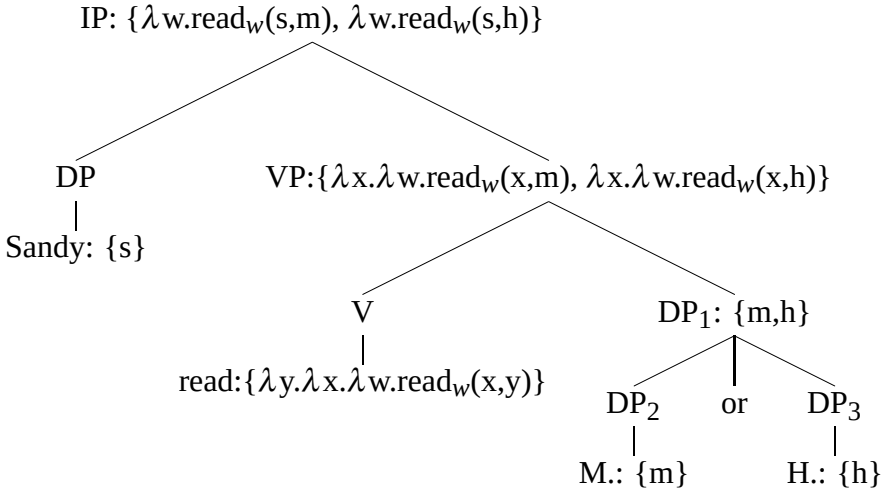
(3.30) $[\![MaryorJohn]\!] = \{m, j\}$

Hamblin alternatives combine with other elements of the sentence by function application as defined in (3.31).

(3.31) The Hamblin rule (cited after Alonso-Ovalle, 2006):
If $[\![\alpha]\!] \subseteq D_{<\sigma,\tau>}$ and $[\![\beta]\!] \subseteq D_\sigma$,
then $[\![\alpha(\beta)]\!] = \{c \in D_\tau \mid \exists \alpha \in [\![\alpha]\!] \exists [\![\beta]\!] \in [\![\beta]\!] (c = a(b))\}$ (Hamblin, 1973)

The rule in (3.31) says that every object of type $\langle\sigma,\tau\rangle$ applies to every object of type σ, and the outputs are collected in a set. Consider an example with disjunction (from Alonso-Ovalle, 2006, p. 12).

(3.32) a. Sandy read Moby Dick or Huckleberry Finn.
b.



In disjunction case, it is assumed that the alternatives introduced by disjunction are caught by an existential closure defined in (3.33).

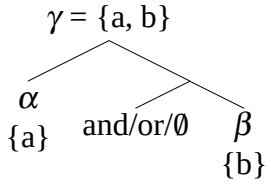
(3.33) Existential closure:
Where $[\![A]\!] \subseteq D_{<s,t>}$, $[\![\exists P]\!] = \{\lambda w.\exists p[p \in [\![A]\!] \& p(w)]\}$ (Alonso-Ovalle, 2006)

The existential closure operator maps a set of alternatives into a singleton containing the proposition that is true in a world *w* if and only if at least one of the propositions in alternatives is true in *w*. According to Alonso-Ovalle (2006), existential closure is triggered under the immediate scope of modals (for more details see Alonso-Ovalle, 2006).

3.5.1.1 A Hamblin semantics for conjunction

It has been noticed (Munn, 1993) that both conjunction and disjunction can be viewed as set-forming operators. It is conceptually preferred to have the same analysis for both coordinators. I assume that these statements are true and propose that the natural language conjunction introduces into the semantic derivation the denotation of its conjuncts as Hamblin alternatives. I propose a general syntax-semantic rule for all connectives, including disjunction, conjunction, and null or omitted coordinators,[12] schematized in (3.34).

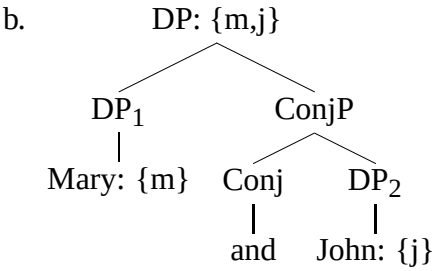
(3.34)



On this proposal, conjunction denotes the set whose members are Hamblin alternatives created by the conjuncts. For instance, a coordination phrase in (3.35a) has the denotation in (3.35b).

(3.35) a. Mary and John

b.



[12] An implication for omitted coordinators is discussed in section 3.6.

To distinguish between conjunction and disjunction, I claim that there might be closure operations with different quantificational force. Whereas the set of Hamblin alternatives formed by disjunction is closed by existential closure (3.33), the 'conjunction' set must be 'universally' closed (cf. Chierchia, 2004). The universal closure rule is stated in (3.36).

(3.36) Universal closure:
Where $[\![A]\!] \subseteq D_{<s,t>}$, $[\![\forall P]\!] = \{\lambda w.\forall p[p \in [\![A]\!] \rightarrow p(w)]\}$

The universal closure operator maps a set of Hamblin alternatives into the singleton containing the proposition that is true in a world *w* if and only if every proposition in alternatives is true in *w*.

3.5.2 A note on closure operations

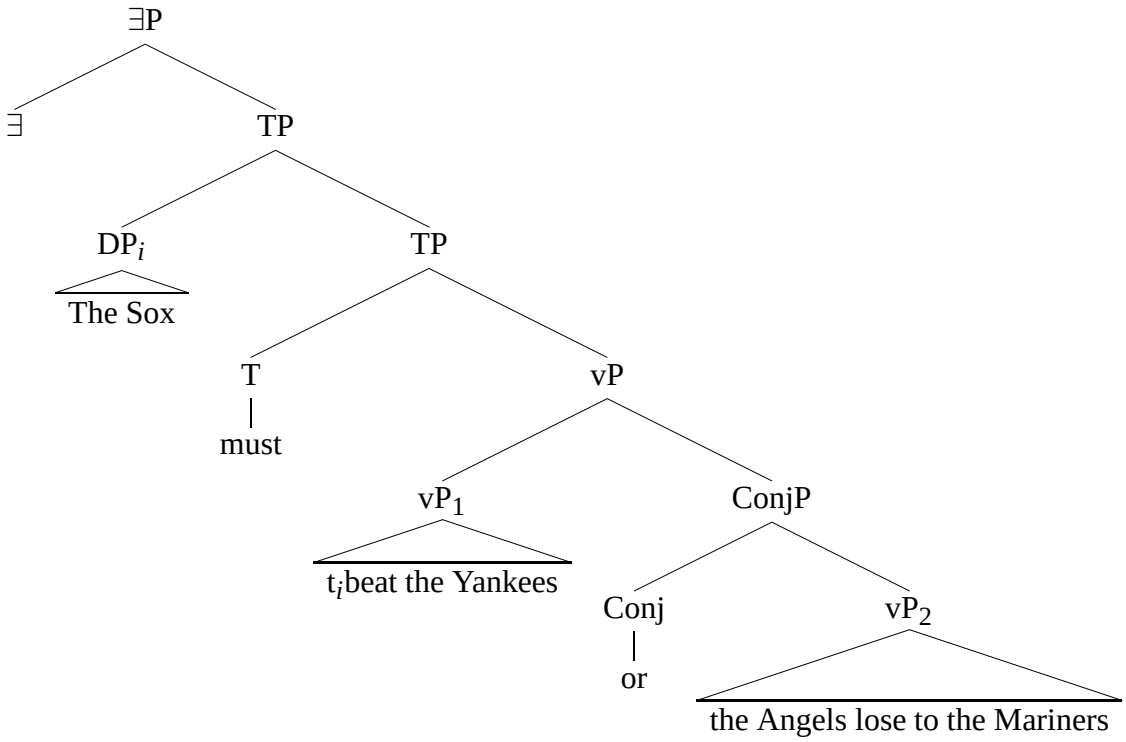
Existential closure operation has been introduced to account for quantificational variability of indefinites in different contexts (Kamp, 1981; Heim, 1982). On this view, indefinites are not existentially quantified inherently; rather indefinites introduce variables that have to be bound by some other operator in the sentence, such as an implicit existential quantifier. On this approach, existential closure operation applies at the sentence level or even at the text or discourse levels.

In coordination, scope of disjunction is the point of existential closure (Alonso-Ovalle, 2006; Hulsey, 2008), implemented as an existential closure phrase ∃P (cf. Alonso-Ovalle, 2006). Such an approach helps to derive scope effects in coordination with disjunction. Consider as an example the following gapping sentence with disjunction (from Hulsey, 2008, p. 95), which is ambiguous between the wide and narrow scope readings of the modal.

(3.37) For the Red Sox to make the playoffs...
The Sox must beat the Yankees or the Angels lose to the Mariners.
a. either of two events is sufficient □ (S or M)
b. ...but I don't remember which. (□ S or □ M)

In case, the existential closure applies above the modal, we get the distributed modal reading (3.38).

(3.38)



On a Hamblin semantics, each disjunct in (3.38) denotes the singleton set containing a proposition (3.39a). The disjunction takes the two singleton sets and returns a set with two members (3.39b). Next, the modal combines by function application with each member of the set. It distributes over each member of the disjunction set, returning a set that has two members (3.39c). Finally, the existential closure applies (3.39d).

(3.39) a. $[\![vP_1]\!]$ = {the Sox beat the Yankees}; $[\![vP_2]\!]$ = {the Angels lose to the Mariners}

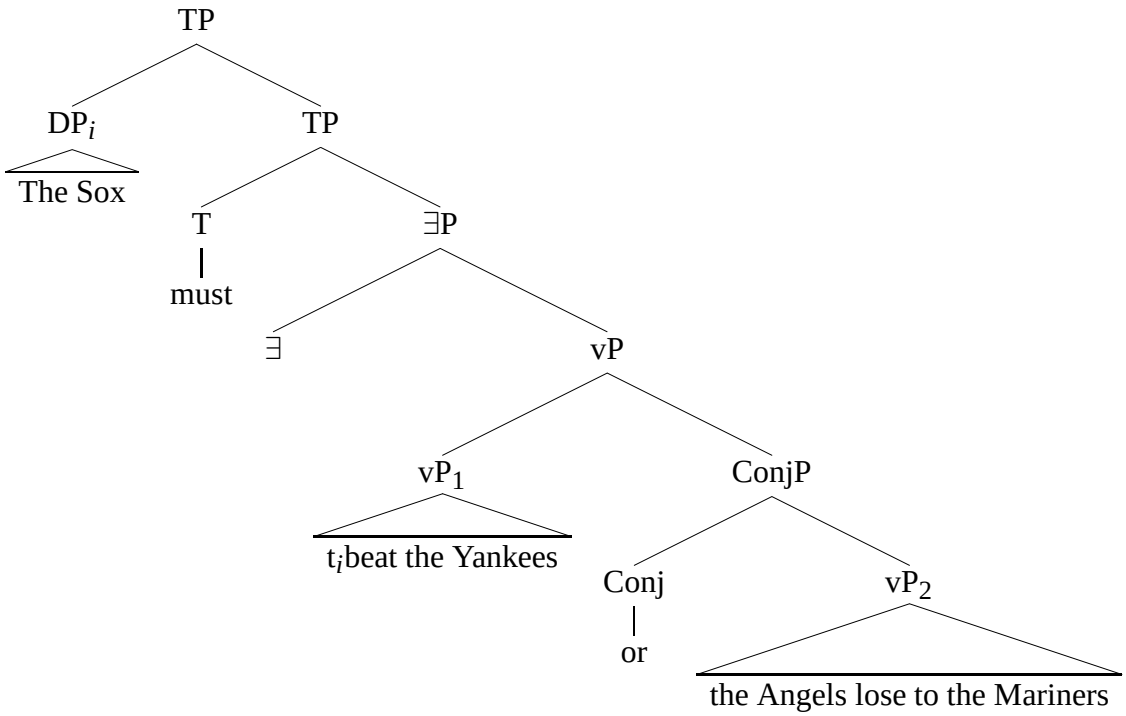
b. $[\![vP_1 or vP_2]\!]$ = {the Sox beat the Yankees, the Angels lose to the Mariners}

c. $[\![must(vP_1 or vP_2)]\!] = \{\lambda w.\forall w'[w' \in D_w \rightarrow vP_1(w')], \lambda w.\forall w'[w' \in D_w \rightarrow vP_2(w')]\}$

d. $[\![\exists(must(vP_1) or must(vP_2))]\!] = \{\lambda w''.\exists p[p \in \{\lambda w.\forall w'[w' \in D_w \rightarrow vP_1(w')], \lambda w.\forall w'[w' \in D_w \rightarrow vP_2(w')]\}$ & $p(w'')]\}$
= 1 iff one of the two propositions in the set (the Sox must beat the Yankees, the Angels must lose to the Mariners) is true.

To derive the narrow scope reading of the modal, the existential closure should apply before the modal (3.40).

(3.40)



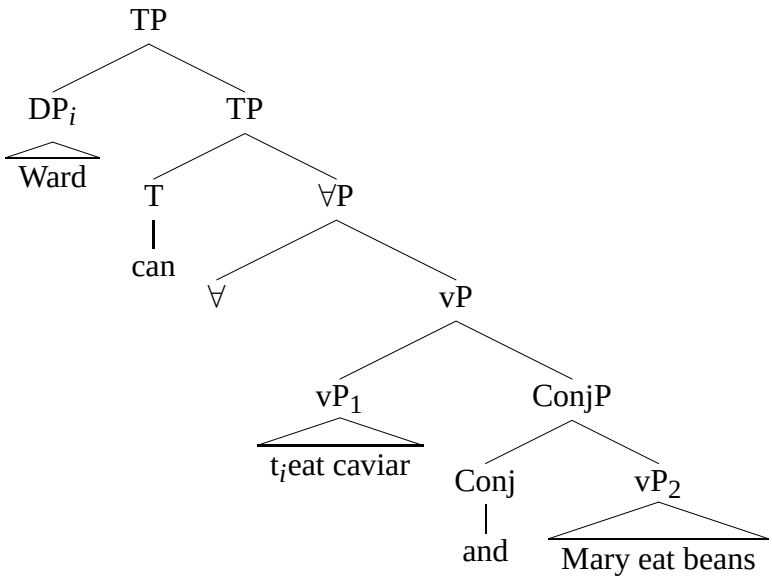
The derivation proceeds in the same way as in (3.39) up until the point when the modal enters the derivation. Before applying the modal, the existential close operation closes the set of Hamblin alternatives (3.41a). It gives a singleton set where one of the two propositions is true. In the next step, the modal applies to the singleton set (3.41b). The modal takes scope over disjunction resulting in the reading that the speaker is uncertain which of the two requirements holds.

(3.41) a. $[\![\exists(vP_1 \textit{or} vP_2)]\!]$ = {λw.∃p[p ∈ {the Sox beat the Yankees, the Angels lose to the Mariners} & p(w)]}

b. $[\![\textit{must}\exists(vP_1 \textit{or} vP_2)]\!]$ = {λw.∀w′[w′∈ D_w → {λw″.∃p[p ∈ {vP_1, vP_2} & p(w″)]}(w′)]} = 1 iff it is necessary that one of the two propositions {the Sox beat the Yankees, the Angels lose to the Mariners} is true.

I claim that, similar to disjunction, scope of conjunction is the point of universal closure operation realized as a universal closure phrase ∀P. In English, universal closure can be triggered under the scope of a modal verb resulting in a wide scope reading (3.42).

(3.42)



On a Hamblin semantics, each conjunct in (3.42) denotes the singleton set containing a proposition (3.43a). The conjunction takes the two singleton sets and returns a set with two members (3.43b). Next, the universal closure operation closes the set of Hamblin alternatives (3.43c). It gives a singleton set where every propositions is true. In the next step, the modal applies to the singleton set (3.43d).

(3.43) a. $[\![vP_1]\!]$ = {Ward eat caviar}; $[\![vP_2]\!]$ = {Mary eat beans}
b. $[\![vP_1 and vP_2]\!]$ = {Ward eat caviar, Mary eat beans}
c. $[\![\forall(vP_1 and vP_2)]\!] = \{\lambda w.\forall p[p \in \{\text{Ward eat caviar, Mary eat beans}\} \rightarrow p(w)]\}$
d. $[\![can\forall(vP_1 and vP_2)]\!] = \{\lambda w.\forall w'[w' \in D_w \rightarrow \{\lambda w''.\forall p[p \in \{vP_1, vP_2\} \rightarrow p(w'')]\}(w')]\}$
= 1 iff it is possible that every proposition {Ward eat caviar, Mary eat beans} is true.

We now can derive different scope readings of modal verbs in gapping in Russian.

3.5.3 Deriving ambiguous cases

Consider the sentence (3.25) again, repeated in (3.44). The sentence has both wide and narrow scope readings of the modal verb. Applying an alternative semantic approach to conjunction, we can derive both readings without altering the syntactic representation of the gapping sentences in Russian.

(3.44) Odni mogut **est'** ikru, a drugie **est'** boby.
Some can eat caviar and others eat beans
'Some can eat caviar and others eat beans.'

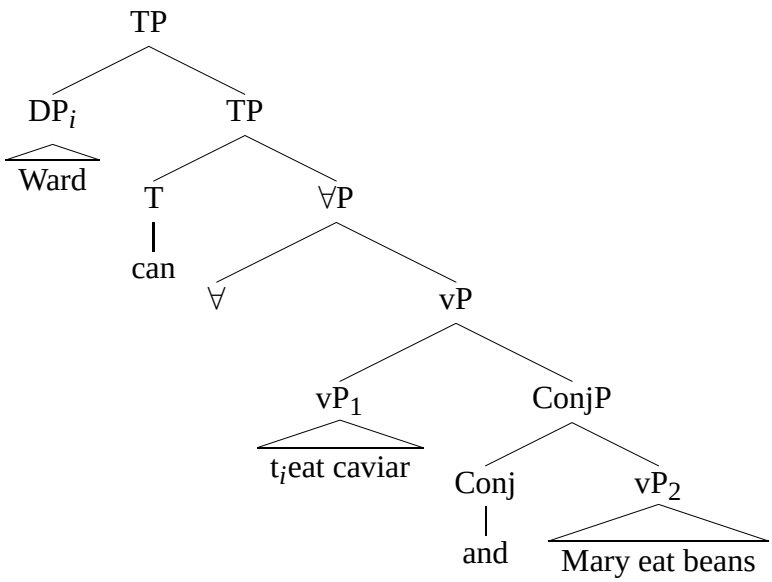
a. It is possible that some eat caviar while others eat beans. (can > and)

b. Some can eat caviar and others can eat beans. (and > can)

3.5.3.1 Wide scope of the modal

To derive a wide scope reading of the modal, universal closure operation should apply before the modal verb enters the derivation (3.45).

(3.45)



(3.46) a. $[\![vP_1]\!]$ = {Ward eat caviar}; $[\![vP_2]\!]$ = {Mary eat beans}

b. $[\![vP_1 and vP_2]\!]$ = {Ward eat caviar, Mary eat beans}

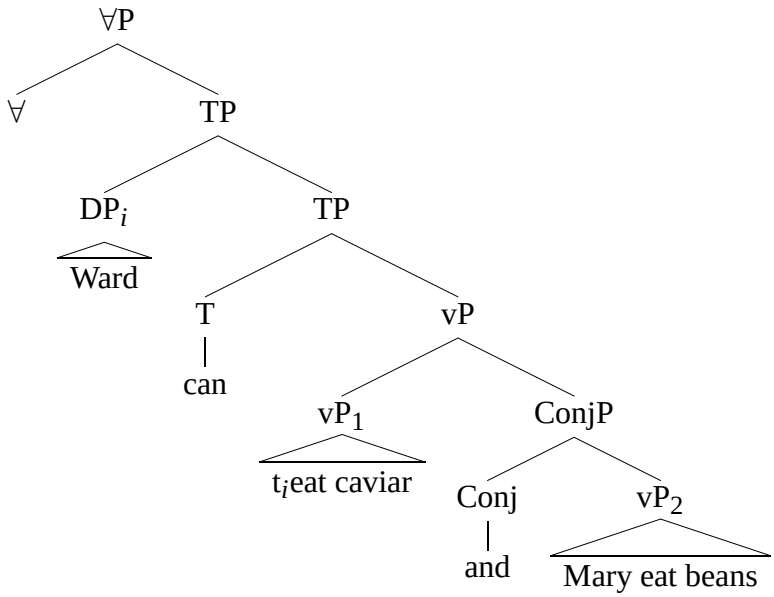
c. $[\![\forall(vP_1 and vP_2)]\!] = \{\lambda w.\forall p[p \in \{\text{Ward eat caviar, Mary eat beans}\} \rightarrow p(w)]\}$

d. $[\![can\forall(vP_1 and vP_2)]\!] = \{\lambda w.\forall w'[w' \in D_w \rightarrow \{\lambda w''.\forall p[p \in \{vP_1, vP_2\} \rightarrow p(w'')]\}(w')]\}$
= 1 iff it is possible that every proposition {Ward eat caviar, Mary eat beans} is true.

3.5.3.2 Narrow scope of the modal

We derive a narrow scope reading of the modal by applying the modal verb first and the universal closure operation afterwards (3.47).

(3.47)



(3.48) a. $[\![vP_1]\!]$ = {Ward eat caviar}; $[\![vP_2]\!]$ = {Mary eat beans}

b. $[\![vP_1 and vP_2]\!]$ = {Ward eat caviar, Mary eat beans}

c. $[\![can(vP_1 and vP_2)]\!] = \{\lambda w.\forall w'[w' \in D_w \rightarrow vP_1(w')], \lambda w.\forall w'[w' \in D_w \rightarrow vP_2(w')]\}$

d. $[\![\forall(can(vP_1) and can(vP_2))]\!] = \{\lambda w''.\forall p[p \in \{\lambda w.\forall w'[w' \in D_w \rightarrow vP_1(w')], \lambda w.\forall w'[w' \in D_w \rightarrow vP_2(w')]\}$ & $p(w'')]\}$
= 1 iff every propositions in the set (Ward eat caviar, Mary eat beans) is true.

Now we can turn to the second puzzling question why there is narrow scope reading of modals in gapping with conjunction in Russian, but not in English. I attribute the cross-linguistic variation to the selectivity property of conjunctions.

3.5.4 Selectivity

In the paper on indeterminate pronouns Kratzer and Shimoyama (2002) emphasize that cross-linguistic variation in indeterminate pronouns can be explained with the help of selectivity. On this proposal, the German indeterminate pronoun *irgendein* 'someone' is selective. It has an uninterpretable feature [∃], which has to be checked against its interpretable counterpart. In case of *irgendein*, it has to be an existential quantifier. On the other hand, its Japanese counterpart does not have such an uninterpretable feature. It is not selective. The corresponding Japanese indeterminate

pronoun gets its existential or universal interpretations depending on the operator it encounters on its way (for more details see Kratzer and Shimoyama, 2002).

In this section, I adopt the selectivity approach to cross-linguistic variation and claim that conjunction and disjunction can be selective. In the following, I lay out details of the selectivity approach to cross-linguistic variation in indeterminate pronouns. Then, I extend the approach to coordination. On this approach, conjunction in English has an uninterpretable feature [∀] which has to be checked against its interpretable counterpart, such as a universal quantifier. In Russian, conjunction has an uninterpretable feature [Asp], which has to be checked against an 'inflectional category', such as aspect. The proposed analysis further supports "the no variation hypothesis" (Matthewson, 2001), which claims that no crosslinguistic variation occurs in semantics; rather all languages share certain basic semantic structures.

3.5.4.1 Indeterminate phrases can be selective

In the paper on indeterminate pronouns, Kratzer and Shimoyama (2002) attribute the difference in distribution between the Japanese and German indeterminate phrases to the selectivity property. In German, the indeterminate pronoun *irgenein* 'someone' is selective. It carries an uninterpretable feature [∃] that has to be checked against its interpretable counterpart such as an existential operator. It cannot associate with the universal, question or, what they call, inflectional negation operators, but only with the existential operator. The sentence with *irgendein* in (3.49) has the readings in (3.49a) and (3.49b) but not in (3.49c).

(3.49) **Irgendeins** von diesen Kindern kann sprechen.
irgend-one of these children can talk

a. One of those children can talk (the speaker doesn't know or care which one it is).
b. One of those children is allowed to talk (any one is a permissible option).
c. * Any one of those children can talk (in the sense of 'any one of those children has the ability to talk.')

(3.49c) has a generic reading triggered by the presence of a universal operator, but *irgendein* cannot associate with it. Similarly, the indeterminate pronoun cannot associate with the inflectional

negation ‘nicht’ (3.50a) or the question word ‘ob’ (3.50b).

(3.50) a. * Ich hab’ nicht **irgendwas** gelesen.
I have not irgend-what read
‘I didn’t read anything.’

b. Der Lehrer hat gefragt, ob Hans **irgendein** Buch gelesen hat.
the teacher has asked whether Hans irgend-one book read has
‘The teacher asked whether Hans read any book.’
Impossible reading: The teacher asked whether {Hans read book a, Hans read book b, Hans read book c, . . . etc. for all books in the universe of discourse}

The indeterminate pronoun *irgendein* can associate with a negative quantifier, which closes its scope existentially. Compare (3.50a), which is ruled out, and the grammatical (3.51).

(3.51) Niemand musste **irgendjemand** einladen.
nobody had irgend-one invite
‘Nobody had to invite anybody.’

In Japanese, indeterminate pronouns do not have any uninterpretable features. They are not selective. A pronoun gets its interpretation depending on the operator it encounters on its way, as schematized in (3.52).

(3.52) [indeterminate pronoun]-ka/-mo,
where -ka is a *wh*-question and -mo is a universal quantifier

On this approach, there is no need to provide different semantics for the English and Japanese indeterminate pronouns relation between the indeterminate pronoun and its operator can now be viewed as feature movement that obeys syntactic constraints. Here is an example at work.

(3.53) Der Lehrer hat gefragt, ob Hans **irgendein** Buch gelesen hat.
the teacher has asked whether Hans irgend-one book read has
‘The teacher asked whether Hans read any book.’

a. **irgendein** stays within the domain of ∃ within the **ob**-clause
b. ***irgendein** scopes over ∃, but stays within the **ob**-clause
c. ***irgendein** scopes out of the **ob**-clause
d. *the alternatives created by **irgendein** expand beyond ∃

On the current approach, (3.53b) is ruled out because of the feature clash with [Q]. (3.53c) violates scope constraints, and (3.53d) can't happen because the expanding alternatives are caught by ∃. Let's now turn to conjunctions.

3.5.4.2 Conjunctions can be selective

I adopt the selectivity approach to cross-linguistic variation and claim that in English and Russian coordinators are selective. In English, *and* has an uninterpretable feature [∀] and associates with a universal operator. Disjunction has an uniterpretable feature [∃] and associates with an existential operator.

(3.54) a. John is (both) laughing and crying.
b. John is (either) laughing or crying.

The selectivity approach predicts different coordinators to have distinct selection features. The prediction is born out (3.55).

(3.55) a. *John is either laughing and crying.
b. *John is both laughing or crying.

Conjunction cannot associate with the existential quantifier *either*, and vice versa disjunction cannot associate with the universal quantifier *both*.

It also cannot appear within the scope of a negative quantifier *neither* which closes its scope with [∃], as shown in (3.56).

(3.56) a. John is laughing and crying.
b. *John is neither laughing and crying.

We conclude that in English conjunction has an uninterpretable [∀] feature, which has to be checked against an interpretable feature carried by a universal operator such as *both*.

We claim that in Russian *a* has uninterpretable ∀ feature which has to be checked by an operator. However, Russian differs from English in that *a* checks its feature against an 'inflectional category' such as aspectual operator (e.g. generic aspect, which carries ∀ or an aspectual verb that carries ∀ (cf. Schmitt, 1996)). For instance, the sentence in (3.57) has generic reading.

(3.57) Petja umeet pet', a Vanja tancevat'.
Petja can to-sing and Vanja to-dance
'Petja knows how to sing and Vanja knows how to dance.'

On the other hand, *a* in (3.58) cannot associate with the universal quantifier *every morning*, as the reading in which universal closes the set of alternatives is not possible.

(3.58) Petja$_i$ moğet kağdoe utro [t$_i$ pet', a Vanja tancevat'].
Petja can every morning to-sing and Vanja to-dance
Impossible reading: It is possible that every morning Petja sings and Vanja dances.

In the following sentence, both verbs are aspectual verbs but they rather correspond to an existential quantifier (Schmitt, 1996). As a result, the sentence does not have a wide scope reading of the modal. Only aspectual verbs that introduce universal quantifiers can associate with *a*.

(3.59) Petja moğet **spet'**, a Vanja **stancevat'**.
Petja can sing and Vanja dance
Impossible reading: Petja can sing while Vanja dances.'

a cannot associate with [Q], as shown in (3.60).

(3.60) * Petja ne znaet kak pet', a Vanja tancevat'.
Petja not know how to-sing and Vanja to-dance
'Petja does not know how to sing and Vanja does not know how to dance.'

a cannot associate with [Neg] or a negative operator such as *never* that carries [∃].

(3.61) a. Petja$_i$ moğet ne [t$_i$ pet', a Vanja tancevat'].
Petja allowed not sing and Vanja dance
Impossible reading: Petja is allowed not to sing and Vanja is allowed not to dance.
b. Petja nikogda [ne poet, a Vanja ne tancuet].
Petja never not sing and Vanja not dance
Impossible reading: It is never the case that Petja sings and Vanja dances.'

3.5.5 Explaining differences in interpretation

We now can turn to the question why there is no wide conjunction reading in English but there is wide conjunction reading in Russian. The difference is in the different selection properties. In English, *and* selects for interpretable feature [∀] carried by a universal quantifier, whereas in

Russian, *a* selects for [∀] carried by an 'inflectional category' such as aspect. The way the features interact with corresponding operators determines the distribution. Let's take a look at the English example first.

(3.62) Ward can't ∀ **both** eat caviar and his guest eat dried beans.

(3.63) *Ward ∃ **both** can't ∀ eat caviar and his guest eat dried beans.

(3.64) *$\forall_{GEN}$ Both Ward can't ∀ eat caviar and his guest eat dried beans.

a. *and* stays within the domain of **both** (wide scope reading of the modal)
b. *and* scopes over the modal (narrow scope reading of the deontic modal)
c. alternatives created by *and* expand beyond **both** (narrow scope reading of the epistemic modal)

The only possible reading is (3.62) where *and* stays within the scope of ∀. (3.63) is a feature clash with [∃] carried by tense or negation. (3.64) is ruled out because expanding alternatives are caught by ∀. Similarly, we derive the readings in Russian.

(3.65) Odni mogut [Asp] est' ikru, a drugie est' boby.
Some can eat caviar and others eat beans
'Some can eat caviar and others eat beans.'

(3.66) Odni [Asp] mogut est' ikru, a drugie est' boby.
Some can eat caviar and others eat beans
'Some can eat caviar and others eat beans.'

(3.67) [Gen] Odni mogut est' ikru, a drugie est' boby.
Some can eat caviar and others eat beans
'Some can eat caviar and others eat beans.'

a. *a* stays within the domain of aspect (wide scope reading of the modal)
b. *a* scopes over the modal (narrow scope reading of the deontic modal)
c. alternatives created by *a* expand beyond ∀ carried by aspect (narrow scope reading of the epistemic modal)

The possible reading in (3.65) is the result of *a* occurring within the scope of ∀ carried by aspect. In (3.66), *a* scopes over the modal but is caught by ∀ carried by generic aspect. Finally, in (3.67) alternatives expand until they are caught by generic aspect.

3.6 Some implications: The homophony puzzle

In English, both *and* and *or* can be omitted in coordinate structures with more than two elements (3.68).

(3.68) a. John, Bill and Mary left.
b. John, Bill, or Mary left.

On the standard semantic approach to coordination, coordinator omission with both *and* and *or* results in a homophony puzzle. According to the standard approach, the natural language coordinators *and* and *or* denote two different logical connectives. On this view, we have to postulate that there are actually two distinct omitted coordinators: one a conjunction, and the other a disjunction (3.69).

(3.69) a. John $\varnothing_{and}$ Bill and Mary left.
b. John $\varnothing_{or}$ Bill or Mary left.

Such a claim, however, is problematic. First, we will have to somehow ensure that the omitted coordinator that is a conjunction can't ever occur when the overt coordinator is a disjunction, and vice versa. In other words, we will have to ensure that the following holds.

(3.70) a. John $\varnothing_{and}$/*$\varnothing_{or}$ Bill and Mary left.
b. John $\varnothing_{or}$/*$\varnothing_{and}$ Bill or Mary left.

Second, coordinator omission occurs in many different languages (Haspelmath, 2004). We will have, then, to explain why the accidental homophony between two distinct omitted coordinators holds for a bunch of different languages. If we adopt a Hamblin semantics (Hamblin, 1973; Kratzer and Shimoyama, 2002) for both conjunction and disjunction, we void the need to postulate two homophonous unpronounced coordinators. On this approach, all coordinators are treated in the same way, so that and, or, and $\varnothing$ form alternative sets.

(3.71) a. $[\![AandB]\!] = \forall x.x \in \{A, B\}$
b. $[\![AorB]\!] = \exists x.x \in \{A, B\}$
c. $[\![A\varnothing B]\!] = \{A, B\}$

For disjunction, alternatives are independently motivated (Alonso-Ovalle, 2006). Using alternatives for disjunction requires only changing the nature of the quantifier. Disjunction can thus be interpreted as existential quantification over alternatives. For conjunction, the quantification is universal. The omitted coordinator will always do precisely the same thing. It will form alternative sets. The approach treating a coordinator as forming alternative sets voids the problems we encounter on the standard semantic approach to coordinators.

3.7 Summary and outlook

We started with addressing the interpretation puzzle in Russian gapping constructions. We have shown that gapping in Russian shares several properties with gapping in English. We have extended the small conjunct approach to gapping in Russian and argued for a unified analysis for gapping cross-linguistically. We have proposed a Hamblin semantics for conjunction. We extended the proposal to coordination in Russian. To account for the difference between English and Russian, we proposed that conjunctions can be selective in a way that they carry uninterpretable features corresponding to the interpretable features on operators. In English, *and* has an uninterpretable feature [$\forall$] which has to be checked by its interpretable counterpart such as the universal quantifier. In Russian, *a* has also an uninterpretable feature [$\forall$], but it has to be checked against an 'inflectional category' such as aspect. The interaction between the features and corresponding operators is subject to syntactic constraints. The latter explains why there is no wide scope conjunction reading in English. One implication of the proposal is that it naturally accounts for the homophony puzzle. The analysis predicts that omitted coordinators are coordinators that are not specified or underspecified for selective features. On the current proposal, the difference between disjunction and conjunction in English and cross-linguistically is determined by selectivity. It is interesting to see how the proposal can derive distribution facts in disjunction and conjunction outside of gapping. We address this question in the near future.

Chapter 4

SCOPE AMBIGUITY AND MINIMALIST GRAMMARS

One of the key problems in computational linguistics is resolving linguistic ambiguities of all kinds. This chapter addresses a computational aspect of scope ambiguity in coordinate structures. I adopt a Minimalist Grammars formalism (Stabler, 1997; Stabler and Keenan, 2003; Kobele, 2006) to derive scope ambiguities and suggest a new explanation of scope effects in coordinate structures.

4.1 Introduction

A key task of computational linguistics is to resolve various kinds of ambiguities, e.g., lexical ambiguities, scope ambiguities, structural ambiguities, and attachment ambiguities. Ambiguities in natural language create possible readings which can grow exponentially.[1] For example, the sentence in (4.1) has two scope elements, i.e. two quantifiers *something* and *everyone*. The sentence allows for 2! (two factorial) possible readings which equal to narrow (surface scope) and wide (inverse scope) scope readings of the object, paraphrased in (4.1a) and (4.1b).

(4.1) Something devoured everyone.
   a. There is something that devoured everyone. (something $>$ everyone)
   b. For each person, there is something that devoured him. (everyone $>$ something)

One way to deal with ambiguities in natural language when processed by a man or a machine is to enumerate all possible interpretations first and test their acceptability afterwards. However, the exponential growth of alternative readings makes such an approach inefficient and often infeasible.

Recently, other formalisms have been introduced to deal with ambiguities in natural language (e.g. Alshawi, 1990; Geurts and Rentier, 1993; Reyle, 1993; Bos, 1996; Muskens, 1999; Egg et al.,

[1] A sentence containing n scope bearing elements which are freely permutable will have $n!$ possible readings. A set of m such sentences will have $(n!)^m$ possible readings.

2001; Erk, 2002; Copestake et al., 2005). Common to all these formalisms is the use of underspecification techniques, which avoid the problem of exponential alternatives. The main idea underlying underspecification is to derive a single (constrained) description[2] of all readings instead of generating all possible readings. In this chapter, I address scope ambiguity in coordination. I adopt a Minimalist Grammars formalism (Stabler, 1997; Stabler and Keenan, 2003; Kobele, 2006), which uses underspecification in semantic representations. I use the formalism to account for different readings in gapping constructions with disjunction embedded under a modal verb. I extend the coverage of the approach to other scope ambiguity cases in disjunction.

The chapter is organized as follows. Section 4.2 discusses present underspecification techniques which deal with scope ambiguity. Section 4.3 introduces a Minimalist Grammars formalism and direct compositionality. A scope ambiguity puzzle in coordination and a solution to the puzzle within the Minimalist Grammars formalism are presented in section 4.4. Section 4.5 concludes.

4.2 Approaches to scope ambiguity

4.2.1 What is scope ambiguity?

Resolving scope ambiguities is a core task of computational linguistics. The main issue that arises from scope ambiguity is that there is no one to one relation between syntax and semantics. For instance, the sentence in (4.2) has two interpretations, which correspond to the narrow (4.2a) and wide (4.2b) scope readings of the object *a girl*. In (4.2), multiple truth conditions arise from a single surface form.

(4.2) Every boy adores a girl.
  a. For each boy there is some girl that he adores. (every $>$ a)
  b. There is a girl that every boy adores. (a $>$ every)

There are three principal ways to deal with the mismatch issue. One way is to assume a nondeterministic one-to-one mapping between syntax and semantics (Cooper storage approaches

[2] A description here is understood as a set of logical sentences.

(Cooper, 1983)). Another way is to assume a different syntactic structure for each reading.[3] In the generative grammar (Chomsky, 1965, 1995; May, 1985; Hornstein, 1995) scope ambiguity is resolved at level of logical form (LF), a syntactic level of representation that mediates between surface syntax and truth-conditional semantics. In the example (4.2), the single surface syntactic structure maps onto more than one possible LF structure, as shown in (4.3). Multiple LFs lead to multiple distinct interpretations of the sentence.

(4.3) Every boy adores a girl.
  a. LF_1: [every boy_i [a $girl_j$ [$_{XP}$ t_i adores t_j]]]
  b. LF_2: [a $girl_j$ [every boy_i [$_{XP}$ t_i adores t_j]]]

Finally, there is one semantic representation for one syntactic structure (Underspecified Discourse Representation Theory (UDRT) (Reyle, 1993), Minimal Recursion Semantics (Copestake et al., 2005), Constraint Language for Lambda Structures (Egg et al., 2001)).

Any method to treat the syntax-semantics mismatch in ambiguous structures outputs multiple interpretations. As mentioned in the introduction, the way of dealing with scope ambiguities in natural language by enumerating all possible interpretations first and testing their acceptability afterwards is inefficient and often infeasible due to the exponential growth of alternative readings. Another solution to the problem is to employ underspecification. Recently, several formalisms using underspecification techniques have been introduced to deal with scope ambiguities in natural language, including Quasi Logical Form (Alshawi, 1990), Underspecified Logical Form (Geurts and Rentier, 1993), Underspecified Discourse Representation Theory (Reyle, 1993), Hole Semantics (Bos, 1996), Description Theory (Muskens, 1999), Constraint Language for Lambda Structures (Egg et al., 2001), and Minimal Recursion Semantics (Copestake et al., 2005). The use of underspecification techniques – common to all these formalisms – permits to avoid the problem of exponential alternatives. Instead of generating all possible readings, using underlying underspec-

[3]It is still debatable whether a sentence's surface structure maps directly onto a semantic representation or whether some linguistic level of representation, such as LF, intervenes between the surface form and the interpretation of a sentence. Hale (2007), for example, argues that the parser need not construct logical forms. In this chapter, I do not defend or object to logical forms.

ification one can derive a single (constrained) description. In the following subsection, I briefly discuss computational techniques which employ underspecification in semantic representations to deal with scope ambiguity.

4.2.2 Underspecification techniques

In this subsection, I survey[4] underspecification techniques. Then, I introduce a Minimalist Grammars formalism and direct compositionality that uses underspecification in semantic representations. I adopt the formalism to account for scope ambiguities in coordination.

4.2.2.1 Parsing with logical forms

Several underspecification techniques use an intermediate level of representation in their set-up. In particular, they use Logical Forms to resolve scope ambiguity (e.g., Quasi Logical Forms (Alshawi, 1990), Underspecified Logical Forms (Geurts and Rentier, 1993), Description Theory (Muskens, 1999).) Logical Form is a level of representation at which all grammatical structure relevant to semantic interpretation is provided (Hornstein, 1995). Let's consider the Description Theory approach (Muskens, 1999) – one of the techniques that uses Logical Forms to resolve scope ambiguity.

The sentence in (4.4) has two scope-taking elements: *every* and *a*, where the object *a girl* can take wide or narrow scope with respect to the subject *every boy*.

(4.4) Every boy adores a girl.
  a. There is a girl that every boy adores. (a $>$ every)
  b. For each boy there is some girl that he adores. (every $>$ a)

The Description Theory employs descriptions to represent a sentence. A description is a set of atomic (logical) sentences. It specifies a certain collection of nodes, referred to with the constants $n_1, \ldots, n_k$. The nodes are labeled *s*, *np*, *vp*, etc., and stand in certain relations, such as *proper*

[4]See Bunt (2007) for an overview of various underspecification techniques.

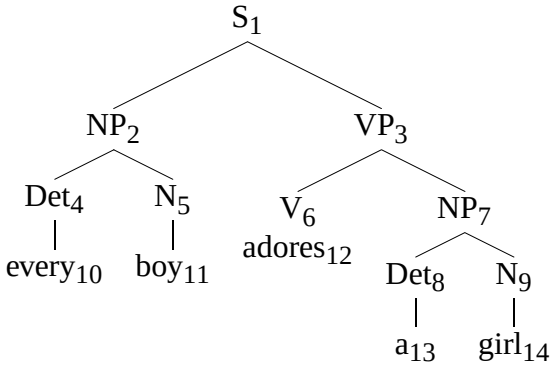
dominance ($\lhd^+$) and *precedence* ($\prec$). The sentence in (4.4) can be represented as a description in (4.5).

(4.5)

$n_1 \lhd^+ n_2$	$n_5 \lhd^+ n_{11}$	$lab(n_1, s)$	$lab(n_{10}, every)$
$n_1 \lhd^+ n_3$	$n_6 \lhd^+ n_{12}$	$lab(n_2, np)$	$lab(n_{11}, boy)$
$n_2 \lhd^+ n_4$	$n_8 \lhd^+ n_{13}$	$lab(n_3, vp)$	$lab(n_{12}, adores)$
$n_2 \lhd^+ n_5$	$n_9 \lhd^+ n_{14}$	$lab(n_4, det)$	$lab(n_{13}, a)$
$n_3 \lhd^+ n_6$	$n_2 \prec n_3$	$lab(n_5, n)$	$lab(n_{14}, girl)$
$n_3 \lhd^+ n_7$	$n_4 \prec n_5$	$lab(n_6, v)$	
$n_7 \lhd^+ n_8$	$n_6 \prec n_7$	$lab(n_7, np)$	
$n_7 \lhd^+ n_9$	$n_8 \prec n_9$	$lab(n_8, det)$	
$n_4 \lhd^+ n_{10}$		$lab(n_9, n)$	

The description in (4.5) indicates, for example, that the S node n_1 properly dominates the NP node n_2 and the VP node n_3. The constants *every*, *boy*, *adores*, etc., refer to the lexical items which label certain nodes. We can give the description in (4.5) a more convenient graphical representation as in (4.6).

(4.6)

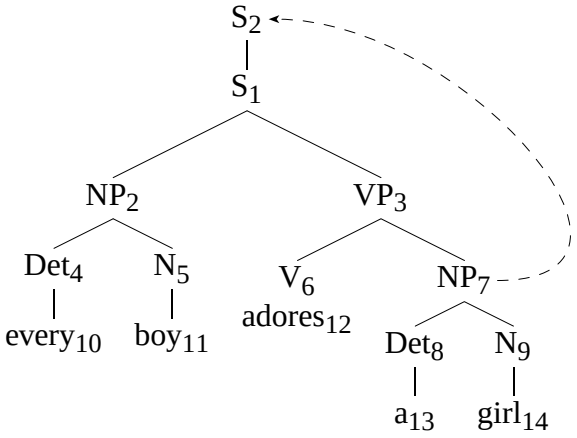


Here every subscript represents a constant (e.g. the subscript 2 in NP_2 refers to n_2), every arc represents a proper dominance statement (e.g. $n_1 \lhd^+ n_3$), every left-right ordering of sisters corresponds to a precedence statement (e.g. $n_2 \prec n_3$), and every category label or lexical element represents a *lab* statement ($lab(n_3, vp)$, $lab(n_{10}, every)$).

By the Description Theory, sentence interpretation is mediated by Logical Forms (LFs) which are connected with a certain description. LFs are levels of representation which then get interpreted. According to this approach, each quantified NP licenses an extra node, which is labeled with S and is placed above the surface S node. The extra *S* node corresponds to the place where the NP is quantified-in. This is formalized as a link between a quantified NP and a non-surface S

node k_i. The NPs remain in situ and the linking arrows tell where quantifying-in takes place. In the example (repeated in 4.7), wide scope reading of the object *a girl* can be formalized as $link(n_7, k_2)$. The corresponding LF is given in (4.7b).

(4.7) a. Every boy adores a girl.

b. 

By this reasoning, the description in (4.5) is underspecified for its Logical Forms. The Description Theory parser does not generate either of the readings. Instead it provides a description which is true of both.

This example shows how descriptions with LFs can provide a better way of representing scope ambiguity. However, Hale (2007) argues that the use of logical forms in a parser may not be efficient. For this reason a number of alternative undespecification techniques that do not use LFs but compositionally derive the meaning can be used (Hole Semantics (Bos, 1996), Constraint Language for Lambda Structures (Egg et al., 2001; Erk, 2002), Minimalist Grammars and direct compositionality (Kobele, 2006)).

4.3 Interpretation and Minimalist Grammars

In this section, we introduce a grammar formalism – Minimalist Grammars (Stabler, 1997; Stabler and Keenan, 2003; Kobele, 2006). We adopt this grammar formalism to derive scope ambiguities and suggest a new explanation of scope effects in coordinate structures.

4.3.1 Minimalist Grammars: A formal definition

Minimalist Grammars (MGs) is a grammar formalism that relies on a generative approach to language (Chomsky, 1965, 1995, 2004). An MG is a five-tuple[5] G = (Σ, F, *Types*, *Lex*, $\digamma$), which consists of an alphabet, a set of features, categorial types, a lexicon and two generating functions – *merge* and *move*. (4.8) provides a formal definition of MGs (from Stabler and Keenan, 2003, p. 346).

(4.8) **Definition.** *A Minimalist Grammar* G = (Σ, F, *Types*, *Lex*, $\digamma$), where
Alphabet $\Sigma \neq \emptyset$
Features F = base (basic features, $\neq \emptyset$)
$\cup\{= f \mid f \in \text{base}\}$ (selection features)
$\cup\{+ f \mid f \in \text{base}\}$ (licensor features)
$\cup\{- f \mid f \in \text{base}\}$ (licensee features)
Types = {::, :} (lexical, derived)
Lexicon *Lex* $\subseteq C^+$ is a finite subset of $\Sigma^* \times \{::\} \times F^*$.
Generating functions $\digamma$ = {*merge*, *move*}, partial functions from E^* to E.

The deduction rules for the *merge* and *move* functions are given in (4.9) and (4.10), respectively (from Stabler and Keenan, 2003, p. 347).

(4.9) *merge*:$(E \times E) \to E$ is the union of the following three functions, for $s, t \in \Sigma^*$, $\cdot \in \{:, ::\}$, $f \in$ *base*, $\gamma \in F^*$, $\delta \in F^+$, and *chains* $\alpha_1, \ldots, \alpha_k$, $\iota_1, \ldots, \iota_l$ $(0 \leq k, l)$

a. $\dfrac{s ::= f\gamma \quad t \cdot f, \alpha_1, \ldots, \alpha_k}{st : \gamma, \alpha_1, \ldots, \alpha_k}\, merge1$ (concatenation of the strings)

b. $\dfrac{s := f\gamma, \alpha_1, \cdot, \alpha_k \quad t \cdot f, \iota_1, \ldots, \iota_l}{ts : \gamma, \alpha_1, \ldots, \alpha_k, \iota_1, \ldots, \iota_l}\, merge2$ (concatenation of the strings)

c. $\dfrac{s\cdot = f\gamma, \alpha_1, \cdot, \alpha_k \quad t \cdot f\delta, \iota_1, \ldots, \iota_l}{s : \gamma, \alpha_1, \ldots, \alpha_k, t : \delta, \iota_1, \ldots, \iota_l}\, merge3$ (empty string concatenation)

(4.10) *move*:$E \to E$ is the union of the following two functions, for $s, t \in \Sigma^*$, $f \in$ *base*, $\gamma \in F^*$, $\delta \in F^+$, and *chains* $\alpha_1, \ldots, \alpha_k$, $\iota_1, \ldots, \iota_l$ $(0 \leq k, l)$; none of $\alpha_1, \ldots, \alpha_{i-1}, \alpha_{i+1}, \ldots, \alpha_k$ has $-f$ as its first feature (the shortest move condition)

a. $\dfrac{s : +f\gamma, \alpha_1, \ldots, \alpha_{i-1}, t : -f, \alpha_{i+1}, \ldots, \alpha_k}{ts : \gamma, \alpha_1, \ldots, \alpha_{i-1}, \alpha_{i+1}, \ldots, \alpha_k}\, move1$

[5] A tuple is an ordered list of elements.

b. $$\frac{s : +f\gamma, \alpha_1, \ldots, \alpha_{i-1}, t : -f\delta, \alpha_{i+1}, \ldots, \alpha_k}{s : \gamma, \alpha_1, \ldots, \alpha_{i-1}, t : \delta, \alpha_{i+1}, \ldots, \alpha_k} \textit{move}2$$

Language $L(G)$ = closure(*Lex*, F). For any f $\in F$, the strings of category f, $S_f(G) = \{s | s \cdot \text{f} \in L(G)$ for some $\cdot \in Types\}$.

MGs generate tuples of categorized strings or 'chains'. A chain has a type and features such that *Chains* $C = \Sigma^* \times Types \times F^*$. A sequence of chains forms an expression such that *Expressions* $E = C^+$. Each expression is nonempty and finite.

4.3.2 Minimalist Grammars: An example

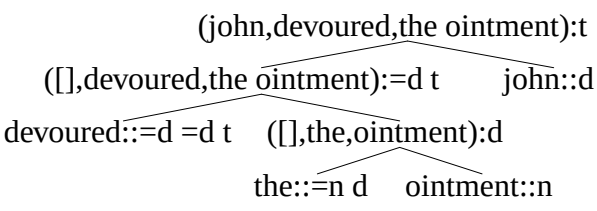
In MGs expressions are built by the *merge* and *move* operations. The two operations are feature-driven. As an example, consider a transitive sentence (Kobele, 2006, p. 22) and a MG for this sentence (4.11b).

(4.11) a. John devoured the ointment.

b. john::d devoured::=d, =d, t
the::=n, d ointment::n

In (4.11a), *john*, *devoured*, *the*, and *ointment* are lexical items, which we combine to build a complex expression or a sentence. Each lexical item has *categorial* (f) and *selection* (=f) features. The noun *ointment* has the categorial feature of a noun *n*; *john* and *the* have the categorial feature of a determiner *d*; the verb *devoured* has the categorial feature of being a tense phrase *t*. In the example, only *the* and *devoured* have selection features. Selection features indicate that a lexical item requires another lexical item with a particular property. Whereas *the* selects for a noun, the verb *devoured* selects for two determiners. (4.12) is a derivation of the example sentence with the MG (4.11b), which shows how the selection features are checked in the derivation process.

(4.12)

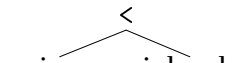


Now, let's take a look at another example, which involves the *move* operation (4.10). (4.13a) is an intransitive sentence with a MG in (4.13b).

(4.13) a. John arrived.
b. john::d, -k arrive::=d, v '-ed'::=v, +k, t

The following derivation steps are involved in building the sentence. First, we merge *John* and *arrive* as in (4.14). The label > indicates the head of the expression (the verb *arrive*) by pointing toward it.

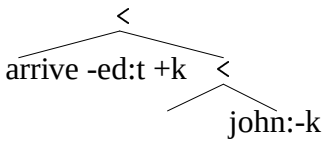
(4.14)



arrive:v john:-k

Then, we merge the derived expression (4.14) with a tense head (4.15).[6]

(4.15)

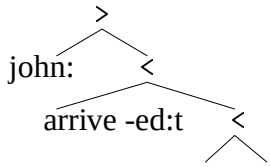


arrive -ed:t +k >

john:-k

Notice, that both the tense head and *John* are marked for features that initiate movement. The tense head has the +k feature, which licenses movement (the licensor). The proper name *John*, on the other hand, has the -k feature (the licensee), which triggers movement of the DP as soon as the licensor feature is available. The next step in the derivation brings *John* into SpecTP position by movement operation and checks the -k feature on the subject DP as shown in (4.16).

(4.16)

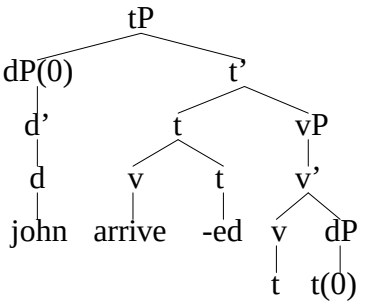


john: >

arrive -ed:t >

A more traditional tree view is provided in (4.17).

[6]There is a head movement of *arrive* to the tense head of the TP. For more details regarding the head movement see Kobele (2006).



(4.17)

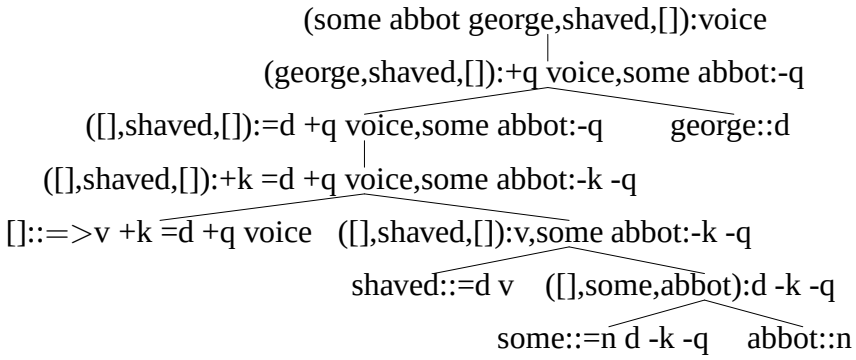
4.3.3 Direct compositionality and MGs

A version of MGs proposed in Kobele allows for direct compositionality of derivation trees. According to this approach, items are interpreted as they move through the derivation, including their intermediate positions. The idea is implemented by associating a semantic value with each feature of an expression. Objects are interpreted as each feature is checked. As an example, consider the following sentence in (4.18a) and a MG for the sentence (Kobele, 2006, p. 75).

(4.18) a. George shaved some abbot.

b. george::d some::=n d -k -q abbot::n
shaved::=d v ε::$\Rightarrow$v +k =d +q voice

The sentence has the derivation in (4.19), which shows checking of relevant features in the derivation process.



(4.19)

The following modes of semantic combination (4.20), associated with the *merge* and *move* operations, are used to provide direct compositional semantics of expressions (Kobele, 2006).

(4.20) a. $[\![merge(\alpha,\beta)]\!] \rightarrow [\![\alpha]\!]([\![\beta]\!])$ (FA)

b. $[\![merge(\alpha,\beta)]\!] \rightarrow [\![\beta]\!]([\![\alpha]\!])$ (BA)

c.	$[\![merge(\alpha,\beta)]\!] \rightarrow [\![\alpha]\!]([\![\beta]\!])$	$store(\alpha)^\frown store(\beta)$	(FA)
d.	$[\![merge(\alpha,\beta)]\!] \rightarrow [\![\beta]\!]([\![\alpha]\!])$	$store(\alpha)^\frown store(\beta)$	(BA)
e.	$[\![merge(\alpha,\beta)]\!] \rightarrow [\![\alpha]\!](x_i)$	$store(\alpha)^\frown G([\![\beta]\!])(\lambda_i)^\frown store(\beta)$	(Store)
f.	$[\![move(\alpha)]\!] \rightarrow [\![\alpha]\!]$	$store(\alpha)$	(Id)
g.	$[\![move(\alpha)]\!] \rightarrow Q([\![\alpha]\!])$	$store(\alpha) - Q$[7]	(Retrieve)

The derivation proceeds as follows. First, we merge *some* and *abbot*. The denotation of the noun applies (by function application (4.20a)) to the function denoted by the determiner, resulting in **some(abbot)**. Next, we merge *shave* with *some abbot*. The denotation of *shave* (a function from individuals to predicates) cannot combine with the denotation of *some abbot* (a function from predicates to assignments). To tackle the problem Kobele (2006) suggests to use some storage mechanism (similar to Cooper, 1983) by feeding a variable to the denotation of the verb and storing the meaning of the DP for later interpretation (4.20e). The resultant denotation of the VP *shave some abbot* is **shave**($\mathbf{x}_0$) with the function **G**(**some**(**abbot**))(λ_0) in store. Then, we merge the voice head ε::⇒`v +k =d +q voice` with the VP (4.20d). Now, *some abbot* moves to check its case feature -k (4.20f). The stored meaning is not retrieved at this point. The subject *george* is merged next (4.20d). The result of the subject merge is the set of assignments **shave**($\mathbf{x}_0$)(**g**), with stored **G**(**some**(**abbot**))(λ_0). Now, *some abbot* moves to check its -q feature (4.20g). We retrieve the stored meaning of the DP and apply the set of assignments **shave**($\mathbf{x}_0$)(**g**) to the stored **G**(**some**(**abbot**))(λ_0) as in (4.21).

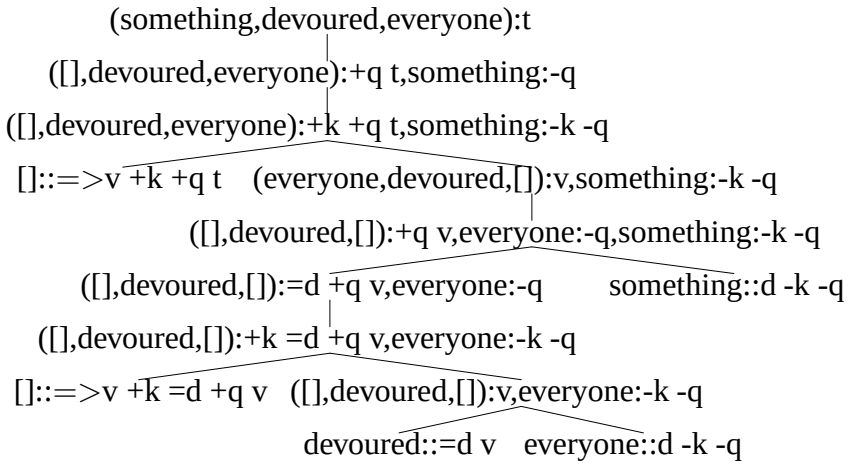
(4.21) **G**(**some**(**abbot**))(λ_0)(**shave**($\mathbf{x}_0$)(**g**)) = **some**(**abbot**)(λ_0(**shave**($\mathbf{x}_0$)(**g**))) = {h: for some f ∈ [G → E], g shaved $f(h)$ and $f(h)$ is an abbot}

Another relevant example involves quantifier scope interaction (Kobele, 2006, p. 80) and introduces the notion of the underspecified semantic representation in MGs. The sentence in (4.22) is ambiguous between the wide and narrow scope reading of the subject with respect to the object.

(4.22) Something devoured everyone.
  a. There is something that devoured everyone. (something > everyone)
  b. For each person, there is something that devoured him. (everyone > something)

[7] Where Q is the stored meaning of the moving constituent.

The sentence has the single derivation as in (4.23).



(4.23)

The derivation in (4.23) is a underspecified semantic representation of the two possible readings of the sentence. We calculate the narrow scope reading of the subject as follows. First, we merge *devour* (a function from individuals to predicates) and *everyone* (a function from predicates to assignments) by function application and store the denotation of *everyone* (4.20e). The resultant denotation of the VP *devour everyone* is **devour**($\mathbf{x}_0$) with the function **G**(**everyone**)(λ_0) in store. Next, we merge (by function application (4.20c)) the voice head with the derived expression. We then move *everyone* to check its -k feature without retrieving its denotation from the store (4.20f). In the next step, we merge *someone*. Now, we can retrieve the stored denotation of *everyone* (4.20g) yielding **everyone**(λ_0(**someone**(**devour**($\mathbf{x}_0$)))).

To calculate the wide scope reading of the subject we, first, merge *devour* and *everyone* and store the denotation of *everyone*. We then merge the voice head and move *everyone* to check its -k feature. Now, we merge *something* with the derived expression and store its denotation by feeding the VP another variable yielding **devour($\mathbf{x}_0$)($\mathbf{x}_1$)** and the functions **G(something)(λ_1)** and **G(everyone)(λ_0)** in store. In the next step, we retrieve the denotation of *everyone* yielding **everyone(λ_0(devour($\mathbf{x}_0$)($\mathbf{x}_1$)))** and **G(something)(λ_1)** in store. Finally, we retrieve the denotation of *something* and yield **something(everyone (λ_0(devour($\mathbf{x}_0$)($\mathbf{x}_1$))))**.

4.4 Scope ambiguity and coordination

It has been observed, as early as Rooth and Partee (1982), that disjunction shows properties of a scope-bearing element. In this section, we discuss an instance of scope ambiguity in coordinate structures with disjunction. We talk about different readings in gapping constructions embedded under a modal verb.

4.4.1 Scope of modals in gapping with disjunction

The sentence in (4.24) is a gapping sentence with disjunction in which the finite verb appears in the first disjunct (underlined), but it is omitted (marked with a dash) in the second disjunct (Ross, 1967). Although the verb is not present in the second disjunct overtly, it is interpreted as if it were there.

(4.24) John <u>ate</u> natto or Bill – rice.

There exist two approaches to gapping with respect to the size of the gapped disjunct. On the one hand, it is assumed that the disjunct containing the gap is much larger than it appears on the surface and that it is of the size of the ungapped disjunct. This approach is usually referred to as the large-conjunct approach (Ross, 1967; Neijt, 1979; van Oirsouw, 1987; Wilder, 1994, 1997; Hartmann, 2000). On the other hand, it is hypothesized that the gapped disjunct is smaller than its ungapped counterpart. This approach has been called the small-conjunct approach to gapping (Johnson, 1996, 2009; Coppock, 2001; Lin, 2002).

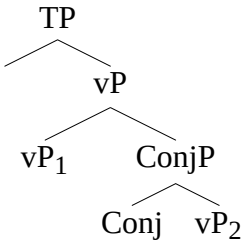
On the large-conjunct approach, the sentence receives the parse as in (4.25a), where the strike-out represents reduced material. According to the small-conjunct approach, the sentence is a vP-coordination and has a parse as in (4.25b).

(4.25) a. [$_{TP}$ John <u>ate</u> natto] or [$_{TP}$ Bill ~~ate~~ rice]
b. John$_i$ <u>ate</u> [$_{vP}$ t$_i$ natto] and [$_{vP}$ Bill rice]

In Chapter 3, we have seen that syntactic and semantic distribution of gapping in English provides evidence for the small-conjunct approach. I assume that the approach is right and that

gapping in English involves conjunction of small phrases where the "shared" material lies outside the coordination as in (4.26).

(4.26)



In English, gapping with disjunction when embedded under a modal verb has more than one reading (Hulsey, 2008). Consider, for instance, the gapping sentence in (4.27) which is ambiguous between the wide and narrow scope readings of the modal *must*. On first reading, the modal takes wide scope over the entire disjunction (4.27a). On this reading, the sentence has one requirement that both characters do not weigh the same, as paraphrased in (4.27a). On second reading, the modal takes narrow scope with respect to disjunction. On this reading, the modal distributes into each disjunct and the sentence denotes two requirements that *The Incredible Hulk must outweigh the Thing and the Thing must outweigh the Hulk,* as indicated by the continuation *. . . , but I don't remember which* in (4.27b).

(4.27) The Incredible Hulk must outweigh the Thing or the Thing outweigh the Hulk.
   a. They must not weigh the same. (must $>$ or)
   b. But I don't remember which. (or $>$ must)

Hulsey (2008) has observed that under the small-conjunct approach of gapping the narrow scope reading of the modal is not predicted, which is puzzling. On this approach, the gapping sentence in (4.27) has a parse as in (4.28). Here, the modal lies outside the disjunction and is predicted to always take wide scope.

(4.28) [$_{TP}$ The Incredible Hulk$_i$ must [$_{vP}$ [$_{vP}$ t$_i$ outweigh the Thing] or [$_{vP}$ the Thing outweigh the Hulk.]]]

A solution to the puzzle proposed by Hulsey (2008) has a new semantics for disjunction (independently argued for in Alonso-Ovalle, 2006). According to this new approach, disjunction denotes a set of Hamblin alternatives rather than the logical $\vee$ operator. The alternatives intro-

duced by *or* are caught by an existential closure operator ∃ triggered under the scope of a modal verb. Scope of the disjunction is a point of existential closure application. According to this approach, when the existential closure applies before the modal verb, the sentence has wide cope reading. Narrow scope reading of the modal is derived by first combining the modal with the disjunction phrase using the function application rule and then closing the set with existential closure (for more details see Hulsey, 2008). The two derivations of wide and narrow scope readings are schematized in (4.29).

(4.29) [$_{TP}$ The Incredible Hulk$_i$ must [$_{vP}$ [$_{vP}$ t$_i$ outweigh the Thing] or [$_{vP}$ the Thing outweigh the Hulk.]]]

a. must ∃ ((the IH outweigh the T) or (the T outweigh the H))

b. ∃ ((must(the IH outweigh the T)) or (must(the T outweigh the H)))

In the next subsection, I implement a new solution to the puzzle using compositional semantics of Minimalist Grammars (Kobele, 2006). According to the approach, denotation of a disjunction phrase can be put on store in the process of derivation and retrieved later for interpretation. We derive narrow scope reading of the modal by storing the disjunction phrase and by allowing the modal to distribute over each disjunct (by function application). We derive wide scope reading of the modal in a regular way, without putting the disjunction phrase on store. Implemented in such a way, the new solution captures a set-forming property and does not abandon the standard semantics of disjunction.

4.4.2 Deriving scope effects with Minimalist Grammars

In this subsection, we apply the direct compositionality and MGs approach to derive the scope of modals in gapping with disjunction. Recall, that the sentence in (4.30) is ambiguous between the wide and narrow scope readings of the modal with respect to disjunction (Hulsey, 2008).

(4.30) *For the Red Sox to make the playoffs…* (context)
The Sox must beat the Yankees or the Angels lose to the Mariners.

a. Either of two events is sufficient. (must > or)

b. …, but I don't remember which. (or > must)

On the first reading, the modal takes wide scope and the sentence has the denotation that *for the Red Sox to make the playoffs, either of two events is sufficient* (4.30a). On the second reading, the modal takes narrow scope and the sentence can be continued with *. . . , but I don't remember which* (4.30b).

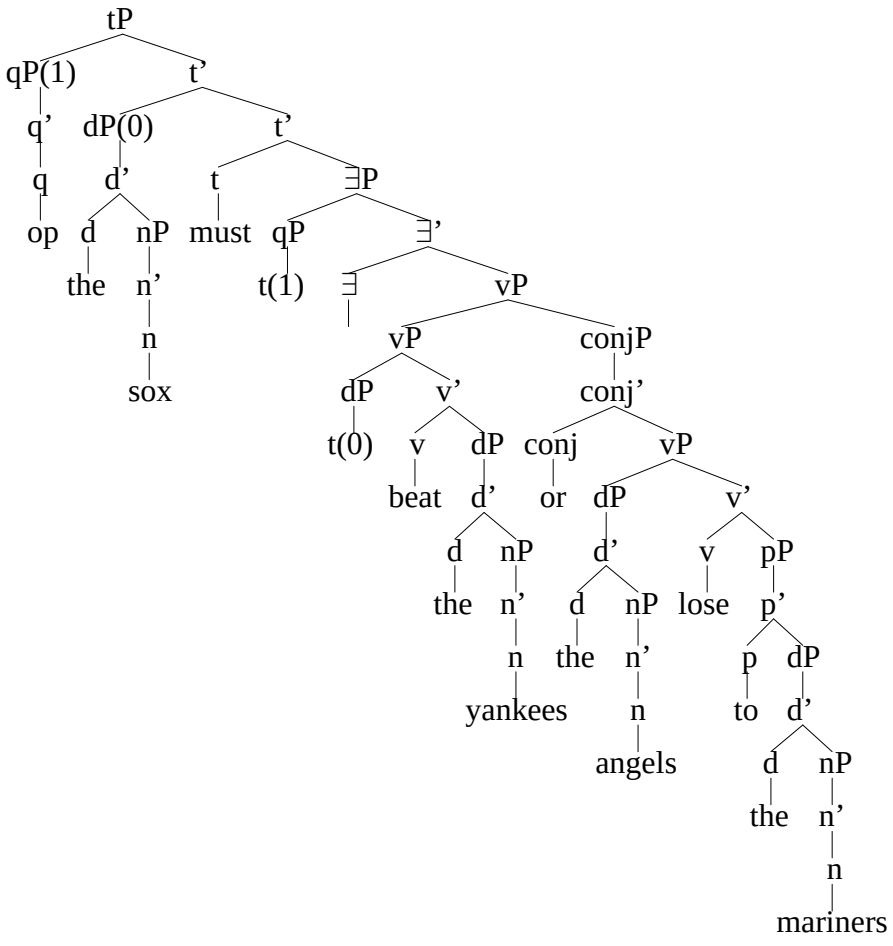
Following previous research on syntax of disjunction (Larson, 1985; Higginbotham, 1989), I assume that *either* marks the left edge of a disjunction. In the grammar (4.31), the idea is implemented as an existential closure phrase ∃P, which hosts *either* or a phonologically null scopal element *op* in its specifier position.

(4.31)

sox::n	yankees::n	angels::n	mariners::n
the::=n d	the::=n d -k	to::=d p	beat::=d =d v
lose::=p =d v	must::=∃ +k +q t	ε::=v =q ∃	op::q -q
or::=v conj	v<<conj	startCategory(t)	

The MG parser and grammar in (4.31) output a tree structure in (4.32).

(4.32)



The tree structure (4.32) is an underspecified semantic representation of the two possible readings of the gapping sentence. The sentence has the single derivation (Figure C.1), which involves the following (relevant) derivation steps.

1. merge(or::=v conj, v)
2. merge(1, v)
3. merge(ε::=v =q $\exists$, 2)
4. merge(3, op::q -q)
5. merge(must::=$\exists$ +k +q t, 4)
6. move(5)
7. move(6)

We calculate the modal wide scope reading of the sentence (4.30a) as follows. We assume that denotations of each disjunct are calculated in a regular way. Then, we merge disjunction with the first and the second vP disjuncts by function application mode of semantic combination (4.20a). At this point, we do not store the denotations of the disjuncts. By function application (4.20a), we merge the existential closure phrase and the modal. We move the subject to satisfy the **-k** feature (by Id mode of semantic combination (4.20f)). No store of the disjunction phrase is required to derive the wide scope reading of the modal.

We calculate the modal narrow scope reading of the sentence (4.30b) in the following way. We merge disjunction with the first vP disjunct, assigning the disjunction an index **or($\mathbf{x}_0$)** and putting the denotation of the first disjunct in store **G(the angels lose to the mariners)(λ_0)**. We use the Store mode of semantic combination (4.20e). In the next step, we merge the derived expression with the second disjunct **or($\mathbf{x}_0$)($\mathbf{x}_1$)** and put it in store **G(the sox beat the yankees)(λ_1), G(the angels lose to the mariners)(λ_0)**. By function application (4.20c), we merge the existential closure

phrase and the modal **must(or(x_0)(x_1))**, with both disjuncts still being in store. We move the subject to satisfy the **-k** feature (by Id mode of semantic combination (4.22a)). Finally, we move the phonologically null scopal element and retrieve the disjuncts from the store (by Retrieve mode of semantic combination (4.22a)) **must(or(x_0)(x_1))(G(the sox beat the yankees)(λ_1))(G(the angels lose to the mariners)(λ_0))**, receiving a distributed modal interpretation of the sentence.

4.4.3 Extending the coverage

In this subsection, I extend the approach to other cases of scope effects in disjunction, including interaction of *or* and *either*, tense, and negation.

4.4.3.1 Scope ambiguity

As observed in Rooth and Partee (1982), the sentence in (4.33) is ambiguous in three ways.

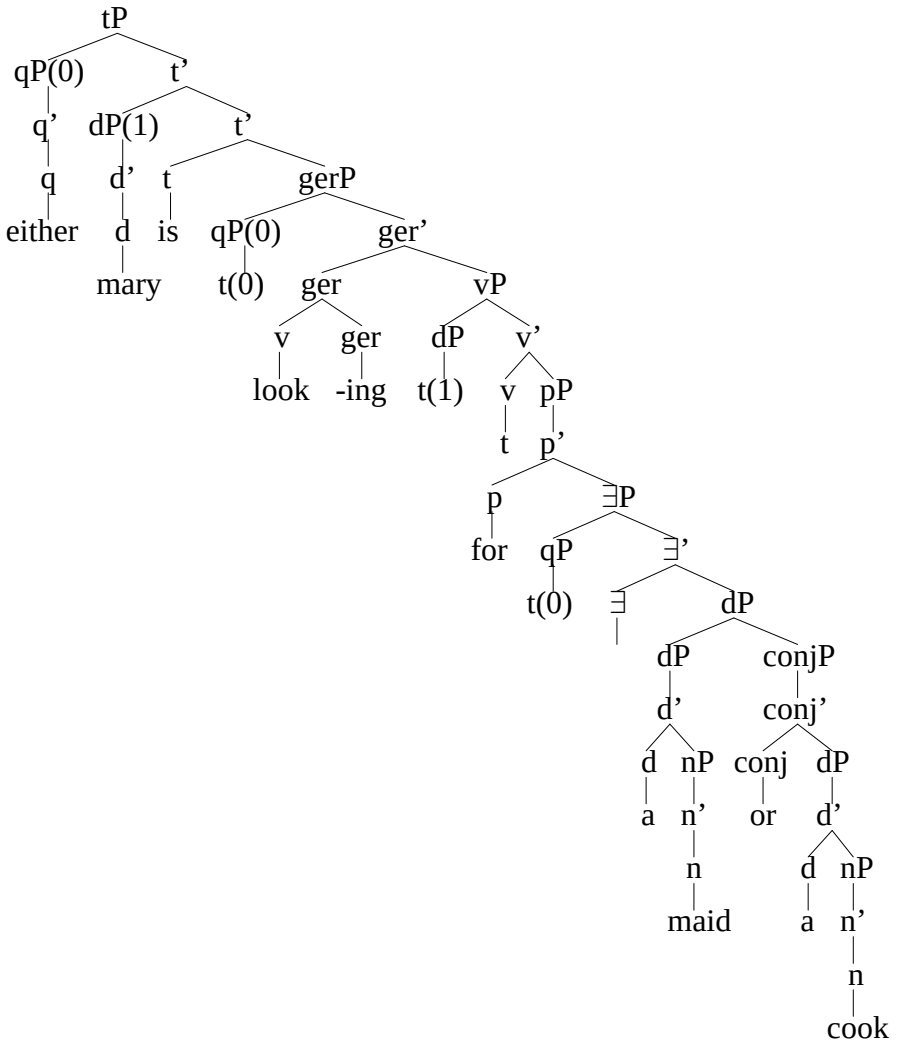
(4.33) Mary is looking for a maid or a cook.
- a. Mary is looking for ((a maid) or (a cook)). (de dicto)
- b. for some *x*, a maid or a cook, Mary is looking for *x*. (de re)
- c. Mary is looking for (a maid) or Mary is looking for (a cook). (wide scope or)

The scope of disjunction correlates with the distribution of *either* (Larson, 1985).

(4.34)
- a. Mary is looking for either a maid or a cook.
- b. Either Mary is looking for a maid or a cook.

In (4.34a), *either* is not displaced and marks the left edge of the disjunction phrase. All three of the readings are available. However in (4.34b), *either* is displaced from the disjunction phrase. It occurs clause initially and the sentence has only wide scope reading of disjunction.

Within the approach developed in this chapter, we can capture the facts in (4.33) and (4.34) with a single description tree (4.35) and a underspecified semantic representation (Figure C.2).



(4.35)

We calculate different scope readings by storing the disjunction phrase and retrieving it when merged with *either* at different scope marking edges, i.e. when gerP or tP is merged.

4.4.3.2 Tense boundary

Another interaction is observed between scope of *or*, *either* and tense.

(4.36) a. John believes that Bill said that Mary was drinking or playing video games.
b. John believes that Bill said that Mary was either drinking or playing video games.

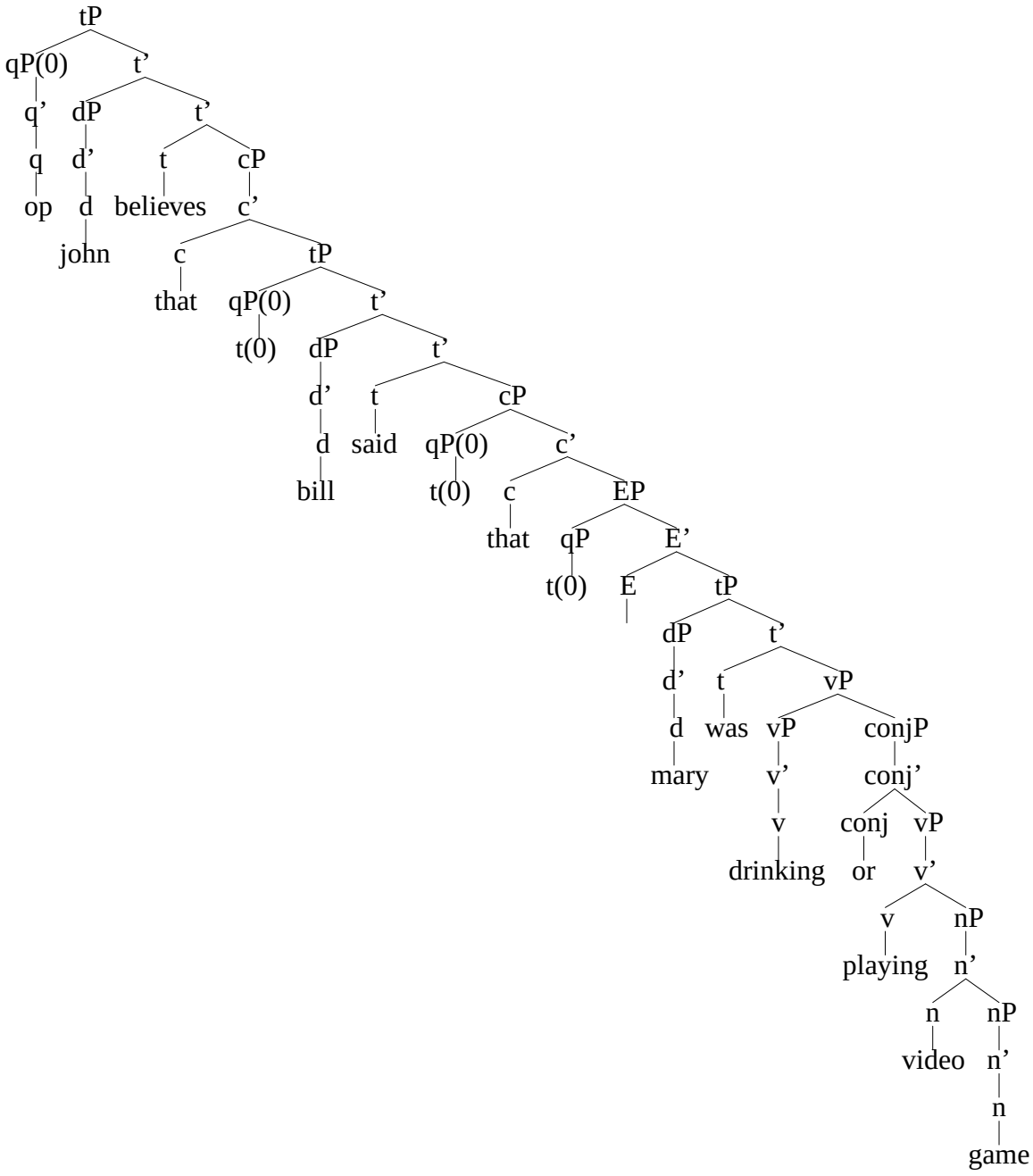
The sentence in (4.36a) is three ways ambiguous having *de dicto*, *de re* and *wide scope or* readings. However, (4.36b) with overt *either* marking the left edge of disjunction is not ambiguous any more. In fact, the sentence does not have intermediate or wide-scope readings of disjunction.

The sentence has to be read as disjunction taking scope inside both of the intentional verbs *believe* and *say*. Moreover, the following set of sentences shows that *either* does not appear outside the minimal tensed sentence which contains its associated disjunction.

(4.37) a. John believes that Bill said that [either Mary was drinking or playing video games]
b. ??John believes that Bill said either that [Mary was drinking or playing video games]
c. ??John believes that either Bill said that [Mary was drinking or playing video games]
d. *Either John believes that Bill said that [Mary was drinking or playing video games]

In (4.37a), *either* occurs within the tensed sentence containing the disjunction, and the sentence is grammatical. In (4.37b-4.37d), *either* occurs outside and the sentences are ungrammatical.

We can capture this intuition with the following structure (4.38) and a derivation tree (Figure C.3).



(4.38)

The structure in (4.38) implements the idea that if there is no overt *either*, disjunction can take wide scope and the phonologically null scopal element *op* can appear clause initially in the tree. On the other hand, *believe*, *said* and *that* do not check feature -q on *either*, capturing the fact that the overt *either* taking the widest scope is blocked by tense.

4.4.3.3 Scope of disjunction and negation

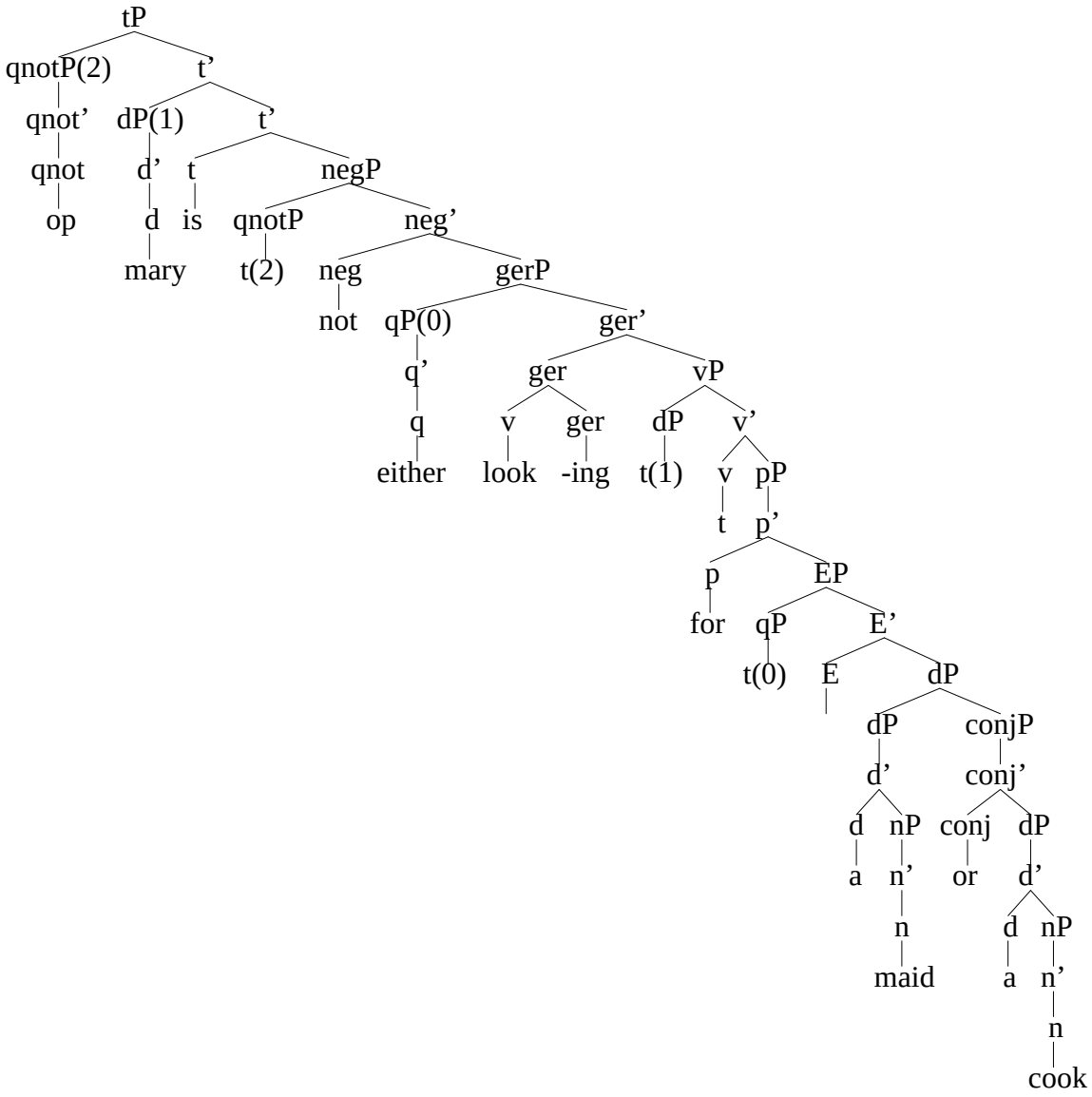
This section examines interaction of scope of disjunction and negation. The descriptive generalization is that in sentences such as (4.39), disjunction cannot take scope over the negation. The unavailable wide scope reading of disjunction in (4.39b) is conclusive evidence for that.

(4.39) Mary isn't looking for a maid or a cook.
  a. Mary isn't looking for ((a maid) or (a cook)). (de dicto)
  b. *Mary isn't looking for a maid or Mary isn't looking for a cook. (wide scope)

Similar distribution is observed if *either* is present overtly in the sentence. In (4.40a) and (4.40b), where *either* scopes below negation, disjunction sentences are grammatical. In (4.40c) and (4.40d), negation takes scope over *either* resulting in ungrammaticality.

(4.40) a. Mary isn't looking for either a maid or a cook.
  b. (?)Mary isn't either looking for a maid or a cook.
  c. ??Mary either isn't looking for a maid or a cook.
  d. ??Either Mary isn't looking for a maid or a cook.

In the tree structure (4.41) and a derivation tree (Figure C.4), wide scope of *either* is blocked by feature `-q` that appears on negation.



(4.41)

4.5 Summary and outlook

In this chapter, I addressed scope ambiguity in coordination from a computational point of view. I adopted a Minimalist Grammars formalism (Stabler, 1997; Stabler and Keenan, 2003; Kobele, 2006), which uses underspecification in semantic representations. I used the formalism to account for different readings in gapping constructions with disjunction embedded under a modal verb. I extend the coverage of the approach to other scope ambiguity cases in disjunction.

Chapter 5

CONCLUSION

This dissertation provides solutions to several syntax-semantics interface puzzles in coordination. I argue that asymmetric coordination is not exceptional and that the distinction between symmetric and asymmetric coordinate structures is reflected in their syntax. I further argue that conjunctions form a set of Hamblin alternatives and that the scope of conjunction is not its syntactic position but the point of application of the relevant closure operator. Finally I argue that underspecified semantics is the most efficient way of implementing scope ambiguities.

Future work may include extending my results to account for cross-linguistic variation in coordination and looking at processing of scope ambiguity in coordination in order to model psycholinguistic behavior using computational methods, including the formal grammar I developed in Chapter 4.

APPENDICES

Appendix A

ENGLISH GRAMMAR

```
%   File:       grammar.pl
%   Author:     I Agafonova
%   Created:    Feb 2010
%   Last modified:  June 2010

% The grammar.pl covers grammatical and ungrammatical disjunction
%   sentences from Larson, Richard K. (1985), "On the syntax of
%   disjunction scope," Natural language and linguistic theory 3,
%   217-264.  It applies a direct compositional semantics for MGs
%   as in Kobele, G. (2006), "Generating copies: An investigation
%   into structural identity in language," Ph.D. thesis, UCLA.

% noun phrases
[maid]::[n].
[cook]::[n].
[airport]::[n].
[burglar]::[n].
[cab]::[n].
[games]::[n].
[house]::[n].
[mother]::[n].
[thief]::[n].
[video]::[=n,n]. % 'video games'
```

```
[leave]::[nid].  % noun used in an idiomatic expression 'went on leave'

% determiner phrases
[mary]::[d].
[bill]::[d].
[john]::[d].
[mary]::[d].
[sherlock]::[d].

% determiners
[]::[=n,d].
[a]::[=n,d].
[the]::[=n,d].

% possesives
[johns]::[=n,d].
[johns]::[=n,d,-k].

% quantifiers
[either]::[q].     % base generated 'either'
[either]::[q,-q].  % QR of 'either'
[]::[=d,=q,q].
[]::[=aux,=q,q].
[]::[=ger,=q,q].

% pronouns
[her]::[=n,d].
```

```
[his]::[=n,d].

[her]::[=n,d,-k].

[his]::[=n,d,-k].

[i]::[d,-k].

[she]::[d,-k].


% prepositions

[at]::[=d,p].

[for]::[=d,p].

[for]::[=q,+q,p].

[for]::[=q,p].

[on]::[=nid,pid].

[to]::[=d,p].


% verbs


% cp/wh selecting verbs

% (do not have '+q' feature ==> 'either' cannot scope over tensed clause)

[believes]::[=c,=d,vcp].

[said]::[=c,=d,vcp].

[claimed]::[=c,v].

[know]::[=wh,v].


% transitive verbs

[ask]::[=d,+k,v].

[pretended]::[=inf,=d,t].

[pretended]::[=inf,+q,=d,t].
```

```
[resigned]::[=d,+k,v].
[went]::[=pid,v].

% infinitives
[resign]::[vinf].
[retire]::[vinf].

% -ing verbs
[drinking]::[ger].
[driving]::[=d,ger].
[looking]::[=p,ger].
[looking]::[=p,+q,ger].
[playing]::[=d,ger].
[taking]::[=d,ger].

% auxiliary verbs
[be]::[=ger,aux].
[be]::[=ger,+q,aux].
[dont]::[=v,aux].
[is]::[=ger,=d,+q,t].
[is]::[=ger,+q,=d,t].
[is]::[=ger,=d,t].
[is]::[=neg,=d,t].  % does not have '+q' feature ==>
                        % 'either' cannot scope over negation
[is]::[=adv,+k,t].
[should]::[=v,modal].
[was]::[=ger,=d,t].
```

```
[was]::[=ger,=d,+q,t].

[was]::[=q,=d,t].

[was]::[=q,=d,+q,t].


% complementizers

[that]::[=t,c]. % does not have '+q' feature ==>

                    % 'either' cannot scope over tensed clause

[that]::[=vcp,c].

[whether]::[=t,wh].

[]::[=t,c].

[]::[=vcp,c].


% adverbs

[there]::[adv].


% other

[to]::[=vinf,inf].

[to]::[=aux,inf].

[not]::[=ger,neg].

    [to]::[=aux,+q,inf].


% disjunction (as adjunction cf. Munn 1993)

[or]::[=v,conj].

[or]::[=ger,conj].

[or]::[=d,conj].

[ger]<<[conj].

[d]<<[conj].
```

```
[v]<<[conj].


startCategory(c).
```

Appendix B

SET OF GRAMMATICAL AND UNGRAMMATICAL DISJUNCTION SENTENCES

B.1 Grammatical sentences

Mary is looking for a maid or a cook.

Mary is looking for either a maid or a cook.

Either Mary is looking for a maid or a cook.

Mary is either looking for a maid or a cook.

Mary either is looking for a maid or a cook.

Sherlock pretended to be looking for a burglar or a thief.

Sherlock pretended to be looking for either a burglar or a thief.

Sherlock pretended to either be looking for a burglar or a thief.

Sherlock either pretended to be looking for a burglar or a thief.

John believes that Bill said that Mary was drinking or playing video games.

John believes that Bill said that Mary was either drinking or playing video games.

John believes that Bill said that either Mary was drinking or playing video games.

Mary isn’t looking for a maid or a cook.

Mary isn’t looking for either a maid or a cook.

I know whether Bill should ask John to resign or retire.

I don’t know whether Bill claimed that John resigned or went on leave.

Either Mary is driving to the airport or she is taking a cab.

Mary either is driving to the airport or she is taking a cab.

Mary is either driving to the airport or she is taking a cab.

Either Mary is taking a cab to the airport or John is driving there.

Either Mary is at John’s house or his mother is there.

B.2 Ungrammatical sentences

??John believes that Bill said either that Mary was drinking or playing video games.

??John believes that either Bill said that Mary was drinking or playing video games.

*Either John believes that Bill said that Mary was drinking or playing video games.

(?)Mary isn’t either looking for a maid or a cook.

??Mary either isn’t looking for a maid or a cook.

??Either Mary isn’t looking for a maid or a cook.

*Mary is driving either to the airport or she is taking a cab.

*Mary is driving to the airport or she either is taking a cab.

*Mary is driving to the airport or she is either taking a cab.

?Mary is either taking a cab to the airport or John is driving her.

*Mary is either taking a cab to the airport or John is driving there.

*Mary is either at John’s house or his mother is there.

Appendix C

DERIVATION TREES

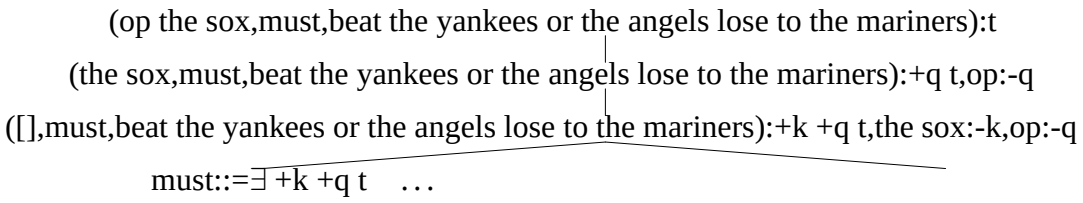


Figure C.1: Scope of modals in gapping with disjunction

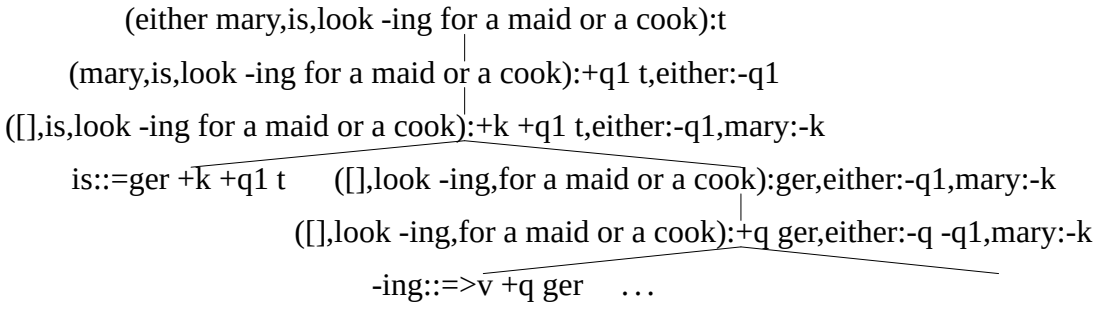


Figure C.2: Scope of disjunction and *either*

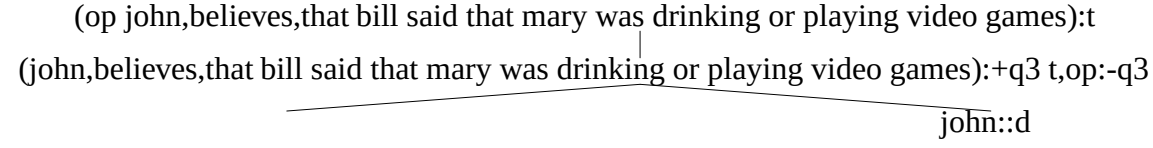


Figure C.3: Tense boundary

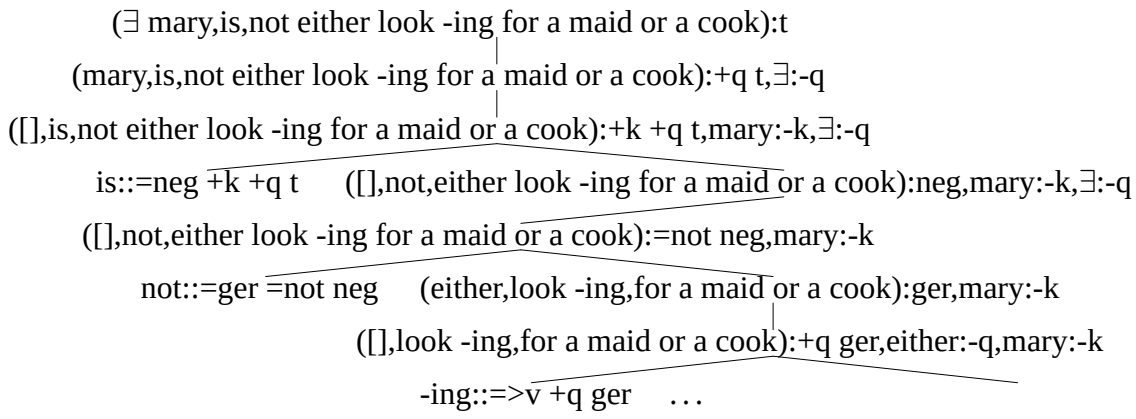


Figure C.4: Scope of disjunction and negation

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